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**POLITECNICO DI TORINO**

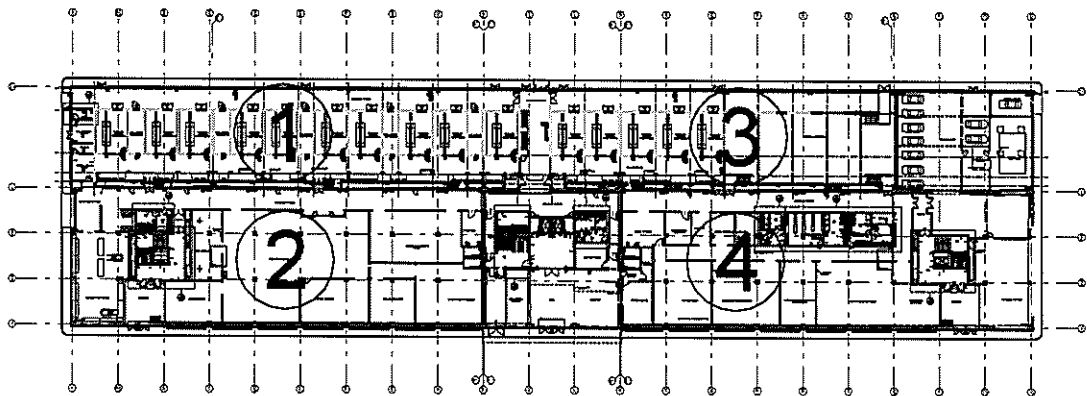
C.so Duca degli Abruzzi n.24 - 10129 - TORINO

POLITECNICO DI TORINO  
**PROGETTO DI RADDOPPIO**  
**MANICA DA 24 M: NEW RESEARCH CENTER - SPECIAL UTILITIES**  
**PROGETTO ESECUTIVO**

RESPONSABILE DEL PROCEDIMENTO  
 PROF. ING. FRANCESCO OSSOLA



left wing ◀▶ right wing



Description :

Bauteil:

**SPECIAL CONTRACT DOCUMENT  
 AND TECHNICAL NORMS OF EXECUTION**

Scale : Maßstab :		Name	Date	Contract-No : Auftrags-Nr.:	<b>0602</b>
	Drawn :			Document No : Blatt-Nr.:	
	Checked : Approved :				

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**0.** **Building site facilities for title 1-20**

**0.1.** **Building site facilities for title 1-20**

**0.1.10.** **Worksite equipment**

with all facilities, devices and tools required for an orderly operation, delivery and erection ready to operate.

Following belongs to a worksite equipment:

- Staff barracks with break and wash rooms, latrines and sanitary room incl. equipment objects acc. to valid regulations.

Foreman and/or construction manager container with office and conference room.

Worksite magazine and storage rooms with tool and small devices.

Formwork material

Construction machines e.g. electric distributor, pumps and compressors, drilling devices, lighting systems, power units.

Traffic securing measures incl. traffic symbol plan and all signs, blocking measures and lighting acc. to official directions.

Foundations for machines and containers.

Work and protection scaffolds acc. to accident prevention regulations (prescrizioni antinfortunistiche).

Protective clothing and equipment

Railing and blocking measures acc. to accident prevention regulations (prescrizioni antinfortunistiche).

Power and water connection

The supply of power and water will be provided at central location by the ordering party.

The supply line to worksite is the contractor's business. The contractor shall provide a standpipe with calibrated water meter.

Construction rubbish disposal of arising rubbish of own disciplines acc. to direction of supervisor, acc. to valid waste law of district. Erection, maintenance and regular hauling off of waste containers, incl. all fees.

Construction cleaning, weekly in entire building and related exterior areas acc. to direction of supervisor.

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The planned site facility shall be represented in drawing with all applicable facilities, traffic control, storage zones etc. and submitted to the supervisor for approval.

**0.1.20. Maintenance**

of entire worksite equipment for the construction time (11 months) incl. maintenance and all required operation agents and fuels.

**0.1.30. Worksite clearing**

with dismantling and transport of entire site facility. Removal of all solid interior parts of site facility and reprovision of original condition.

**0.1.40. Surcharge maintenance**

to item 0.1.10  
for the site facility exceeding the agreed construction time for each 1 month.

**0.1.50. Office container supervision**

consisting of 3 containers connected as one room (see sketch in enclosure).

Utilization as office and conference container for the local supervision for the entire construction time. Erection acc. to site facility plan and mobilization as well as room division acc. to attached layout.

**Equipment:**

Office container with 3 cabinets, 2 desks, 1 deposit table, 3 chairs, locker, 2 rows shelves and latrine cell with 1 toilet and wash basin. Connection for 2 telephones, fax (separate connection) and internet.

Conference room for approx. 20 persons as double container with tables, chairs, wardrobe, deposit facilities for drawing magnet rails and magnets, wardrobe as well as a kitchenette with water connection.

A sliding folding wall shall be provided for the separation of office and conference area.

Winter resistant with power supply and heating, air conditioning unit. Accesses lockable, erection, with cleaning once a week.

Dismantling of office container after completion of construction

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measure, removal and reprovision of original condition.

Maintenance for 11 months.

- 0.1.60. Surcharge maintenance**  
to item 0.1.50  
for office containers exceeding the agreed construction time for each 1 month.
- 0.1.70. Temporary fence mobile**  
for protection of worksite area, provision acc. to direction of supervisor, maintenance exceeding the period of construction time, dismantling and removal acc. to directions of supervisor.
- In stable design made of elements with circumferential pipe frame with grid wire filling and weighted base stands. The elements shall be connected together non-detachably (opening with special tool) and secured additionally with welding points. Height approx. 2200 mm.
- Maintenance 11 months.
- 0.1.80. Surcharge maintenance temporary fence**  
to item 0.1.70  
exceeding the period of agreed construction time for each 1 month.
- 0.1.90. Mobile relocation of temporary fence**  
relocation of existing temporary fence during the construction time due to worksite requirements.
- 0.1.100. Surcharge temporary fence gate 2-wing**  
to item 0.1.70  
stable design with circumferential pipe frame per wing, 3000 mm x 2200 mm, with grid wire filling, as 2-wing gate, 6000 mm wide, lockable from inside and outside, incl. posts reinforced with sectional steel.
- 0.1.110. Surcharge temporary fence gate 1-wing**  
to item 0.1.70  
stable design with circumferential pipe frame 1000 mm x 1000 mm, with grid wire filling, 1-wing gate, 1000 mm wide, handle with cylinder lock on both sides and at least 10 keys incl. an additional post, 100/100 mm.

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- 0.1.120. Meter lines**  
for following disciplines marked by glued synthetic labels in red color shade with engraved line and height elevation. Location acc. to direction of supervisor.
- 0.1.130. Low voltage distributor**  
acc. to VDE regulations as subdistributor completely for the finishing trades on each floor incl. supply lines, delivery, provision, maintenance and dismantling after completion.
- Equipment:  
2 receptacles 400 V/32 A  
6 receptacles 400 V/16 A  
12 receptacles 230 V/16 A
- The fault current breakers (FI) shall be coordinated and possibly retrofitted to the power supply of the Contracting Agency. The retrofitting shall be included in the unit prices.
- Period of maintenance: 11 months
- 0.1.140. Surcharge maintenance low voltage distributor**  
to item 0.1.130  
exceeding the period of agreed construction time for each 1 month.
- 0.1.150. Construction lighting**  
consisting of a total of 75 fluorescent lamps with 56 W, suitably equipped for wet rooms, for the illumination of traffic ways, stairs, halls, etc., incl. required, firmly connected cabling on average 30000 mm wet room line, provision, maintenance, dismantling afterwards.
- The power connection shall be accomplished as permanent connection. The switching will be accomplished with 2 circuits:  
1 circuit only for stairwell  
1 circuit for all other areas
- The on/off switch installed at central point shall be lockable.
- 0.1.160. Surcharge additional light fixtures**  
to item 0.1.150,  
increased or decreased quantities of fluorescent lamp with 56 W, suitably equipped for wet rooms, at installation of construction lighting and maintenance.



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**0.1.170. Surcharge spare fluorescent tubes**  
to item 0.1.150,  
for the delivery and exchange of defective fluorescent tubes, 56  
W.

**0.1.180. Lateral protection**  
in the area of all openings, as fall protection acc. to accident  
prevention regulations (prescrizioni antinfortunistiche),  
exceeding the carcass time, provision and maintenance and  
dismantling after no more existing fall danger.

The assembly of all required lateral protection equipment shall  
be included as secondary service in the unit prices.

Lateral protection as stable wood construction incl. impact-proof  
connection to reinforced concrete ceiling an/or supports or  
walls.

Maintenance period: 11 months.

**0.1.190. Working platforms**  
Provision of working platforms in the area of installation shafts  
on each floor.

Delivery, erection, maintenance and dismantling after end of  
installation of technical building equipment.  
Maintenance for the period of 11 months, dimensioned acc. to  
scaffold group: LK 3 acc. to DIN EN 12811-1.

**0.1.200. Surcharge maintenance working platforms**  
to item 0.1.190  
exceeding the period of agreed construction time for each 1  
month.

**0.1.210. Steel pipe scaffold, load class 3, h = 8000 mm**  
acc. to DIN EN 12811-1 as work scaffold, circumferential, for  
load class 3, area related useful weight 200 kg/m<sup>2</sup>, width class  
W06, corresponds to a width of 600 mm incl. provision of  
substructure and bracing, maintenance for the period of 11  
months and dismantling.

Only the component area provided with scaffold will be  
reimbursed.

A stability proof in reviewable copy shall be submitted in  
triplicate free of charge upon request of the supervisor.

Scaffold for technical building equipment work and finishing

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trades, stand area horizontal on paved base, on all floors.

Scaffold height = up to approx. 8000 mm within the building as free-standing module room scaffold.

**0.1.220. Surcharge maintenance to item 0.1.210**

to item 0.1.210

exceeding the period of agreed construction time for each 1 month/m<sup>2</sup>.

**0.1.230. Steel pipe scaffold, load class 3, h = 17000 mm, on flat roof**

acc. to item 0.1.210

for the installation and fastening of chimney system.

Stand area horizontal on reinforced concrete flat roof provided with sealing layer.

The base panels of stands shall be placed on a load distributing base made of dirt mats and boards.

Scaffold height = up to approx. 17000 mm

Stand height on flat roof = approx. +7250 mm above terrain.

Anchoring of scaffolds in wall area, reinforced concrete wall with insulated sheet steel facade.

Utilization time: 4 weeks.

**0.1.240. Surcharge brackets**

to item 0.1.230,

for the arrangement of brackets installed inside for covering extension, brackets incl. covering and protective railing, width approx. 1000 mm.

**0.1.250. Alteration of work scaffold of item 0.1.210,**

repeated alteration acc. to direction of supervisor.

Number of alterations: approx. 15 ea

**0.1.260. Alteration of work scaffold of item 0.1.230,**

repeated alteration acc. to direction of supervisor.

Number of alterations: approx. 3 ea

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- 0.1.270. Mobile working platform, load class 3, 5500 mm**  
Mobile scaffold, DIN EN 12811, load class 3, area related utilization weight 200 kg/m<sup>2</sup>, height of top scaffold layer 5500 mm, with lateral protection on all sides, erection in the building. Utilization time: 11 months.
- 0.1.280. Surcharge maintenance, mobile working platform 5500 mm**  
to item 0.1.270,  
exceeding the period of agreed provision for each 1 month/ea.
- 0.1.290. Mobile working platform, load class 3, 8000 mm**  
acc. to item 0.1.270,  
however, height of top scaffold layer 8000 mm.  
  
Utilization time: 11 months.
- 0.1.300. Surcharge maintenance, mobile working platform 8000 mm**  
to item 0.1.290,  
exceeding the period of agreed provision for each 1 month/ea.
- 0.1.310. Protective covering flat roof**  
for protection against damages of existing hot roof. Covering consisting of a fabric reinforced synthetic tarpaulin installed loosely on sealing layer with overlapping and a protective layer made of scaffold boards, thickness 45 mm, delivery and installation and maintenance for the period of 11 months and dismantling after completion of work.
- 0.1.320. Surcharge maintenance, protective covering, flat roof**  
to item 0.1.310,  
of protective covering exceeding the period of agreed provision for each 1 month/ea.
- 0.1.330. Covering of floor openings, as fall protection**  
made of 2 layers chipboards E1/V100, per panel at least 19 mm thick, delivery, maintenance and provision as robust covering incl. required subconstruction in the area of ceiling openings acc. to accident prevention regulations (prescrizioni antinfortunistiche). Load 5 kN/m<sup>2</sup>.  
  
Incl. maintenance during required construction time, dismantling and disposal of protective covering after completion of all work of subcontractors acc. to coordination with the supervisor.  
  
The protective covering becomes again property of the

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contractor after dismantling.

Size of single panel: acc. to choice of contractor.

Ceiling openings (l/w) up to 2000 mm / 1000 mm

Maintenance period: 11 months

- 0.1.340. Hot air heating unit 115 kW maintenance**  
Capacity 115 kW, incl. appropriate hot air valves and hoses,  
delivery, erection ready to operate, maintenance, relocation and  
removal after utilization.
- 0.1.350. Hot air heating unit 115 kW operation**  
for the operation of heating unit, incl. maintenance, monitoring  
and operation material.

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**1. Sound insulating doors, gates and windows**

**1.1. Sound insulating windows**

**1.1.10. Sound insulating window 1.20/1.15 m**

as special construction, with building authority approved fire resistant window element on control room side, accomplishment EI 90, with pressure reinforced requirements. On test stand side e.g. box window, installed jointly in a reinforced concrete wall, with a wall thickness of  $t=0.30$  m

consisting of:

Frame box window on test stand side:

made of edged sheet steel as 2-part frame construction incl. concealed fastening installed to reinforced concrete. The rough masonry opening on test stand side is bordered with a concreted circumferential sectional steel angle L 100\*100\*10 mm.

It shall be observed at the construction of frames that it will only minimal reduce the existing parapet height of 1.00 m in height in installed condition. The window frame shall only reduce the rough masonry opening on each side by max. 0.10 m. A possible large sight opening exists due to this.

The grouting of frame with swelling mortar shall be accomplished by the contractor in own responsibility.

Window frame control room side

made of stud framework with steel hollow profiles with fire resistant glazing beads and facing profiles made of aluminum cover shells or edged sheet steel, concealed fastening, with building authority approval.

Fire resistance class EI 90 acc. to DIN EN 13501-2

Surfaces:

all steel parts with double rust protective paint coat, prepared for local final paint coat. Paint coat damages shall be repaired after installation.

Aluminum cover shells powder coated, color shade acc. to NCS (Natural Colour System NCS) standard color shades.

Soffit areas:

Construction with border damping, filled with mineral wool mats, construction material class A1 incombustible, acc. to DIN EN 13 501-1, with black glass fleece top and decorative grid covering made of dull anodized aluminum perforated sheet metal, cut edges shall be bordered.

Glazing:

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Control room side made of fire protection glass with a fire resistance class EI 90 acc. to DIN EN 13501-2.

Test stand side made of penetration resistant bulletproof glass class P7B, DIN EN 356 and laminated safety glass.

Number, distances and glass thicknesses of panes acc. to sound technical dimensioning of bidder, as well as acc. to requirement due to stated pressure requirement.

The pane arrangement shall be designed in such a manner that mirror coatings will be prevented as far as possible, e.g. by slanted position of the panes.

The panes shall be embedded circumferentially in rubber, structural sound insulated and air-tight. The pane distance shall be provided to approx. 0.30 m outside/outside.

The pane intermediate space shall be dried via inserted silica gel package for prevention of moisture steaming up at interior sides.

Panels and sealing shall only be installed after local finishing coat.

Installation:

The installation will be accomplished in 2 sections

- installation frame
- installation glazing (not until extensive completion of interior development). The separate trip shall be included.

Sound insulating requirements for the total window construction:

evaluated sound insulation size  $R'w \geq 45 \text{ dB}$  acc. DIN EN ISO 717-1

125	250	500	1000	2000	(Hz)
$\geq 35$	$\geq 45$	$\geq 50$	$\geq 53$	$\geq 50$	(dB)

The prescribed sound insulation shall be confirmed by a test certificate from a approved expert.

Fire protection technical requirements:

Fire protection glazing fire resistance class EI 90 acc. to DIN EN 13501-2 on control room side.

Requirements to pressure resistance:

on test stand side, in direction control room with **50 kPa** (max. pressure top) in case of an explosion like pressure increase.

Structural marginal conditions

Structural dimensions: w/h = approx. 1.20 / 1.15 m  
Parapet height: 1.00 m from top of finish

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Wall thickness: 0.30 m

Clear sight size: w/h > 1.00 / 0.95 m

It shall be assumed that still no finished floor/false floor,  
top of slab = -1.45 m is existing on both wall sides at the time of frame  
installation.

Possible auxiliary constructions for the transport and installation of  
windows shall be included.

Installation location is ground floor level +/-0.00 m.

make: Manfred Hagmeyer e.K or equivalent  
Ulmer Straße 40  
72587 Römerstein  
Tel: (+49)7382/ 93790  
email: G.Hagmeyer@hagmeyer-tueren.de

or

Stahltürenbau Buchele GmbH or equivalent  
Postf. 1124  
73055 Ebersbach/Fils  
Tel: 07163 / 1001-0  
www.buchele.de

### 1.1.20. **Sound insulating window 1.20/1.15 m, chassis dyno**

acc. to item 1.1.10

as box window, accomplishment acc. to fire resistance class E30 acc.  
to DIN EN 13501-2, installed in a reinforced concrete wall, with a wall  
thickness of t=0.30 m

consisting of:

#### Frame:

Edged sheet steel as 2-part frame construction incl. concealed  
fastening installed to reinforced concrete.

It shall be observed at the construction of frames that it will only  
minimal reduce the existing parapet height of 1.00 m in height in  
installed condition. The window frame shall only reduce the rough  
masonry opening on each side by max. 0.10 m. A possible large sight  
opening exists due to this.

The grouting of frame with swelling mortar shall be accomplished by  
the contractor in own responsibility.

#### Surfaces:

Double rust protective paint coat, prepared for local final paint coat.  
Paint coat damages shall be repaired after installation.

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Soffit areas:

Construction with border damping, filled with mineral wool mats, construction material class A1 incombustible, acc. to DIN EN 13 501-1, with black glass fleece top and decorative grid covering made of dull anodized aluminum perforated sheet metal, cut edges shall be bordered.

Glazing:

Control room side made of fire protection glass with a fire resistance class EI 90 acc. to DIN EN 13501-2.

Test stand side made of penetration resistant bulletproof glass class P7B, DIN EN 356.

Number and distances of panes acc. to sound technical dimensioning of bidder, as well as acc. to requirement due to stated pressure requirement.

The pane arrangement shall be designed in such a manner that mirror coatings will be prevented as far as possible, e.g. by slanted position of the panes.

The panes shall be embedded circumferentially in rubber, structural sound insulated and air-tight. The pane distance shall be provided to approx. 0.30 m outside/outside.

The pane intermediate space shall be dried via inserted silica gel package for prevention of moisture steaming up at interior sides.

Panes and sealing shall only be installed after local finishing coat.

Installation:

The installation will be accomplished in 2 sections  
- installation frame  
- installation glazing (not until extensive completion of interior development). The separate trip shall be included.

Sound insulating requirements:

evaluated sound insulation size  $R'w$  **> 45 dB**  
acc. DIN EN ISO 717-1

125	250	500	1000	2000	(Hz)
$\geq 35$	$\geq 45$	$\geq 50$	$\geq 53$	$\geq 50$	(dB)

The prescribed sound insulation shall be confirmed by a test certificate from a approved expert.

Fire protection technical requirements:

Fire protection glazing fire resistance class E 30 acc. to DIN EN 13501-2 on control room side.



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Structural marginal conditions  
Structural dimensions: w/h = 1.20 / 1.15 m  
Parapet height: 1.00 m from top of finish  
1.15 m from top of slab  
Wall thickness: 0.30 m  
Clear sight size: w/h > 1.00 / 0.95 m

Installation location is ground floor level +/-0.00 m.

**1.1.30. Surcharge opening wing 1.20/1.15 m**  
to item 1.1.10  
The window element on test stand side shall be constructed for opening with screw connections and support hinges for cleaning of interior pane sides.  
It shall be guaranteed that the cleaning personal will not have to accomplish a complete dismantling of opening wing, but the construction shall be constructed as a turn hardware with given requirements.

**1.1.40.** accord. to Item 1.1.30.  
**Surcharge opening wing 1.20/1.15 m, chassis dyno**  
to item 1.1.20  
structural dimensions: w/h = 1.20 / 1.15 m

**1.1.50. Structural proof**  
Structural calculation of window elements considering the prescribed marginal conditions regarding pressure and fire protection.  
  
The documents shall be submitted in triplicate exempt from charges.

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**1.2. Sound insulating doors and gates**

**1.2.10. Sound insulating one-wing SD door and EI90 door**

Sound insulating one-wing steel door, as special construction, with pressure reinforced requirements on test stand interior side and a one-wing steel door fire resistance class EI90-C5 acc. to DIN EN 13501-2, on control room interior side.

Installed in a reinforced concrete wall, with a wall thickness of  $t=0.30$  m, consisting of:

Door leaf:

bearing steel subconstruction with double-sided sheet steel planking, extremely warp resistant and camber-free processed, 2 ea safety pins from door leaf to frame.

Door leaf filling:

made of e.g. mineral wool, construction material class A1 incombustible, acc. to DIN EN 13 501-1, processed without settling and/or acc. to requirement.

Door hinges:

Accomplishment with 3-part heavy construction hinges, ball borne, number of hinges acc. to requirement.

Accomplishment as left door. Control room side accomplishment right.

Door wing:

Locking facility, prepared for installation of a cylinder lock delivered by others.

Door test stand side:

The latch bolt shall be constructed as press-on bolt, the construction shall allow an automatic closing in case of fire (bolt, worm will be pulled back automatically).

Number of latch bolts e.g. 3-latch bolt mortise lock, acc. to requirement.

Handle set with smooth-running light metal long lever in robust make, with long escutcheon.

Function of door handle:

a) Door handle at 90° placed towards top, worm and latch bolt in gear

b) Door handle in horizontal position, worm free, latch bolt in gear

c) Door handle pushed towards bottom, latch bolt will be pulled back

Door handle shall be always pulled back into horizontal via

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springs at slanted position.

Frame:

3-sided sheet steel corner frame, welded to a circumferential sectional steel angle L 100\*100\*10 mm concreted locally on test stand side.

Fastening of corner frame on control room side with anchor, doweled to reinforced concrete wall, wall thickness approx. 0.30 m.

The soffit area between both corner frames shall be connected with an edged sheet steel.

The door frame shall reduce the rough masonry opening at each side only by max. 0.05 m in order to provide a possibly large clear passage.

Sealing:

between frame and door leaf made of solid rubber profiles and fire protection strip, constructed as double cutting sealing.

Threshold:

Construction as ramp threshold with a permissible rise above top edge floor of max. 10 mm.

Continuously in steel in connection with frame.

Sufficient recesses shall be provided for the filling with grouting mortar which shall be closed supplementary with suitable locking caps.

Threshold sealing:

via double rubber lip sealing, its formation guarantees a perfect inversion at closing and opening.

The sealing in corner areas between threshold and frame shall be guaranteed with suitable agents.

Surface:

galvanized and double primed, prepared for local finishing coat. Paint coat damages shall be repaired after installation.

Grouting:

The filling of frame and threshold with non-shrinking grouting mortar e.g. make Pagel or equivalent

belongs to the services of the contractor incl. all secondary work.

Installation sealing:

The sealing shall be dismantled after completion of gate installation, stored and reinstalled after completion of painting work.

The costs shall be considered in unit price.

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Sound insulating requirements for the total construction consisting of both doors described above:

evaluated sound insulation size  $R'w \geq 45$  dB  
and sound insulation size at 125 Hz  $> 35$  dB  
acc. DIN EN ISO 717-1

125	250	500	1000	2000	(Hz)
$\geq 35$	$\geq 42$	$\geq 48$	$\geq 52$	$\geq 52$	(dB) octavos

The prescribed sound insulation shall be confirmed by a test certificate from a approved expert.

Requirements to pressure resistance at test stand side:  
in direction control room with 50 kPa (max. pressure top) in case of an explosion like pressure increase.

Structural marginal conditions

Structural dimensions w/h: 1.10/2.15 m from top of finish  
Structural dimensions w/h: 1.10/2.25 m from top of slab  
Wall thickness: 0.30 m

Clear passage size:

w/h  $> 1.00 / 2.05$  m

Transport and installation note:

It shall be assumed that still no finished floor/false floor, top of slab = -1.45 m is existing on both wall sides at the time of door installation. Possible auxiliary constructions for the transport and installation of doors shall be included. Transport way see attached layout groundfloor.

Installation location is groundfloor level +/-0.00 m.

make: Manfred Hagemeyer e.K or equivalent  
Ulmer Straße 40  
72587 Römerstein  
Tel: (+49)7382 / 93790  
email: G.Hagemeyer@hagemeyer-tueren.de

or

Stahltürenbau Buchele GmbH or equivalent  
Postf. 1124  
73055 Ebersbach/Fils  
Tel: 07163 / 1001-0  
www.buchele.de

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### 1.2.20. **Sound insulating one-wing SD door**

Sound insulating one-wing steel door, accomplishment acc. to fire resistance class E30 acc. to DIN EN 13501-2, installed in a reinforced concrete wall, with a wall thickness of  $t=0.30$  m, consisting of:

Door leaf:

bearing steel subconstruction with double-sided sheet steel planking, extremely warp resistant and camber-free processed.

Door leaf filling:

made of e.g. mineral wool, construction material class A1 incombustible, acc. to DIN EN 13 501-1, processed without settling and/or acc. to requirement.

Door hinges:

Accomplishment with 3-part heavy construction hinges, ball borne, number of hinges acc. to requirement.  
Accomplishment as left door.

Door wing:

Locking facility, prepared for installation of a cylinder lock delivered by others.

The latch bolt shall be constructed as press-on bolt, the construction shall allow an automatic closing in case of fire (bolt, worm will be pulled back automatically).

Number of latch bolts e.g. 3-latch bolt mortise lock, acc. to requirement.

Handle set with smooth-running light metal long lever in robust make, with long escutcheon.

Function of door handle:

a) Door handle at 90° placed towards top, worm and latch bolt in gear

b) Door handle in horizontal position, worm free, latch bolt in gear

c) Door handle pushed towards bottom, latch bolt will be pulled back

Door handle shall be always pulled back into horizontal via springs at slanted position.

Frame:

Sheet steel circumferential frame with anchor doweled to reinforced concrete wall, wall thickness approx. 0.30 m.

The door frame shall reduce the rough masonry opening at each side only by max. 0.05 m in order to provide a possibly large clear passage.

Sealing:

between frame and door leaf made of solid rubber profiles, constructed as double cutting sealing.

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Threshold:

Construction as ramp threshold with a permissible rise above top edge floor of max. 10 mm.

Continuously in steel in connection with frame.

Sufficient recesses shall be provided for the filling with grouting mortar which shall be closed supplementary with suitable locking caps.

Threshold sealing:

via double rubber lip sealing, its formation guarantees a perfect inversion at closing and opening.

The sealing in corner areas between threshold and frame shall be guaranteed with suitable agents.

Surface:

galvanized and double primed, prepared for local finishing coat. Paint coat damages shall be repaired after installation.

Grouting:

The filling of frame and threshold with non-shrinking grouting mortar e.g. make Pagel or equivalent belongs to the services of the contractor incl. all secondary work.

Installation sealing:

The sealing shall be dismantled after completion of gate installation, stored and reinstalled after completion of painting work.

The costs shall be considered in unit price.

Sound insulating requirements:

evaluated sound insulation size R'w                      **≥ 45 dB**  
acc. DIN EN ISO 717-1

125	250	500	1000	2000	(Hz)
≥ 35	≥ 42	≥ 48	≥ 52	≥ 52	(dB) octavos

The prescribed sound insulation shall be confirmed by a test certificate from a approved expert.

Structural marginal conditions

Structural dimensions w/h: 1.05/2.15 m from top of finish

Structural dimensions w/h: 1.05/2.30 m from of slab

Wall thickness: 0.30 m

Clear passage size:

w/h > 0.95 / 2.05 m

Transport and installation note:

Installation location is groundfloor level +/-0.00 m.

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**1.2.30. Two-wing REI90 gate, pressure reinforced**

Two-wing special steel gate, accomplishment acc. to fire resistance class REI90-C5 acc. to DIN EN 13501-2, with pressure reinforced requirements, installed in a reinforced concrete wall, with a wall thickness of  $t=0.30$  m,

consisting of:

Door leaf:

bearing steel subconstruction with double-sided sheet steel planking, braced and camber-free processed, 2 ea safety pins from door leaf to frame per door leaf.

Door leaf filling:

made of e.g. mineral wool, construction material class A1 incombustible, acc. to DIN EN 13 501-1, processed without settling and/or acc. to requirement.

Door hinges:

Accomplishment with 3-part heavy construction hinges, ball borne, number of hinges acc. to requirement.

Active wing:

Locking facility, prepared for installation of a cylinder lock delivered by others.

Handle set with smooth-running aluminum long lever in robust accomplishment, with long escutcheon.

Stationary wing:

The stationary wing shall be locked automatically against opening at locking process, the delocking will be accomplished via a smooth-running lever bolt on hinge counter side, with concealed rod. Operation by smooth-running long lever on door interior side.

Frame:

Sheet steel U-frame welded to a circumferential sectional steel angle L100\*100\*10 mm concreted on both wall sides. Wall thickness approx. 0.30 m.

The door frame shall reduce the rough masonry opening at each side only by max. 0.05 m in order to provide a possibly large clear passage.

Sealing:

between frame and door leaf with a fire protection strip and rubber profiles. Floor connection with automatical doorseal integrated in the active and the stationary wing.

Surface:

galvanized and double primed, prepared for local finishing coat. Paint coat damages shall be repaired after installation.

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Grouting:

The filling of frame and threshold with non-shrinking grouting mortar e.g. make Pagel or equivalent belongs to the services of the contractor incl. all secondary work.

Installation sealing:

The sealing shall be dismantled after completion of gate installation, stored and reinstalled after completion of painting work.

The costs shall be considered in unit price.

Wing division 1 : 1

Requirements to fire resistance:

Accomplishment acc. to fire resistance class EI 90 C5  
acc. to DIN EN 13501-2.

Requirements to pressure resistance:

on test stand side, in direction loading path with 50 kPa (max. pressure top) in case of an explosion like pressure increase.

Structural marginal conditions

Structural dimensions w/h: 2.00/2.15 m from top of finish  
Structural dimensions w/h: 2.00/2.25 m from top of slab

Wall thickness: 0.30 m

Clear passage size:

w/h > 1.90 / 2.05 m

Transport and installation note:

It shall be assumed that still no finished floor/false floor, top edge room = -1.45 m is existing on test stand side at the time of door installation. Possible auxiliary constructions for the transport and installation of doors shall be included. Transport way see attached layout groundfloor.

Installation location is groundfloor level +/-0.00 m.

**1.2.40.** \*\*\* Item N/A

**1.2.50.** \*\*\* Item N/A

**1.2.60.** **Surcharge panic door lock rod handle**  
to item 1.2.20,  
acc. to EN 1125 as panic door lock, panic function: A, stainless steel



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rod handle with integrated gear on active wing, concealed screwing.

Delivery and installation.

**1.2.70. Surcharge top door closer, 1-wing doors**

to item 1.2.10 and 1.2.20,  
for one-wing sound protection doors and fire protection doors acc. to  
DIN EN 1154 A, as top located rack and pinion door closer with rod,  
incl. fastening material for left and right doors, for standard installation  
suitable for the installation in sound and fire protection doors, with  
continuously adjustable locking power, locking speed and final rebate.

Make: Dorma or equivalent  
[www.dorma.de](http://www.dorma.de)

or

GEZE or equivalent  
[www.geze.de](http://www.geze.de)

Color: silver

Delivery and installation.

**1.2.80. Surcharge top door closing system, 2-wing doors**

to item 1.2.30,  
however, for two-wing fire protection gates in pressure reinforced  
accomplishment same as described above,  
door closer for stationary and active wing with locking sequence  
control, electrical release of locking process by remote alarm of fire  
alarm system as well as manually operated closing. Opening angle of  
active and stationary wings max. 180 degrees.

Scope of delivery per system:

2 ea scissors top door closer  
1 ea locking sequence controller  
incl. fastening material.

Make: Dorma or equivalent  
[www.dorma.de](http://www.dorma.de)

or

GEZE or equivalent  
[www.geze.de](http://www.geze.de)

Color: silver

Delivery and installation.

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1.2.90. \*\*\* Item N/A

1.2.100. \*\*\* Item N/A

**1.2.110. Surcharge electric magnetic clamps for 2-wing EI 90 gate**  
to item 1.2.30,  
2 ea electric magnetics for surface mounted wall and floor installation  
incl. anchors, holding power dimensioned for 2-wing EI90 fire  
protection gates described above, wing size up to w/h approx. 1.00 /  
2.15 m

1 ea 24 V AC/DC supply, with general building authority approval in  
utilization as arresting system.

Electric release of locking process by remote alarm of fire alarm  
system as well as manually operated locking.

1 ea manual release push button red with lettering "Close door", make  
and type and color in coordination with the supervisor

Complete delivery, connection and installation incl. cabling and manual  
release push button.

**1.2.120. Subconstruction magnetic clamps**  
Subconstruction e.g. made of steel hollow profiles with base panel for  
a projecting fastening of magnetic clamps described above, fastened  
to reinforced concrete wall via approved fastening agents.

Corrosion protection:  
all steel parts with prime coating acc. to DIN EN ISO 12944-1.

Delivery and installation.

**1.2.130.** accord. to Item 1.2.110.  
**Surcharge electric surface magnetic clamp**  
to item 1.2.10 and 20,  
electric magnetic for electro-magnetic locking of one-wing doors incl.  
adhesive counter panel and fastening angles. Installation to frame in  
lintel area, holding power dimensioned for 1-wing gates described  
above,  
wing size up to w/h approx. 1.10 / 2.15 m

24 V AC/DC supply, dimensionally stable aluminum casing, surface  
natural colored anodized.

Complete delivery, connection and installation incl. cabling.

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**1.2.140. Surcharge blind cylinder**  
to 1- and 2-wing doors and gates described above.

**1.2.150. Built-in magnetic contact**  
as opening detector with cast-on 4-wired cable, in standard length 3.00 m, installed in door leaf and leading out of cable in top door corner.

Delivery and installation.

**1.2.160. Cable transition 480 mm**  
Cable transition consisting of:  
Robust metal spiral with installation box for insertion of flexible connection cables up to 8 mm thickness. A non-squeezing and sabotage protected connection between wing and frame shall be guaranteed.

Delivery and installation

**1.2.170. Bolt switch contact**  
with electromechanical contact for monitoring of door lock of interior and exterior doors incl. 3 m connection cable, inserted inaccessible in locking plate of door frame and operated by lock bolt, leading out of cable in top door corner.

Function:

Monitoring of locked or non-locked door with message to the center.

Contact: 1 x change-over switch

Delivery and installation.

### **Surcharge door hardware**

Object hardware acc. to DIN EN 1906 with maintenance-free steel friction bearing, firmly revolving connection by clip-leg spring, spring-mounted borne compensation ring as well as catch spring connection with 9 mm square pin. Cover escutcheons on metal bottom escutcheon with supporting steel cams and thread screws, invisible screwing.

With handle cover plate and key cover plate.

Material and surface: stainless steel

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- 1.2.180. Surcharge stainless steel handle set**  
to one-wing EI90 doors,  
as object hardware made of stainless steel, suitable for fire protection  
doors. Set with handle on both sides, handle towards door leaf, with  
bent shape.
- Handle set consisting of:  
2 ea stainless steel door handle with 9 mm square pin  
2 ea cover plates  
2 ea cover key escutcheons perforated
- Delivery and installation
- 1.2.190.** \*\*\* Item N/A
- 1.2.200.** \*\*\* Item N/A
- 1.2.210. Structural proof**  
Structural calculation of doors and gates considering the prescribed  
marginal conditions regarding pressure and fire protection.
- The documents shall be submitted in triplicate exempt from charges.

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**1.3. Quick opening gate chassis dyno room**

**1.3.10. Quick opening aluminum spiral gate with round spiral**

Gate type:

Module construction, with spiral shaped gate leaf installation rails and pull spring mechanics integrated in lateral frames for the weight compensation and for manual emergency opening, gate leaf routing via ball borne roll devices in frames, emergency delocking on bracket in interior area, spiral type: round spiral

Rough masonry opening:

Width: 4500 mm  
Height: 2700 mm  
Lintel height: 1530 mm

Speed:

Lift speed approx. 1 m/s  
Lowering speed approx. 0.6 m/s

Covering type:

Double-walled aluminum lamellas (E6/EV1 anodized), individually screwed to hinges, connected with rubber sealing. Brush strip as end sealing on steel subconstruction, delivery, fastening and adjustment.

Spiral facing at lintel made of aluminum and hollow space damping with mineral fiber panels, with subconstruction, dismantable for maintenance purposes.

Control / motor / electronics:

Microprocessor control with info-display and foil indicating board "OPEN-STOP-CLOSE", in separate sheet steel switch cabinet (IP64); high frequency motor with frequency converter  
connection voltage: 400 V  
wiring completely and ready to operate, network connection to main switch at the site.

Push button, function "OPEN-STOP-CLOSE", with key switch on/off, prepared for a profile semi cylinder, in light metal casing as surface mounted make, doweled to reinforced concrete wall. Enameling acc. to choice of ordering party.

Safety facility:

Electrical safety contact strip acc. to professional organization regulations with stop function for interruption of closing process. The closing process shall be continued after release of contact strip.

Potential-free alarm contacts:

Gate open / gate closed for foreign system (24 V DC)

Gate locking:

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Mechanical gate locking via lever on bracket in interior area

Sound insulation:

Sound insulation value:  $R'w = 25$  dB (in installed condition)  
tested acc. to DIN EN 20140-3. The prescribed sound insulation shall  
be confirmed by a test certificate from a approved expert.

Make: Efaflex or equivalent  
Type: SST-R or equivalent  
<http://www.efaflex.com/>

or  
Make: Albany Door Systems or equivalent  
Type: RapidRoll 3000 or equivalent  
<http://www.albanydoors.com>

Delivery and installation of roll gate system incl. all fastening agents.  
The cabling of individual components among each other incl. fastening  
agents shall be included in the unit price.

- 1.3.20. Surcharge view elements**  
to item 1.3.10  
for 4 ea rows aluminum view lamellas located on above the other with  
completely transparent one-shell polycarbonate view fields.
- 1.3.30. Surcharge electronical gate line light grid**  
to item 1.3.10,  
gate line light grid directly effective in gate closing level, protectively  
integrated in lateral frames, height up to 2500 mm,  
tight light grid made of infrared rays.  
Releasing: stop of automatic closing process of gate.
- 1.3.40. Surcharge NCS coating of all steel parts**  
to item 1.3.10 and 1.3.20,  
powder coating in NCS color shade acc. to choice of ordering party for  
all visible steel parts of components.
- 1.3.50. Surcharge NCS coating of all aluminum lamellas**  
to item 1.3.10 and 1.3.20,  
powder coating in NCS color shade acc. to choice of ordering party for  
all aluminum lamellas of gate leaf.

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**1.4. Sound measurement**

**1.4.10. Sound measurement**

Measurement of actual construction sound insulation size R'w of elements listed above acc. to DIN EN 20140 in octavos by an approved expert in the presence of the Contracting Agency or its representative.

Each one gate, door and window acc. to choice of Contracting Agency will be measured, if the required sound insulation sizes of an element are not achieved, the measurement shall be accomplished at all elements.

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**1.5. Inspection documents**

**1.5.10. Inspection documents, documentation**  
for title 1.1 up to 1.3

The form of inspection documents will be determined by the Contracting Agency (e.g. uniform organization, folder colors, numbering acc. to project code, CAD data exchange, etc.).

The documentation regulations of the Contracting Agency is attached to this specification.

All documents have to be submitted in the demanded number of copies.



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**2. Raised floor**

**2.1. Raised floor made of steel, test benches**

**2.1.10. Cleaning the concrete subbase**

from dirt. The subbase has been prepared with epoxy resin coat by others.

As work preparation prior to installation of the raised floor.

**2.1.20. Elevated steel raised floor**

Difficult installation has to be assumed due to the high density of technical installations.

Overall height: approx. 145 cm  
Grid size: 60 x 60 cm  
Distributed load: min. 30 kN/m<sup>2</sup>  
Concentrated load: min. 10 kN (measured with a roll, diameter 65 x 40 mm)  
Acceptable deformation: L / 300

Nominal concentrated load acc. to DIN EN 12825: > 7000 N  
Class 6 acc. to DIN EN 12825  
Certificate of conformity has to be submitted.  
Resistance to ground RA ≥ 107 Ω without covering

Installation location: ground floor +/- 0.00 m, 15 ea test benches

Stable, reinforced substructure consisting of galvanized square profiles, C-profiles or rectangular hollow profiles acc. to the indicated loads, fork lift traffic has to be taken into consideration, screwed as grid frames glued on tubular supports with base and centering plate onto the unfinished floor, height adjustable due to adjusting thread with counter nut, slabs installed on top of electroconductive sound-absorbing padding.

Bearing grate braced against the containing walls and/or bordering profiles in such a way that it cannot be displaced.

Performance of floor slabs:

Mineral floor slabs, cell fiber reinforced calciumsulphate slab, construction material class A2 acc. to DIN EN 13501-1, reinforced with galvanized sheet steel on the bottom. Edge protection on all sides, glued over the whole slab thickness, for mechanical protection and against penetration of moisture.

Slab covering of rolled checkered aluminum plate, surface pattern "Duett", 2 beads acc. to EN 1386 arranged in parallel

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and offset. Durably glued to the mineral slab with an adhesive that is resistant to oil, benzene and heat.

The slab anchoring shall be chosen in such a way that the original evenness of the floor and fitting accuracy is achieved even after repeated removal of single slabs.

If the slabs have to be fastened by screwing them to the substructure, a uniform hole pattern needs to be regarded (e.g. provision of drillings with a template for hole patterns) and countersunk screwing.

Column with on the edge:  $\leq 2$  mm  
Paralell offset on the cross point the plates corner,  
to each other  $\leq 4$  mm

Supply and mounting

**2.1.30. Bordering raised floor slabs with steel profile**  
for circumferential bordering of the raised floor slabs at the transition to the wall slab and the clamping plate, as galvanized rectangular profile, C-profile or square profile (profile height substructure standard range + slab thickness), profile dimensions approx. 72.5 x 40 x 2 mm, connected with the raised floor substructure and borne by the supports unshiftable, additionally required supports will not be reimbursed.

Supply and mounting

**2.1.35. Surcharge diagonal braces**  
to item 2.1.20,  
for tension- and pressure-resistant diagonal bracing of the substructure doveled with galvanized profile bar onto the unfinished floor.

Supply and mounting

**2.1.40.** \*\*\* Item N/A

**2.1.50. Surcharge bridgings 1200 - 1800 mm**  
to item 2.1.20,  
for bridging of the support bases consisting of galvanized steel profiles.  
Length up to 1200 mm.

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The structural requirements for the indicated loads have to be met.

Supply and mounting

**2.1.60.** accord. to Item 2.1.50.  
**Surcharge bridgings 1200 - 1800 mm**  
to item 2.1.20,  
length more than 1200 up to 1800 mm.

**2.1.70.** **Surcharge installation of trimmer**  
to item 2.1.20,  
for installation of a trimmer within the raised floor substructure  
for the acceptance of cable routes. Fastening underneath the  
bearing profiles.

Supply and mounting

**2.1.80.** **Bevel cuts / separating cuts**  
Provision of subsequent separating cuts in the raised floor of  
item 2.1.20 for adjustment of fixtures, incl. additional galvanizing  
of the cutting edges.

**Provision of subsequent cutouts**  
in the above-described raised floor, acc. to the directions of the  
supervision, in various dimensions, incl. additional galvanizing of  
the cutting edges.

**2.1.90.** **Surcharge for subsequent cutouts up to 200 mm**  
to item 2.1.20,  
in slabs up to 200 mm, round or square.

**2.1.100.** **Surcharge for subsequent cutouts 210 - 400 mm**  
to item 2.1.20,  
in slabs from 201 up to 400 mm, round or square.

**2.1.110.** **Lifting tools**  
for removal of a slab.

**2.1.120.** **Removal of floor slabs**  
for installation work in the raised floor on demand of the  
supervision incl. later reinstallation. Billing per ea floor slab.

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- 2.1.130. Sectional steel constructions**  
for special structures, edge supports of slabs etc. (only on demand of the supervision), consisting of:  
standard profiles, primed, completely incl. all accessories such as screws, dowels, etc., to be fastened to reinforced concrete.  
  
Supply and mounting
- 2.1.140. Surcharge hot-dip galvanizing**  
to item 2.1.130  
of the sectional steel constructions.
- 2.1.150. Surcharge raised floor for wall connection**  
to item 2.1.20,  
provision of a wall connection with permoplastastic joint tape made of hardly inflammable material, construction material class B acc. to DIN EN 13501-1.  
  
Supply and mounting
- 2.1.160. Surcharge adjustment to door thresholds**  
to item 2.1.20,  
of the floor in the area of the steel threshold of sound-absorbing doors and gates.
- 2.1.170. Surcharge support doweling**  
to item 2.1.20,  
for additional fastening of the support bases by means of each two hammer-drive anchors M6/40 or equivalent, 2 dowels per support.  
Billing per support.  
  
Supply and mounting
- 2.1.180. \*\*\* Item N/A**
- 2.1.190. Surcharge special slabs**  
to item 2.1.20,  
special slabs as plates for steel raised floors acc. to the above-specified raised floor, however, in various sizes manufactured to dimensions, as border slabs, fitting slabs or transition slabs.  
  
Supply and mounting

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**2.1.200. Final cleaning**  
of the floor, directly before the user moves into the premises.  
  
The floor has to be cleaned from dirt that has been caused during expansion of the rooms, incl. submittal of cleaning and care instructions to the user.

**2.1.210. Surcharge additional round trips**  
to item 2.1.200,  
only on demand of the supervision.

**Provision of recesses in the raised floor**  
(in the works and on site) acc. to the directions of the supervision in various dimensions, round or square, incl. additional galvanizing of the cutting edges.

**2.1.220. Recesses up to 25 cm<sup>2</sup>**

**2.1.230. Recesses 26 - 100 cm<sup>2</sup>**

**2.1.240. Recesses 101 - 200 cm<sup>2</sup>**

**2.1.250. Recesses 201 - 600 cm<sup>2</sup>**

**2.1.255. Recesses 201 - 1300 cm<sup>2</sup>**

**Provision of drillings for cable lead-through.**

Incl. additional galvanizing of cutting edges.

**2.1.260. Drillings up to 10 mm diameter**

**2.1.270. Drillings up to 16 mm diameter**

**2.1.280. Drillings up to 30 mm diameter**

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2.1.290. \*\*\* Item N/A

2.1.300. \*\*\* Item N/A

2.1.310. \*\*\* Item N/A

2.1.320. **Marking of raised floor slabs**  
All raised floor slabs shall be durably marked with punch numbers. The numbering shall be entered in the grid plans.

2.1.330. \*\*\* Base Item 1.0  
**Protective covering of the floor,**  
Delivery and installation of protective covering of the raised floor made of aluminum-laminated milk carton.  
The joints shall be overlapped and sealed with adhesive tape.  
  
Incl. dismantling and disposal of the protective covering after completion of the subcontractor work after consultation with the supervision. The protective covering will return into the contractor's property.  
  
Supply and mounting

2.1.340. \*\*\* Alternative Item 1.1 zu 1.0  
**Protective covering of the floor, hardboards**  
consisting of 3.8 mm thick hardboards, delivery and provision.  
  
The covering will be provided in slab sizes, adapted to the future equipment and/or installations, incl. covering of joints.  
  
Incl. dismantling and disposal of the protective covering after completion of the subcontractor work after consultation with the supervision. The protective covering will return into the contractor's property.  
  
Size of single slab: approx. 1200 x 1200 mm  
  
Supply and mounting

2.1.350. **Structural proof**  
Structural calculation of the floor slabs and the substructure acc. to the requirements which are described in enclosure

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Drawing No. 540-02 and the item 2.1.20 and the following items.

The documents shall be submitted in triplicate exempt from charges.

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### 2.2. Raised floor made of wood

#### Information on transport

Due to existing ventilation ducts, pipelines and cable routes on site, it may not be possible in some portions to transport the raised floor materials by means of fork lift trucks on the unfinished floor.

Installation on ground floor +/- 0.00 m.

#### 2.2.10. Cleaning the concrete subbase

from dirt, incl. application of impregnation onto the concrete floor for dust bonding, consisting of low-viscosity, solvent-free reaction resins, application twice with at least 200 g/m<sup>2</sup> per work step.

As work preparation prior to installation of the raised floor.

#### 2.2.20. Elevated raised floor

consisting of high-density wooden sandwich panels with sheet-laminated bottom side. These requirements must not be reduced by recesses (see prefaces).

Technical data:

Overall height:	approx. 145 cm
Grid of floor slab:	60 x 60 cm
Grid of substructure:	60 x 60 cm
Floor slab thickness:	approx. 3.8 cm
Acceptable deformation:	L / 300

Fire rating:	F30 acc. to DIN EN 13501-2
Substructure:	A1 acc. to DIN EN 13501-1

Nominal concentrated load acc. to DIN EN 12825: > 4000 N

Class 3 acc. to DIN EN 12825

Certificate of conformity has to be submitted.

Resistance to ground: RA ≥ 107 Ω without covering

Substructure consisting of galvanized tubular steel supports with base and centering plate, glued onto the unfinished floor, height adjustable due to adjusting thread with counter nut fixed in hole points.

Slabs installed on top of electroconductive sound-absorbing padding.

Bearing grate braced against the containing walls in such a way that it cannot be displaced.



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The switch cabinets, l/w = 80/80 cm, will be placed directly on top of the raised floor covering. Acc. to the directions of the supervision, recesses have to be provided in the slab covering below the switch cabinets to allow for connection of utilities.

Floor covering as surcharge item.

Supply and mounting

**2.2.30. Surcharge grid bars U-profile**  
to item 2.2.20,  
for installation of screwed grid bars with U-profiles for horizontal bracing.

Supply and mounting

**2.2.40.** \*\*\* Item N/A

**2.2.50. Surcharge building expansion joints and expansion joint profile**  
to item 2.2.20,  
for flush installation of building expansion joints in the raised floor.

An aluminum expansion joint profile,  
Synthetic rubber flexible insert, that can be replaced at any time;  
abrasion, weather and temperature resistant (-30°C to +120°C),  
resistant to oil, acids and bitumen, colour: black,  
has to be included.

For joint width up to 70 mm

In this area the supports have to be fastened with dowels twice to the unfinished floor.

Incl. bracing of every other support.

Supply and mounting

**2.2.60. Surcharge of conductive linoleum flooring**  
to item 2.2.20,  
made of linoleum on jute fabric as base course,  
acc. to DIN EN 548,  
suitability EN 685, 34 very high stress,  
thickness 2.5 mm,  
tiles, dimensions 60 x 60 cm,  
marbled, no direction,  
smooth surface,  
anchoring on subbase spattled on entire surface,

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with conductive adhesive,  
suitable for rooms with electrostatically endangered  
modules, elements and personal protection,  
VM DIN EN ISO 140-8, 3 dB

Resistance to ground R2 DIN EN 1081 max. 108 Ohm,  
(completely installed)

Design at the Contracting Agency's choice or equivalent.

Supply and mounting

**2.2.70. Baseboard made of linoleum**  
of above-specified floor covering, without concave molding,  
dimensions: base height 100 mm,  
color acc. to the floor covering.

Fastening to the wall acc. to the directions of the manufacturer,  
incl. all corner formations.

Anchoring base: exposed concrete, exposed masonry or  
plasterboard.

Supply and mounting

**2.2.80. Surcharge for bridging, length up to 1200 mm, of support bases**  
to item 2.2.20,  
bridging girder consisting of galvanized steel profiles in areas  
where supports cannot be erected due to lines, cable routes and  
ventilation ducts and/or other fixtures.

Performance to bridge one deleted support.

Span width up to 1200 mm.

Supply and mounting

**2.2.90.** accord. to Item 2.2.80.  
**Surcharge for bridging, length = 1200 - 1800 mm, of support bases**  
to item 2.2.20,  
however, span width 1200 - 1800 mm.

**2.2.100.** accord. to Item 2.2.80.  
**Surcharge for bridging, length = 1800 - 2400 mm, of support bases**  
to item 2.2.20,  
however, span width 1800 - 2400 mm.

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- 2.2.110. Surcharge for wall connection with compression tape**  
to item 2.2.20,  
provision at upright walls, supports as well as fronts  
with permoplastastic compression tape.
- Subbase of sandlime bricks, plasterboard and reinforced  
concrete.
- Supply and mounting
- 2.2.120. Surcharge for wall connection with angle**  
to item 2.2.20,  
provision of a wall connection by means of wall angles in areas  
where supports cannot be erected on top of the unfinished floor.  
The wall angles will be fastened with adequate dowels to the  
walls in the dimensions acc. to the required load level.
- Subbase of bricks, plasterboard and reinforced concrete.
- Supply and mounting
- 2.2.130. Surcharge dowel fastening**  
to item 2.2.20,  
for additional fastening of the support bases by means of each  
two hammer-drive anchors M6/40 or equivalent, 2 dowels per  
support.  
Billing per support.
- Supply and mounting
- Provision of recesses in the raised floor, in the works, acc. to  
the directions of the supervision, in various dimensions, round  
or square, incl. grouting and/or sealing of the cutting edge.
- 2.2.140. Recesses up to 25 cm<sup>2</sup>**
- 2.2.150. Recesses 26 - 100 cm<sup>2</sup>**
- 2.2.160. Recesses 101 - 200 cm<sup>2</sup>**
- 2.2.170. Recesses 201 - 600 cm<sup>2</sup>**

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**2.2.175. Recesses 601 - 800 cm<sup>2</sup>**

Provision of recesses in the raised floor, on site, acc. to the directions of the supervision, in various dimensions, round or square, incl. grouting and/or sealing of the cutting edge.

**2.2.180. Recesses up to 25 cm<sup>2</sup>**

**2.2.190. Recesses 26 - 100 cm<sup>2</sup>**

Provision of drillings for cable lead-through.

**2.2.200. Drillings up to 10 mm diameter**

**2.2.210. Drillings up to 16 mm diameter**

**2.2.220. Drillings up to 30 mm diameter**

**2.2.230. \*\*\* Base Item 2.0**

**Protective covering of the floor, "Tetra Pack"**

Delivery and installation of protective covering of the raised floor made of aluminum-laminated milk carton.

The joints shall be overlapped and sealed with adhesive tape.

Incl. dismantling and disposal of the protective covering after completion of the subcontractor work after consultation with the supervision. The protective covering will return into the contractor's property.

Supply and mounting

**2.2.240. \*\*\* Alternative Item 2.1 zu 2.0**

**Protective covering of the floor, hardboards**

consisting of 3.8 mm thick hardboards, delivery and provision.

The covering will be provided in slab sizes, adapted to the future equipment and/or installations, incl. covering of joints.

Incl. dismantling and disposal of the protective covering after completion of the subcontractor work after consultation with the supervision. The protective covering will return into the contractor's property.

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Size of single slab: approx. 1200 x 1200 mm

Supply and mounting

**2.2.250.** \*\*\* Item N/A

**2.2.260.** **Lifting tools for removal of a slab**

**2.2.270.** **Spare slabs 60/60 cm with covering**  
to be delivered acc. to the above-specified raised floor items.

**2.2.280.** **Brass angle 40/20/3 mm**  
to be delivered and installed in single lengths. Performance as specified, e.g. in doors or at material transitions.

**2.2.290.** \*\*\* Item N/A

**2.2.300.** **Removal of floor covering**  
for installation work in the raised floor on demand of the supervision, incl. reinstallation.

Billing per floor slab.

**2.2.310.** **Marking of fire detector**  
in the raised floor, provision of marking with a red point, d = 4 cm, made of linoleum flooring on raised floor slabs, incl. securing of the slab by means of a galvanized chain 100 cm long, fastened to the substructure.

Delivery and installation incl. all fastening elements.

**2.2.320.** **Surcharge special slabs 60 x 40 cm**  
to item 2.2.20,  
special slabs as wooden sandwich panels acc. to the above-specified raised floor items, however, acc. to requirement and measurement, as border slabs, fitting slabs or connecting slabs, the covering will be billed via the covering items.

linoleum flooring

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- 2.2.330. Surcharge adjusting work**  
to item 2.2.20,  
subsequent cutting of the raised floor slabs acc. to local conditions.
- 2.2.340. Final cleaning**  
of the floor, directly before the user moves into the premises.  
  
The floor has to be cleaned from dirt that has been caused during expansion of the rooms, incl. submittal of cleaning and care instructions to the user.
- 2.2.350. Surcharge additional round trips**  
to item 2.2.340,  
only on demand of the supervision.
- 2.2.360. Support bracing**  
Delivery and installation of support bracing consisting of turnbuckle, perforated strip and tension strap. Fastening to the unfinished floor will be realized by means of dowels.
- 2.2.370. \*\*\* Item N/A**
- 2.2.380. \*\*\* Item N/A**

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### 2.3. Inspection documents

#### 2.3.10. Inspection documents, documentation

for all above-specified raised floors.

The form of inspection documents will be determined by the Contracting Agency (e.g. uniform organization, folder colors, numbering acc. to project code, CAD data exchange, etc.).

The documentation regulations of the Contracting Agency is attached to this specification.

All documents have to be submitted in the demanded number of copies.

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**3.**                      **perforated sheet metal sound absorbtion panelling**

**3.1.**                    **perforated sheet metal sound absorbtion panelling**

**Description of sound panelling**

**General**

The construction of the sound panelling has to take place in close collaboration with other HVACR companies (building services).

**Construction**

The folded and galvanized perforate sheet cassettes have to be mount according to the SBI drawings, (drawing number 540-01)

The cassettes are twice edged on four sides to house mineral wool plates as acoustically effective absorption material. The mineral wool plates have to be wrapped into PE=polyethylen foil closed on all sides with breathing openings for protection of penetration of moisture.

The perforate cassettes have to be screwed onto the substructure consisting of C-profile fixing rails. The fixing rails are also used to fix installations on the walls from the HVACR (building services).

It is not allowed to fix pipes, ducts and other technical equipment on the cassette surfaces.

The supplier has to deliver shop drawings made on the base of the drawings of SBI. The shop drawings will be proofed by SBI and the site supervisor. According to this proofed and accepted drawings the installations will be prepared and executed.

Sound absorption requirements for the cassette panelling:

Sound absorbtion coefficients acc. DIN EN ISO 354

125	250	500	1000	2000	4000	(Hz)
≥0,2	≥	≥	≥	≥	≥	(α <sub>s</sub> )
	0,7	0,8	0,8	0,8	0,8	

**3.1.10. C-profile fixing rails, walls**

C-profile fixing rails steel grade S235 JR as substructure for panelling on walls, hot galvanized, vertically between the cassette shutlines, distance of rails as cassette width, to be mounted flush with the cassette.



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make/type: Halfen-Deha  
medium duty framing system HL 36/36  
or equivalent  
www.halfen.de

or

Würth  
C-Montageschiene 36/36  
VARIFIX or equivalent  
www.wuerth.de

C-profile fixing rails have to be aligned and doweled to reinforced concrete walls and brick-masonry with spacers approx. 80 mm up to front edge of the C-profile fixing rails.

The number of fixing points with dowels has to be determined from the required hanging load of 750 N/m<sup>2</sup>.

Length of each individual C-profile fixing rail from approx. up to max. 6300 mm

Fixing possibilities for the screwed connection of the cassettes have to be taken in account, either by means of a flat sheet metal, approx. 70 mm wide, 2 mm thick, or individual folded flat sheet.

Supply and mounting

**3.1.20. surcharge drills, hole diameter 20-25 mm**  
to Pos. 3.1.10,  
for the making of borholes through the fixing rails, diameter 20-25 mm, on the building side for piping ducts by customers including chamfering of edges.

Billing unit according to fixing rail.

**3.1.30. Cassette panelling for walls, thickness 1 mm**  
Cassette panelling for walls, as supporting element for sound absorbing room lining of the test benches on walls, galvanized steel.

Cassettes made of flat sheet steel, twice edged on four sides (approx. 50 - 100 mm) to house mineral wool plates as acoustically effective absorption material.  
A foam material strip, thickness = 5 mm, has to be inserted into the horizontal cassette joints.

The cassettes are to be executed with a perforated area rate of 35%-40%. They are to be screwed onto the substructure consisting of C-profile fixing rails and flat fixing sheet metal.

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Custom made sizes for forming of a parapet duct for electrical installation on both sides, have to be taken into account.

Cassettes for vertical wall installation acc. to drawing and acc. to above description;

Perforated sheet metal with round holes in staggered rows, measures:

material thickness:	1 mm
hole size W=	5 mm
hole center distance t=	8 mm
relative free hole surface area Ao%=	35% - 40%

Maximum dimensions of the sheet metal cassettes:

width approx.=	1300 mm
height approx.=	1180 mm

Supply and mounting

**3.1.40. surcharge Cassette panelling for wall, thickness 2 mm**

to Pos. 3.1.30,  
perforate sheet in areas with heavy duty.  
thickness of sheet metal 2 mm

mounting in the area electrical installation duct between floor and parapet.

Maximum dimensions of the sheet metal cassettes:

width approx.	1300 mm
height approx.	870 mm

Supply and mounting

**3.1.50.** \*\*\* Item N/A

**3.1.60.** \*\*\* Item N/A

**3.1.70. Mineral wool plates, thickness = 60 mm**

Mineral wool plates for wall cassettes, the mineral wool mats have to be mounted into the cassettes and to be permanently fixed.

It is only allowed to use mineral wool plates who are not dangerous to health.

specific weight approx.	50 kg/m <sup>3</sup>
Thickness approx.	60 mm

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construction material class A1, acc. to DIN EN 13 501-1

Supply and mounting

**3.1.80. Surcharge for protective foil**

to Pos. 3.1.70,  
as additional protection of the mineral wool plates against  
penetration of moisture, made of PE foil closed on all sides with  
breathing openings toward the wall at the rear side.  
Color: black

Supply and mounting

**3.1.90. End plates**

for hot galvanized end plates as socle strip, as well as covers  
for devices have to be custom cut and edged.

material thickness: 2 mm  
developed length: 150 mm - 200 mm  
folding: 3 ea

Supply and mounting

**3.1.100. \*\*\* Item N/A**

**3.1.110. Round cutouts, diameter up to d= 100 mm**

in cassettes of wall panelling, different sizes, incl. joining of the  
cassette plates and surrounding of the cut edges with adequate  
escutcheons or plastic pro-files. To be produced acc. to local  
propotions or information from the construction site,

The mineral wool plates are closed with the pe foil on the edges  
of the cutouts.

The closing with the PE-foil has to be taken into account.

diameter up to d=100 mm

**3.1.120. accord. to Item 3.1.110.  
Round cutouts, diameter up to d= 101 to 500 mm**

**3.1.130. \*\*\* Item N/A**

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**3.1.140. Straight cutouts**  
in cassettes of wall panelling, different sizes, surrounding of the cut edges with plastic profiles.

The mineral wool plates are closed with the pe foil on the edges of the cutouts.

The closing with the PE-foil has to be taken into account.

billing unit= edge of cutouts

**3.1.150. Small steel parts**  
Equipment such as supply gallowes for combustion air, electric devices and cooling water etc. with a high weight or high clamping moment have to be provided with custom made spacer supports and spacer consoles in order to bridge the thickness of the absorption panelling.

Supply and install and prime twice: small steel parts for consoles, supports, anchorings, insertions etc. made of steel profile and sheet steel.

**3.1.160. Removal, interim storage and re-installation of cassettes**  
Removal, interim storage and re-installation of cassettes for future installation works behind the absorption panels.

billing unit = apiece cassette panelling

**3.1.170. \*\*\* Item N/A**

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### 3.2. Inspection documents

#### 3.2.10. Inspection documents, documentation

for all above-specified absorption panelling.  
The form of inspection documents will be determined by the Contracting Agency (e.g. uniform organization, folder colors, numbering acc. to project code, CAD data exchange, etc.).

The documentation regulations of the Contracting Agency is attached to this specification.

All documents have to be submitted in the demanded number of copies.

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**4. Crane systems**

**4.1. Crane systems test booths**

**Note regarding the schedule:**

The installation of the crane system will be accomplished in two different steps.

1. Delivery and installation of the crane rail prior to expansion of the test booth.
2. Delivery and installation of the hoisting gear with initial operation after extension of the test booth.

The costs for this are to be included into the unit prices.

- 4.1.10. Electrical chain hoist, lifting capacity 1 t**  
with 2 lifting speeds (quick and fine lift) with chain, chain box, pulley case, load hook, adjustable safety clutch, direct control, protective type IP 55 and pendant push-button switch at the control line, length of control line approx. 4000 mm.

**Technical data hoisting gear:**

lifting capacity:	1	t
group of mechanisms:	1	Am
main lift:	9	m/min
fine lift:	2.2	m/min
lifting height:	5000	mm
operating voltage:	400 V/50 Hz	

**Make:** Demag Cranes or equivalent  
[www.demagcranes.com](http://www.demagcranes.com)

**Type:** DKUN

or

**Make:** Stahl Crane Systems GmbH or equivalent  
[www.stahlcranes.com](http://www.stahlcranes.com)

or

**Make:** KCI Konecranes or equivalent  
[www.konecranes.com](http://www.konecranes.com)

**Trolley:**

hand chain monorail trolley with 4 roll-born track rollers for suspension on property-furnished trolley, e. g. HE-B 180, length approx. 6500 mm.

**Power supply:**

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as complete chain track line power supply.

Delivery and installation incl. 1 pair of clamping bumpers  
for track limitation.

Expert inspection incl. travel expenses.

### 4.1.20.

#### **Crane rail**

of profiled steel S235JR, length 6500 mm, profile e. g. HE-B 220  
for installation of an electrical chain hoist, incl. end stops and  
fastening construction, of suspension, e. g. HE-A 100,  
2 ea on reinforced concrete hollow block ceiling and 1 ea on  
reinforced concrete wall within a wall breakthrough w/h=  
300/300 mm, including doweling to the wall and anchor bolts on  
the ceiling.

Fastening on the reinforced concrete hollow block ceiling will be  
provided by means of anchorage with counter plate on the  
concrete of the unfinished ceiling, ceiling thickness incl.  
concrete 330 mm.

Suspension height of the crane rail: 580 mm  
number of suspensions: 2 ea  
installation location: 15 ea test booths

Bottom edge reinforced concrete ceiling 6300 mm above top  
edge of the false floor.

At the time of the crane rail installation, the planned steel false  
floor (h= 1450 mm) will not be there yet. Thus, the clear room  
height will be h= 7750 mm.

Corrosion protection:  
sand blasting and rust protection prime coating

Fastening brackets by welding for the power supply run as well  
as fastening of a sign holder of plastic or sheet metal showing  
the permitted lifting capacity shall be included.

Delivery and installation incl. all fastening means.

### 4.1.30.

#### **Surcharge finishing coat crane rail**

to item 4.1.20 and 4.1.30,  
for application of a finishing coat, double application,  
of synthetic resin colors, with a layer thickness of at least  
80 micrometer.

Color: acc. to the coordination and the approval of the user.

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### 4.2. Crane systems Preparation Area

#### 4.2.10. Double girder suspension crane

Double girder suspension crane build up with KBK classic construction kit or equivalent. For area-wide transport, mounted under a reinforced hollow block concrete ceiling, for use in closed hall.  
As special-cold rolled track sections profiles in steel.

Installation location: preparation area, ground floor

##### Technical data track section:

Crane track length:	19000 mm
track profil:	KBK II or equivalent
track suspension distance:	max. 3200 mm
suspension distance ceiling:	640 mm

Pendulating suspension, welded on concreted steel plates (250\*250\*15 mm) in the ceiling. V-type suspensions are included.

##### Technical data double girder crane:

acc. to DIN V ENV 1993-6(DIN 15 018), H1/B3

crane girder profil:	KBK II or equivalent
lifting capacity:	1 t
crane girder length:	6400 mm
crane span dimension:	5500 mm

Traveling electrically speed approx. 27 / 7 m/min.

##### Hoisting gear:

electrical chain hoist, matching with the crane bridge with 2 lifting speeds (quick and fine lift) with chain, chain box, pulley case, load hook, adjustable safety clutch, direct control, protective type IP 55.

##### Technical data hoisting gear:

lifting capacity:	1	t
group of mechanisms:	2	M+
main lift:	6	m/min
fine lift:	1,5	m/min
lifting height:	2700	mm
operating voltage:	400 V/50 Hz	

##### min. hook height:

top edge finished floor up to hook:	approx. 2700 mm
clear room height:	approx. 4150 mm

##### Crane control:

Control via pendant push-button switch with strain-relieved control line, length 2500 mm.

##### Coating:

Prime and finishing coat acc. to the Additional Technical Contract



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Conditions 10.11 crane systems item 2.2 Surface protection.

Color acc. to the coordination and the acceptance of the user, e.g. yellow for the track profiles and blue for the hoisting gear.

Main power supply:

as complete integrated 5-pole busbar.

For dimensioning of the system, the low construction height as well as the min. approach dimensions are to be taken into consideration. A maximum possible hook height shall be obtained.

**Make:** Demag Cranes or equivalent  
[www.demagcranes.com](http://www.demagcranes.com)  
**type:** KBK

or

**Make:** Stahl Crane Systems GmbH or equivalent  
[www.stahlcranes.com](http://www.stahlcranes.com)

or

**Make:** KCI Konecranes or equivalent  
[www.konecranes.com](http://www.konecranes.com)

Delivery and installation of the entire system, including all fastening means, suspension parts and the complete electrical equipment.

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### 4.3. **Special services**

#### 4.3.10. **Inspection documents**

for above items consisting of:

preparation of key plans with entry of the crane systems on the site plans, with information about the lifting capacity, crane number and hoisting gear.

Crane books  
Operating regulations acc. to the regulations of the Professional / trade associations operating manuals  
component lists

All documents are to be submitted in triplicate.

#### 4.3.20. **Drawings and calculations**

for above items consisting of:

key, construction and shop drawings, circuit diagrams including exact details of connections to existing system and/or systems yet to be installed.

Flow charts, schematics, schedules, user lists and other drawings required as supplementation to existing drawings and for accomplishment of requested services.

All calculations required for the system's erection and operation. This includes in particular the structural calculation of the track and crane rails with suspensions and their fastening on the structure.

#### 4.3.30. **Protective measures against third parties**

Dust formation, noise, vibration and waste water shall be kept in mind in particular.

The permitted values in the individual emissions may not be exceeded. Coordination with the Contracting Agency or the responsible authorities has to be carried out prior to start of work.

#### 4.3.40. **Work and protective scaffolding**

Working platforms and scaffolds for all described services.  
Delivery, erection, maintenance and removal after completion of all services.

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**4.3.50. Provision of the test load**  
for all services described above by the contractor incl. appropriate lifting accessories for the expert inspection acc. to Italian regulations.

**4.3.60. Inspection**  
Expert inspection acc. to Italian regulations; for all crane systems described above, incl. additional expenditures for travel expenses.

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**5. Fire protection measures**

**5.1. Fire bulkhead**

**Mineral fiber bulkhead EI90**

Provision of wall bulkheads EI 90, acc. to DIN EN 13501, with a building authority approved mineral fiber separation system in reinforced concrete and masonry walls.

Wall recesses occupied with single cables, cable bundles, bus bars and cable trays.

An easy reinstallation shall be guaranteed.  
Used insulation layer creators shall be age resistant.  
Delivery and installation of all material incl. all secondary work.

The recesses will be bricked-up and/or concreted, however, a gap of 3 cm above the cable gutter beading will be kept free for reinstallation. The gap will be closed with mineral fiber bulkhead.

Wall thickness 25 up to 40 cm

Top level wall bulkheads up to 6.00 m.

Angled wall recesses.

**5.1.10. Opening size up to 0.02 m<sup>2</sup> (cable bulkhead wall)**

**5.1.20. Opening size from 0.021 m<sup>2</sup> to 0.04 m<sup>2</sup> (cable bulkhead wall)**

**5.1.30. Opening size from 0.041 m<sup>2</sup> to 0.10 m<sup>2</sup> (cable bulkhead wall)**

**5.1.40. Opening size from 0.101 m<sup>2</sup> to 0.15 m<sup>2</sup> (cable bulkhead wall)**

**5.1.50. Opening size from 0.151 m<sup>2</sup> to 0.20 m<sup>2</sup> (cable bulkhead wall)**

**5.1.60. Opening size from 0.201 m<sup>2</sup> to 0.25 m<sup>2</sup> (cable bulkhead wall)**

**5.1.70. Opening size from 0.251 m<sup>2</sup> to 0.30 m<sup>2</sup> (cable bulkhead wall)**

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**5.1.80. Opening size from 0.301 m2 to 0.35 m2 (cable bulkhead wall)**

**Mineral fiber bulkhead EI90 (plasterboard wall)**

Provision of wall bulkheads EI 90, acc. to DIN EN 13501, with a building authority approved mineral fiber separation system in in partition in stud-wall design planked with plasterboard.

Wall recesses occupied with single cables, cable bundles, bus bars and cable trays.

An easy reinstallation shall be guaranteed.  
Used insulation layer creators shall be age resistant.  
Delivery and installation of all material incl. all secondary work.

Wall thickness from 15 cm up to 22.5 cm

Top level wall bulkheads up to 4.00 m.

Angled wall recesses.

**5.1.90. Opening size up to 0.02 m2 (cable bulkhead plasterboard wall)**

**5.1.100. Opening size from 0.021 m2 to 0.04 m2 (cable bulkhead plasterboard wall)**

**5.1.110. Opening size from 0.041 m2 to 0.10 m2 (cable bulkhead plasterboard wall)**

**5.1.120. Opening size from 0.101 m2 to 0.15 m2 (cable bulkhead plasterboard wall)**

**Ceiling bulkhead same as item 5.1.10**

however, installation in precast reinforced concrete ceiling,  
ceiling thickness up to 42 cm.

**5.1.130. Opening size up to 0.06 m2 (cable bulkhead ceiling)**

**5.1.140. Opening size from 0.061 m2 to 0.10 m2 (cable bulkhead ceiling)**

**5.1.150. Opening size from 0.101 m2 to 0.15 m2 (cable bulkhead ceiling)**

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**5.1.160. Opening size from 0.151 m2 to 0.25 m2 (cable bulkhead ceiling)**

### **Insulation coating for incombustible pipelines**

Filling of remaining space, between concreted pipe sleeve and pipeline, with fire protection insulation of construction material class A1 acc. to DIN EN 13501.

Component ceiling and wall, thickness 25 up to 42 cm.

**5.1.170. Pipe diameter up to d = 15 mm (soft bulkhead)**

**5.1.180. Pipe diameter up to d = 20 mm (soft bulkhead)**

**5.1.190. Pipe diameter up to d = 32 mm (soft bulkhead)**

**5.1.200. Pipe diameter up to d = 50 mm (soft bulkhead)**

**5.1.210. Pipe diameter up to d = 100 mm (soft bulkhead)**

**5.1.220. Pipe diameter up to d = 125 mm (soft bulkhead)**

**5.1.230. Pipe diameter up to d = 150 mm (soft bulkhead)**

**5.1.240. Pipe diameter up to d = 200 mm (soft bulkhead)**

**5.1.250. Pipe diameter up to d = 250 mm (soft bulkhead)**

### **Fire protection tape**

for incombustible pipes with insulation consisting out of synthetic rubber (for example make "armaflex") class B1/B2 acc. to DIN 4102.

Pipes installed in reinforced concrete and masonry wall as well as in ceilings made of precast reinforced concrete.

Component ceiling and wall, thickness 25 up to 42 cm.

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**5.1.260. Pipe diameter up to d = 75 mm incl. insulation**

**5.1.270. Pipe diameter up to d = 90 mm incl. insulation**

**5.1.280. Pipe diameter up to d = 120 mm incl. insulation**

**5.1.290. Pipe diameter up to d = 180 mm incl. insulation**

**5.1.300. Pipe diameter up to d = 210 mm incl. insulation**

**5.1.310. Pipe diameter up to d = 260 mm incl. insulation**

### **Joint bulkhead fire damper**

made of fire protection mortar EI 90 acc. DIN EN 13501 shall be provided at the fire dampers.

The closing of hardly accessible intermediate spaces and the formwork shall be included.

Fire damper installed in reinforced concrete and masonry wall as well as in ceilings made of precast reinforced concrete.

Component ceiling and wall, thickness 25 up to 42 cm.

**5.1.320. Joint width up to 50 mm**

**5.1.330. Joint width from 51 mm to 100 mm**

**5.1.340. Joint width from 101 mm to 150 mm**

### **Fire protection collar** for combustible pipes,

as maintenance-free moisture insensitive pipe bulkhead, in divided make, delivery and installation.

Fire rating EI 90 acc. to DIN EN 13501.

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**5.1.350. Pipe exterior diameter up to 50 mm**

**5.1.360. Pipe exterior diameter up to 125 mm**

**5.1.370. Pipe exterior diameter up to 150 mm**

### **Wall openings with fire protection mortar EI 90**

Formwork and concreting of wall openings in bricked and concreted walls after accomplishment of mechanical installation, occupied with incombustible pipes with pipe sleeve and air ducts.

Closing of wall openings with fire protection mortar, EI 90 acc. to DIN EN 13501.

Very narrow space conditions are to be expected due to the very compact mechanical installation.

Wall thickness from 25 cm to 30 cm

**5.1.380. Wall opening size up to 0.05 m2**

**5.1.390. Wall opening size from 0.051 m2 to 0.10 m2**

**5.1.400. Wall opening size from 0.101 m2 up to 0.15 m2**

**5.1.410. Wall opening size from 0.151 m2 up to 0.20 m2**

**5.1.420. Wall opening size from 0.201 m2 up to 0.25 m2**

**5.1.430. Wall opening size from 0.251 m2 up to 0.30 m2**

**5.1.440. Wall opening size from 0.301 m2 up to 0.35 m2**

**5.1.450. Wall opening size from 0.351 m2 up to 0.40 m2**



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5.1.460. Wall opening size from 0.401 m2 up to 0.45 m2

5.1.470. Wall opening size from 0.451 m2 up to 0.50 m2

5.1.480. Wall opening size from 0.501 m2 up to 0.60 m2

5.1.490. Wall opening size from 0.601 m2 up to 0.70 m2

5.1.500. Wall opening size from 0.701 m2 up to 0.80 m2

5.1.510. Wall opening size from 0.801 m2 up to 0.90 m2

5.1.520. Wall opening size from 0.901 m2 up to 1.00 m2

5.1.530. Wall opening size from 1.001 m2 up to 1.50 m2

5.1.540. Wall opening size from 1.501 m2 up to 2.00 m2

5.1.550. Wall opening size more than 2.00 m2

**Closing of ceiling openings with fire protection mortar  
EI 90**

Formwork and concreting of ceiling openings after accomplishment of mechanical installation, occupied with incombustible pipes with pipe sleeve and air ducts.

Closing of ceiling openings with fire protection mortar, EI 90 acc. to DIN EN 13501.

Very narrow space conditions are to be expected due to the very compact mechanical installation.

Ceiling thickness up to 42 cm

5.1.560. Ceiling opening size up to 0.06 m2

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5.1.570. Ceiling opening size from 0.061 m2 up to 0.10 m2

5.1.580. Ceiling opening size from 0.101 m2 up to 0.15 m2

5.1.590. Ceiling opening size from 0.151 m2 up to 0.25 m2

5.1.600. Ceiling opening size from 0.251 m2 up to 0.50 m2

5.1.610. Ceiling opening size from 0.501 m2 up to 1.00 m2

5.1.620. Ceiling opening size from 1.001 m2 up to 1.50 m2

5.1.630. Ceiling opening size from 1.501 m2 up to 2.00 m2

5.1.640. Ceiling opening size from 2.001 m2 up to 2.50 m2

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**5.2. Fire protective covering ventilation**

**5.2.10. Covering EI 90 of ventilation ducts**

e.g. for a fire damper arranged directly in front of wall or partial areas of ventilation ducts made of 40 mm thick fire protection boards like Promatect-L 500-panels or equal, delivery, installation acc. to approval and covering of panel joints, inside and outside by a circumferential fire protection strip.

**5.2.20. Ventilation line EI 90, automatic**

as self-bearing duct made of two-layered 2 x 20 mm fire protection boards like Promatect-L panels or equal, delivery and installation acc. approval, incl. covering of panel joints and suspension construction for various cross section dimensions in max. 800/450 mm.

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### 6. Coating work

#### NOTE

During calculation it has to be assumed that interruptions have to be expected during the construction period.

Duration of the interruptions up to 14 days, number 3 ea.

It is a continuous measure, it shall be processed in construction phases.

The work will be performed in the chassis dyno top edge +/- 0.00 m and 15 ea test bench pits top edge = -1.45 m and the adjoining pit of the feeding hallway top edge = - 2.00 m.

Narrow space conditions shall be expected in the test bench pits. Moreover, the surfaces to be coated are partially subdivided by concrete upturns, mounting plates, floor ducts and technical fixtures etc. into smaller surfaces.

These marginal conditions shall be considered during unit price formation.

### 6.1. Floor coatings

#### 6.1.10. Cleaning of floor surfaces

from construction debris and concrete and mortar residues incl. sucking off by means of industrial vacuum cleaner.

Base: Reinforced concrete and cement screed

The arising construction debris will become property of the contractor.

#### Floor surface

The surface of the floor must be free from loose, crumbly parts and type-specific layers, which will easily get loose. The surface may not loose dust or sand and has to be free from type-foreign materials (separating agent, unsuitable old coatings, efflorescence, growth, oil etc.).

#### 6.1.20. Roughen floor surfaces

Roughening the surfaces on the entire area and removal of all loose, damaged and non-sufficiently bearing layers.

Procedure:

Shot peening (e.g. Blastrac, incl. border processing along the wall and support base point and final cleaning.

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The concrete surface shall be protected against repeated soiling. The protection of the adjoining components as well as the surroundings is included.

The minimum adhesion removal strength of the base has to be 1.5 N/mm<sup>2</sup> on average.

Base:  
Reinforced concrete horizontal and/or slightly sloped.

Main installation levels: - 2.00 and - 1.45 m.  
Test bench pits, top edge - 1.45 m, number 15 ea  
feeding hallway, top edge - 2.00 m

Aids for the transport of required machines and materials are not provided on site.

After preparation of the base, the surface has to have at least the characteristics demanded in the Technical Information of the following coating system.

The arising construction debris will become property of the contractor.

- 6.1.30. Surcharge roughening of small surfaces, up to 10 m<sup>2</sup>**  
To item 6.1.20  
for base preparation of smaller floor surfaces,  
between technical fixtures and upturns etc. This  
also applies for smallest surfaces as e.g. floor breakthroughs  
in the mechanical stories.  
  
Single surface up to 10 m<sup>2</sup>.
- 6.1.40. Surcharge additional round trips**  
To item 6.1.20  
on instruction of the supervision for additional round trips.
- 6.1.50. Base preparation vertical components**  
Up to a height of 15 cm, e.g. on supports and walls.
- 6.1.60. Scratch and shrink hole leveling**  
Of solvent-free two-component epoxy liquid resin.  
Scratch leveling of two-component epoxy liquid resin, solvent-free,  
glossy, non-pigmented, by mixing of silica sand of grain size  
0.1 - 0.4 mm.

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- 6.1.70. Provision of triangular wedges**  
Along the stiff wall components, in bricked or concreted make, at the transition wall to floor, with epoxy resin mortar incl. prime coating, processing acc. to the target of the manufacturer.  
  
Dimensions: approx. 3/3 cm.
- 6.1.80.** \*\*\* Item N/A
- 6.1.90. Examination of the moisture content**  
Component: Floor with CM-device.  
  
Recording of the results by entry into the plans, provided by the Contracting Agency.
- 6.1.100. Examination of the adhesive tensile strength**  
Examination of the adhesive tensile strength acc. to DIN EN 13892-8.  
  
Component: Floor, on prepared concrete padding  
  
Recording of the results by entry into the plans, provided by the Contracting Agency.
- 6.1.110. Examination of the concrete compressive strength**  
Component: Floor, non-destructive with the rebound hammer  
  
Recording of the results by entry into the plans, provided by the Contracting Agency.
- 6.1.120. Treatment of cracks**  
Widening and saturation of cracks with a lowly viscous 2-component reaction resin and complete closing, and/or gluing of the cracks larger than 0.2 mm, on instruction of the local supervision.
- 6.1.130. Pigmented coating, layer thickness 1 mm**  
With skid-proof surface incl. prime coating.  
  
Layer thickness: 1 mm  
  
Prime coating:  
of two-component epoxy liquid resin, solvent-free, glossy, non-pigmented.  
  
Spreading silica sand of grain size 0.4 - 0.8 mm on the fresh prime

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coating. Removal of the surplus, non-adhesive silica sand after drying.

Skid-proof coating

of two-component epoxy liquid resin, solvent-free, can be mechanically and chemically stressed, glossy, pigmented.

Friction coefficient:  $\mu$  0.3 - 0.4

Chemical resistance: against fuels (diesel, gas) and oils, short-period stress up to 3 days. A material resistance list shall be attached to the offer.

Color shade:

acc. to the coordination and the acceptance of the user, in standard colors.

**6.1.140. Surcharge pigmented coating 1 mm, vapor-diffusion open**

To item 6.1.130,  
however, formation of the above mentioned coating as  
vapor-diffusion open system.

**6.1.150. Surcharge small surfaces pig. coating 1 mm**

To item 6.1.130.  
of smaller floor surfaces, e.g. below the test bench foundations as well  
as in the area of mechanical fixtures etc.  
base surface up to 10 m<sup>2</sup>

**6.1.160. Surcharge base formation, H = 15 cm**

To item 6.1.130.  
for formation of a base area.

Height approx. 15 cm

**6.1.170. Surcharge pump sumps**

To item 6.1.130.  
for coating of the floor depressions on the entire area as e.g.  
pump sumps in different single dimensions,  
approx. 15/15/5 cm.

**6.1.180. Sample surface coating 1 mm**

Provision of a sample surface for the coating,  
as described in item 6.1.130.

Dimensions 1.00 m x 1.50 m

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- 6.1.190. Conducting floating coating**  
Incl. prime coating, of solvent-free two-component epoxy liquid resin.
- Layer thickness: 2 mm
- Prime coating:  
of two-component epoxy liquid resin, solvent-free, glossy, non-pigmented.
- Conducting intermediate layer  
of conducting two-component epoxy liquid resin, solvent-containing, pigmented, incl. copper tape and connection cable.  
The connection to the potential equalization will be provided by others.
- Conductivity acc. to DIN EN 1081 and DIN IEC 61340-4-1, conducting resistance smaller than  $10^6$  Ohm
- The conducting resistance shall be proven by measurement with recording. The costs shall be included into the item.
- Conducting finish coating  
of conducting two-component epoxy liquid resin, solvent-free, can be mechanically and chemically stressed, glossy, pigmented.
- Color shade:  
acc. to the coordination and the acceptance of the user, in standard colors.
- 6.1.200. Surcharge base formation, H = 15 cm**  
To item 6.1.190,  
for formation of a base area adding set-up agent.
- Height approx. 15 cm
- 6.1.210. Surcharge skid-resistant surface**  
To item 6.1.190,  
installation of a conducting granulate layer on the conducting intermediate layer, of conducting two-component epoxy liquid resin, solvent-free, can be mechanically and chemically stressed, glossy, pigmented.
- Friction coefficient:  $\mu$  0.45
- Spreading silicium carbide of grain size 0.3 - 0.5 mm on the fresh coating.



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Conducting finish coating  
of conducting two-component epoxy liquid resin,  
solvent-free, can be mechanically and chemically stressed, glossy,  
pigmented.

Color shade:

acc. to the coordination and the acceptance of the user, in standard  
colors.

**6.1.220. Sample surface conducting coating 2 mm**  
Provision of a sample surface for the coating,  
as described in item 6.1.190.

Dimensions: 1.00 m x 1.50 m

**6.1.230. Provision inspection documents**  
Plan preparation with illustration of all connection points of the  
conducting coating, at the appropriate potential equalization.

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**6.2.** **Joint sealing in the floor area**

**6.2.10.** \*\*\* Item N/A

**6.2.20.** \*\*\* Item N/A

**6.2.30.** **Sealing of connection/separating joints 20 mm**

Flexible sealing of connection, separating and expansion joints in the floor area of two-component polyurethane - joint grouting compound.

Performance:

Prime coating of joint edges.

Joint shall be filled with suitable, closed-cell, softener-free and decaying-resistant foam material and grouting with joint grouting compound.

Joint width: 20 mm  
Color shade: concrete gray

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### CALCULATION BASIS AND REQUESTED DOCUMENTS

Requested documents

Reviewable structural calculation for bearing and also smoke gas leading stainless steel pipe, bearing, support and fastening constructions, construction and workshop drawings incl. connection details of base, fixed and friction bearing construction as well as other fastening and support constructions.

The bidder shall attach following proofs to the offer with the offer submission:

- Load and/or foundation information
- Large ability proof acc. to DIN EN ISO 3834-2 for welding of steel buildings
- Furthermore, the requested ability proofs shall include following welding approvals for the following listed material, however, at least named in specification and offer:
  - Structural steels S 235, S 355 Cr-Ni-steels

Billing bases and quality requirements

DIN EN 1991-1-4,  
DIN EN 13084-1  
DIN EN 13384-1  
DIN V EN V1993-3-2

If further regulations are affected, they will apply accordingly. The bidder shall possess the valid large ability proof acc. to DIN EN ISO 3834-2, issued with his name.

#### **7. Chimney system**

##### **7.1. Chimney system**

###### **7.1.10. Structural calculation and engineering**

The structural calculation as well as the CAD layout drawings incl. anchoring and fastening constructions shall be submitted in reviewable shape to the Contracting Agency and the site supervision for approval within the following listed periods. The reviewable structural calculations shall be provided in triplicate within one week, the layout drawings within 3 weeks after order provision and technical clarification. The CAD drawings shall be submitted to the Contracting Agency and/or design office upon request in dwg or dxf format for further utilization.

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**7.1.20. Review structural calculation**

Review of structural calculation by an independent, approved review structural engineer.

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**7.1.30. Steel chimney system**

Steel chimney system in detail, consisting of:

- 1 ea base construction as seamless steel round pipe with closed bottom, made of stainless steel material 1.4571, incl. all required bracings etc., wall thickness and number of bracings acc. to structural calculation. Base point constructed for the connection to a PTFE friction bearing (separate item).

- 1 ea lightning protection connection device in the area of base panel.

- 1 ea exterior pipe made of S235 JRG2, with closed bottom part, wall thickness acc. to structural calculation, incl. all required recesses and bracings for inlets, cleaning etc.

- 1 ea thermal back ventilation of support pipe above sufficiently dimensioned ventilation grids.

- 1 ea smoke gas leading interior pipe made of stainless steel material 1.4571, in one piece and tightly welded make.

- all required spacer constructions for the interior pipe, consisting of a reinforcement ring made of stainless steel with distance rolls made of temperature resistant PTFE-rolls.

1 ea insulation of interior pipe made of mineral wool acc. to DIN EN 13501-1, class A1, stepped to galvanized wire. The fastening of mineral wool mats will be accomplished by welded stainless steel pins with attached disk clips.

1 ea condensate shell for the interior pipes with drain device made of material 1.4571.

1 ea inspection door for the interior pipe incl. connection piece in overpressure-tight accomplishment completely made of stainless steel material 1.4571.

2 ea steel hollow profile fastening constructions S235 JRG2 for horizontal holding device to building, dimensions and wall thickness acc. to structural calculation, consisting of: welded steel hollow profiles below 90° to local connection points at building in the area of reinforced concrete ceilings, level 1: +14.03 m distance to facade approx. 750 mm,

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level 2: +22.29 m distance to facade approx. 1750 mm,  
screwed to local connection panels.

Forces to be induced:

level 1: horizontal force at top fastening point: +/- 30 KN

level 2: horizontal force at medium fastening point: +/- 3.6 KN

The connection points at the exterior pipe shall be accomplished  
as friction bearing construction with a PTFE-bearing.

1 ea smoke gas inlet connection piece below 90° sloped  
towards chimney axis in double-walled accomplishment with  
appropriate reinforcement ribs acc. to structural calculation.  
The connection piece shall be led out up to approx. 650 mm out  
of structurally bearing pipe. A stainless steel flange with counter  
flange and sealing will be applied at the end of this extension.

1 ea measuring connection piece 3" with screw connection  
offset by 90°

1 ea steel chimney head consisting of a weather resistant  
covering of opening with two welded sliding pipes. The interior  
pipes will be led within sliding pipes via a roll construction and  
end with a flanged stainless steel hood. The complete hood  
construction consists of a stainless steel material 1.4571,  
material thickness: at least 3.0 mm.

1 ea installation device consisting of an additional ring bracing of  
exterior pipe at opening as well as two loop constructions  
accepting appropriately strong shackles for the installation.

1 ea color technical treatment of interior and exterior areas of  
exterior pipe construction consisting of:

- jet derusting acc. to standard purity degree SA 2.5
- double prime coating on zinc phosphate basis,  
layer thickness each at least 40 µm

The exterior areas will be provided additionally:

- double final coating on zinc phosphate basis, layer thickness  
each at least 40µm total layer thickness at least 160 µm, color  
choice acc. to RAL

Technical data of chimney system:

Bottom edge chimney system: h = +7550 mm

Total height above road level: h = 34400 mm

Total height above foundation: h = 26850 mm

Exterior pipe diameter: da= 914 mm acc. DIN EN 10210

Wall thickness: t= 8 mm

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The first 8000 mm from top of the chimney downwards,  
t= 6 mm and afterward t= 8 mm.  
Interior pipe diameter: di= 813 mm acc. DIN EN 10210  
Wall thickness: t= 3 mm  
Insulation thickness: t= 50 mm  
Support pipe at base point: da= 406.4 mm  
acc. DIN EN 10210  
Wall thickness: acc. structural calculation

### Friction bearing construction

as maintenance-free and for the outdoor area suitable friction bearing, force direction on all sides mobile with PTFE sliding element chambered in steel support material and steel counter bearing with polished stainless steel sheet metal, with a rough depth of Rz < 1µm.

Completely processed, welded or screwed and with corrosion protection same as described in item above, provision, delivery and installation.

Incl. required screws and fastening material as well as dowels and drilling of fastening holes.

#### 7.1.40. Friction bearing base point

installed between top edge reinforced concrete foundation and base point chimney system, e.g. as flat friction bearing mobile on all sides. The fastening to foundation and with the base point will be accomplished via screw connection with stainless steel screws.

Forces to be induced:  
Vertical top load: 110 KN

Complete delivery and installation.

#### 7.1.50. \*\*\* Item N/A

#### 7.1.60. Inspection facility

An approved, double-bar climbing protection system will be installed at support pipe for ascent of chimney system described above. The fastening will be accomplished via U-shaped flat steel bows made of stainless steel welded with support pipe via chamfer-free fillet weld.

The equipment of climbing facility includes:

- catch facility element

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- abdominal belt
- required stop landings acc. to trade association regulations

Total length of ladder: base panel starting up to work landing at chimney head

Material: completely S235 JRG2 galvanized

**7.1.70. Work landing**

at chimney opening. The accomplishment of work landing will be performed acc. to valid regulations.

Material: completely S235JR galvanized

**7.1.80. \*\*\* Item N/A**

**7.1.90. Transport and installation**

The entire chimney system shall be constructed in the factory of the contractor in own responsibility as described above. The transport of total system to the worksite as well as unloading, storage or installation of individual components shall be accomplished by the contractor in own responsibility and in due time. Above all, the inspection of worksite and transport and installation possibilities at installation location and coordination of transport with the supervisor belongs to this. The Contracting Agency shall take care that the required installation crane and transport vehicles can drive and/or stand up to directly to location of chimney system (max. distance crane location - chimney axis 20 m).

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**7.1.100. Reinforced concrete foundation chimney**

on the top of the roof. Complicated transport of material has to be taken into account.

Dimensions:

Length: 1000 mm  
Width: 1000 mm  
Height: 800 mm  
top of slab: + 6.63 m

Minimum compressed strength class :  
C30/37 acc. DIN EN 206-1

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**7.1.110. Formwork**  
the formwork for the foundation chimney has to be built as plane wood or steel formwork including notches, recesses, obliqueness and offsets.

**7.1.120. Concrete reinforcement**  
as round steel BST 500 S (IV S) in all dimensions.

**7.1.130. Steel base plate**  
installed of the top edge reinforced concrete foundation with anchor bolt 4 ea M27 connected with the reinforcement of the concrete ceiling. The foundation edges are protected with an circumferential angle 120\*80\*8 mm, welded on the base plate.

Base plate and the angle made of stainless steel material 1.4571.

Dimension steel base plate : 840\*840\*40 mm

The distance between the base plate and the top edges foundation and the anchor pipes have to be filled up with an non shrinking grout, make "EMACO" or equivalent. H= 80 mm

Necessary openings in the baseplates for filling are taken into account.

**7.1.140. Construction of anchorage recesses**  
for attaching on the top of the chimney foundation with corrugated pipes including closing the floor with formwork girder, fixed connection at the formwork and auxiliary construction for safety and calibration.

**7.1.150. Corrugated pipes of galvanized steel panel**  
of galvanised steel panel with sinous surface as lost formwork for recesses to anchor base plates.  
Fixed connection at the formwork including auxiliary construction for safety and calibration.

Construction in different lengths up to 800 mm

Diameter 80 mm



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**8. Ventilation Systems**

**8.1. Air handling units**

\*\*\* Design-Description 8001

**Specifications ventilation and Air Conditioning Systems**

**General requirements:**

**All devices described below have to be realized according to the requirements of Italian laws and the newest technical regulations. The Air handling units have to comply with these requirements.**

- Housing
- Air connection or openings
- Flaps
- Filter unit
- Heat recovery unit
- Air heater and cooler unit
- Fan unit
- Additional equipment and documentation

The described dimensions are maximal dimensions.

**Housing**

Mechanical stability

Max. bend of wall and or frame under normal operating conditions (in test housing: test pressure 1500 Pa overpressure and underpressure): 10 mm per 1m.

Housing leakage EN 1886: 1.9 dm<sup>3</sup>/Sm<sup>2</sup>

Filter bypass leakage total: 1.9 %

Thermal insulation EN 1886: 1.0 to 1.4 W/m<sup>2</sup>K

Heat bridge factor:

External air intake chamber: 0.45 to 0.60

Cooler, elements and following housing elements: 0.3 to 0.45

Wall structure, double-shelled with insulation: 40 mm

Construction material class of insulation material

DIN EN 13238: A1

Joining insulation dim. De (dB) acc. to EN 1866 of model box:

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Hz	125	250	500	1k	2k	4k	8k
De(dB)	16.8	25.5	30.3	32.7	34.6	40.0	36.9

Surface characteristics:  
Outside: Steel sheet, Sendzimir-galvanized  
Inside: Steel sheet, Sendzimir-galvanized

### Additional specifications

The entire system is mounted on a concrete foundation, positioned horizontally and insulated for structure-borne noise against the setup surface.

The connection to the individual sections must be frictional and form-true. The connection surface is sealed with a rubber band. The individual sections must be bolted constructions so that each section can be disassembled into its parts and reassembled.

The individual sections have to be constructed regarding corrosion protection and sealing such that they can be cleaned out with a water jet (inside). The entire floor of the housing must be a selfsupporting basin designed for personnel access and corrosion-protected with runoffsleeves for the cleaning water.

The inspection doors have to be double-walled, stable, galvanized with 40 mm of insulation, double-lever locks including Open-Closed markings for lever positions.

The air-proof seal is to be achieved by means of an all-round, age-resistant rubber profile jammed in the door leaf. This rubber element must be held in the groove and be jammed permanently into the door leaf (not glued). The inspection doorshavre to be equipped with inspections windows at least 250 mm in diameter, glazed with insulation glass. The door-opening fixture must open in the opposite direction to the air pressure.

The floor of the unit is to be covered with galvanized grid.

Each section must have a long-field lamp as long as the basin including lamp element and with an outside switch with control lamp including wiring with connection socket.

The cabling/wiring of several internal feeding connections has to be handled as one common feed-in point

The electric installation must comply with IP 65.  
Insections with high air temperatures, only metal protective

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pipes are permitted.

All integrated installations must be accessible from both sides.

The same or similar components must be supplied by a single supplier.

### Air connection or openings

- Flow rate: max. 8 m/s (with the exception of the fan air exit)
- Flow-off angle: at least  $\alpha = 35^\circ$
- Feed-flow angle: at least  $\alpha = 35^\circ$
  
- Structure-borne noise insulation (no metal contact)
  
- Potential compensation

Surface characteristics:

Inside: steel sheet, Sendzimir-galvanized  
Outside: steel sheet, Sendzimir-galvanized

### Flaps

- Sealing class (EN 1751): 2
- Outside air flap attached inside
  
- Flow rate for flaps:  $\leq 8$  m/s
- Flow-off angle: at least  $\alpha = 35^\circ$
- Feed-flow angle: at least  $\alpha = 35^\circ$
  
- Possibility to install flap - drive; place requirement for external connection
  
- Surface characteristics: steel sheet, Sendzimir-galvanized

Louver flap with stable hollow-body lamellar made of galvanized steel sheet. The counter-positioned lamellar are fastened to continuous galvanized flap axes, in maintenance-free brass bushings and fastened to stable U-profile frames, positioning lever and ball joint for servomotor drive.

### Filter unit

Surface characteristics: in steel sheet sendzimir-galvanized

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Contact manometer with display scale 0-500 Pa, electrical output signal (floating contact 0.5 A / 24 V), signal free selectable in the indicating range, integrated in equipment ready to operate and connected to measurement sleeves with PVC measurement hose.

The electric installation must comply with IP 65. In Filter class at intake (acc. to DIN EN 779)

Filter class: F 5

Filter surface with bag design at least 9 m<sup>2</sup> per filter bag

Permanent sealing seat (e.g. spring and clamps filter fastening must not all work against the airstream)

Max. feed-flow rate (for filter bag 610 mm x 610 mm)  
- 2.7 m/s  
- 3600 m<sup>3</sup>/h

Dimensioning resistance:  
(delta pressure begin + pressure delta end) / 2

Final resistance: 250 Pa

Surface characteristics  
Filter frame: Steel sheet, Sendzimir-galvanized

Inspection opening (min. dia. 150 mm)

Filter differential pressure monitoring  
- Inclined tube manometer  
- Contact manometer

150 mm top level first floor from equipment first filter section, filter bag upright.

### Air Filter

Bag filter consisting of the bag filter W x H x L 592 x 592 x 635 mm (entire filter) with 12 filter bags in conical form made of glass fibre medium with pure-airside gauze rigidity element.

Effective filter surface ia at least 9 m<sup>2</sup> per filter bag. in exceptional cases, half filters W x H x L 287 x 592 x 635 are to be used, for which the effective filter surface is at least 4.5 m<sup>2</sup>.

Long life, economical pressure loss and operating reliability are ensured by the following design features:  
Each bag has 8 conical seams to maintain distance. These seams are sealed with adhesive.

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The bag seams at the top and bottom are also sealed with adhesive.  
The bag-end seams are rigidified with a single strip of gauze to maintain distance.  
The inflow profiles with special edges at the bag entry prevent medium erosion.  
The front frame made of galvanized steel sheet, 25 mm thick, is overlapped at the squaring cuts.  
The bags are glued to the front frame.  
The entire construction is silicone-free.  
Filter frame, drilled, with internal permanently elastic gasket and press- in elements.  
Sheetmetal rigidity element upright between every second row of filters.

### Heat Recovery Unit

as a Run-around system

(Cooler and Heater type like described below)

Cooler installed in extraction air and heater installed in supply air, for segregated airstreams.

Recovery efficiency: > 43%

Including the complete pipework and insulation and additionally galvanized steel metal shroud, fittings, control valve, the whole necessary controlling equipment.

The heat recovery system has to be consisted with following components:

1 each maintenanc-free circulating pump (230 V, AC), inclusive counterflanges, screws and seals PN 10, and insulation as vapour barrier; all materials have to be usable for operation with water/glycol mixture.

4 each dead-end butterfly valve, leak proeedf, inclusive counterflange, screws and seals, with extended handhold, allowing the insulation.

1 each control valve, with acutator (voltage 24V, AC) with analog input (0 -10 V) - interface to MAC

1 each expanding tank with membrane, operation pressure 5.0 bar, inclusive screw joint, with cab valve and fixing material.

1 each membran safty valve 2.5 bar.

1 each difference pressure manometer, with screw joints and 2

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plug valves.

2 each bimetal-pointer thermometer range -20°C up to + 40 °C.

2 each measuring nozzles DN 15,

4 each fill and emptying valve.

1 each frost protection mixture with 35% glycol (deepest temperature ca. - 20°C) volume sufficient for the complete heat recovery system

1 each tank to collect the frost protection mixture, material: stainless steel, dimension depending on the system volume

### Air heater and cooler unit

Feed-flow rate (ribbed surface)

Heater and Cooler:

< 10000 m<sup>3</sup>/h max. 4.0 m/s

> 10000 m<sup>3</sup>/h max. 3.5 m/s

Lamella interval Copper/Aluminium

Heater: min. 2.5 mm

Cooler: min. 2.5 mm

Water pressure losses under normal design conditions (not Heat recovery unit as a Run-around system)

Heater: max. 20 kPa

Cooler: max. 40 kPa

Frost protection room can be pulled out.

Condensate basin made of corrosionresistant special steel (at least 1.4301).

Avoidance of water droplets in all segments

Continuous and complete drainoff of condensate using basin with gradient.

Following switchoff of cooler, no condensate may remain in basin for hygienic reasons.

Cooler must be washable or one should be able to pull it out without removing other parts; drop separator must pull out.

Insulated wall bushing of cooler muff.

Check valve with self-filling by siphon, and pipe system incl. connection for all units to the sewage system.

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The drop eliminator cube pulled out for cleanings can be removed.

### Heat exchanger

Round copper core pipes with inserted aluminium or copper lamellae. Fixed connection between core pipes and lamellae with special mechanical expansion of core pipes and special formation of lamella collar.

Collection pipes made of copper, connected to core pipes by soldering. Dimensioning of collection pipes acc. to flow volume  
Pipe collector made of copper. Brazed connection of individual parts.

Ventilation and emptying with locking plugs at highest and lowest point in heat transfer unit.

Pressure stage: PN 16

Factory pressure test at 1.3 times operating pressure. Elements must be approved by safety test.

Additional performance label attached to outside of box.

### Heating surface

Connection frame: steel, galvanized

Heating medium connection: welding neck flange.

Maximum no. of pipe rows:	4
Operating pressure:	max. 16 bar
Maximum register with:	2.500 mm
Hot water operating temp:	max. 120°C
Maximum weight per heating register unit per element:	300 kg
Max. pressure loss, air side:	150 Pa

### Cooling surface

Connection frame: steel, galvanized

Cooling registers and drop eliminator with common droplet water basin made of special steel (V2A). Condensate runoff muffs coming out at the sides, including siphon at sufficient height and air lock with ball. Connection with flange, counterflange, bolts and gaskets, ventilation and emptying equipment as well as rosettes on unitlining sheets.

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Installation: horizontal core pipe with horizontal airflow.

Maximum no. of pipe rows: 3  
Maximum register with: 2.500 mm

Maximum weight per cooling register unit (per element): 1.000 kg

Max. pressure loss, air side: 200 Pa

### Thermometer

Bimetallic indicator thermometer for construction elements, display range: -15 to 40°C, housing 150 mm dia. central shaft and flange for device installation.  
Each section must have a thermometer.

### Signs

Designation signs for construction elements of the ventilation devices and channel outlets, size c. 150 x 100 mm, plastic execution, coloured with white lettering and permanent fixation. The system scheme must be shown once on the unit (drawing sealed in film or engraved PVC sign).

### Fan unit

In the area of the fan motors (beg. at 50 kg motor mass) a rail for a 1.0 t chain pull is to be attached to the housing lid for repair purposes.

The ventilator section must have a side wall that is readily dismountable to facilitate replacement of ventilator and motor.

High-performance radial impeller, double-side suction,

with backward curved blades, for belt drive. Stable welded housing made of sheet steel, can be partitioned into two axes (3 segments), lacquered with artificial resin, with exit flange. Radial impeller with profiled blades made of sheet steel, welded throughout, lacquered with artificial resin, statically and dynamically balanced. Balancing standard acc. to Italian law.

Steel bearing housing with integrated spherical roller bearings, greased with age-resistant lithium base grease, attached to a common base frame for fan and motor, with motor slide. With vibration insulators between base frame and housing, on pressure side elastic connection to housing.



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Drive via electrically conductive high-performance narrow V-belt acc. to the italian law and technical standards and V-belt pulleys, designed for double safety. The pulleys must be fastened to the fan and motor shaft with taper-lock spring collet system and groove-spring connection.

Drive with V-belt protection, in corrosion-protected sendzimir-galvanized version with longitudinal division and control flap.

Suction opening of fan with suction safety grid and shaft-end protector in corrosion-protected, Sendzimir-galvanized version.

Fan housing with inspection opening, drainage muffs for maintenance and cleaning at lowest point.

Fan bearings with external greasing fixture.

Fan design

Vibration insulation at least 90% related to layout (related to layout point)

Exceptions:

PN

(kW)	Effective vibration rate (mm/s)*
< 7,5	< 2.8
< 45	< 4.5
> 45	< 7.1

\* In design rpm range, measured at point of power transfer of fan-motor unit to housing.

Flow-off element (e.g. baffle plate) at blow-out rate of > 8 m/s (related to flange cross-section) and the following integrated parts.

Suction-side distance to integrated parts or walls in axial direction. Minimum 0.5 x impeller diameter.

Pressure-side distance to integrated parts in fans  
Flow-off angle: at least  $\alpha = 45^\circ$

With belt drive motor shiftable parallel to axis.

Spring collet system.

Inspection opening (at least 150 mm diameter), including lighting.

Motor protection

- rmp-controllt:	PTC Thermistor
- 1n or 2n:	Circuit-breker (MAC)

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Potential compensation.

Surface characteristics general:  
Housing sheet steel, galvanized.

3 -phase motors  
Protection type IP 54, form B 3, for 3-phase current. The same motor makes are to be used for all systems. The motor connection must be with flexible cable. Delta-wye-tap changer > 3.5 kW.

PG threaded cable bushing for motor connection in device housing.

Repair switch  
For main current, cutoff of drive, housing for wall structure, protection type IP 65, can be locked in "OFF" position with safety lock, with 2 auxiliary and floating contact for message to DDC.

### **Additional equipment and documentation**

Transport fasteners for endangered integrated parts (e.g. fan on spring insulators) with information on device accordingly.

Crane eyes, wood blocks or pallets for forklift or crane transport.

Permanent type plaque with permanent labelling and fasteners.

Drawing of device.

Layout data sheet.

Replacement parts list.

Installation, commissioning and maintenance instructions.

### **Frequency converter**

Structural frequency converter for continuous speed control with speed dependent load moment.  
Accomplished as voltage intermediate circuit converter without capacity reduction at converter exit.  
Operation and programming unit with clear text display, programmable in two levels.  
Integrated PID controller, suitable for volume flow, pressure or level control.  
Display of control size in related size unit e.g.

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volume flow (m<sup>3</sup>/h,), pressure (bar) or temperature (C).

Optional display possibility in display of:

- control rated value (%)
- motor frequency (Hz)
- actual value (%),
- motor current (A)
- motor load moment (%)
- motor capacity (kW)
- electrical energy (kWh)
- motor voltage (V)
- intermediate circuit voltage (V)
- thermal motor and frequency converter load (%)
- display possibility of two data values at the same time
- as well as status and rotating direction display

Rated voltage: 3 x 400 V

Ambiente temperatur: 40°C

Type of protection: IP 54

Radio shielded filter: class B

Network overvoltage and network transient protection

Rated protective throttle in intermediate circuit for reduction of network harmonics.

Control connections galvanically separated from power element.

Standard equipment:

- automatic energy optimization for optimum motor effective degree in partial load area
- switching at exit
- operation hour meter
- minimum and maximum speed limit
- ramp functions
- motor trap
- d.c. brake
- variable cycle frequency
- PID controller
- multi-motor operation is possible
- same motor capacity as at direct operation at network
- V-belt monitoring
- motor PTC thermistor monitoring

Protective functions:

- motor protection (thermal copy)
- built-in motor coils (exit throttle / filter) for long motor lines and reduction of voltage increase speed du/dt
- short-circuit and ground-fault resistant
- overcurrent protection
- thermal frequency converter protection
- low voltage and overvoltage monitoring
- phase failure monitoring

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Analog inputs:

0 - 10 V, 0(4) - 20 mA and inverted signal,

4 digital inputs:

start/stop, reversing, motor PTC thermistor,

quick stop/motor freewheel/d.c. brake,

receipt, fixed speed, electrical

motor potentiometer, MANUAL - 0 - AUTOMATIC

2 analog/digital output relays: 250 V AC or 24 V DC, 2 A

Profibus DP.

The manual/system book (immediately) as well as the programming and parameter list (after accomplished initial operation) shall be submitted to the Contracting Agency for each frequency converter.

The resonant frequencies shall be determined and faded out.

Accessories:

Frequency converter installed on a steel rack in the vicinity of ventilator.

Repair switch completely cabled (shielded lead and flexible) with motor and frequency converter, incl. conduit installed on clamps.

Make, Frequency converter: Siemens, Danfoss, ABB, or equivalent

**8.1.10.** accord. To Design Description 8001  
**Air handling unit, Combustion air left wing (dyno 1-10)**  
Unit type and size: single-unit  
Volume flow rate: 18750 m<sup>3</sup>/h  
Length x Width x Height: 5800 x 1600 x 1600 mm

### Supply air Unit

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Preheater
- Empty section
- Cooling with drop eliminator
- Reheater
- Fan unit
- Flexible connection

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Flexible connection

Dimensions 960 x 1460 mm

Louvre flap

Dimensions 960 x 1460 mm

Empty section

Dimensions Length 1090 mm

Bag filter

Filter class F 5  
Initial pressure loss 47 Pa  
Design pressure loss 124 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

Preheater

Volume flow 18750 m<sup>3</sup>/h  
Heating capacity 220.6 kW  
Temperature of intake air -8.0 °C  
Humidity of intake air 1.0 g/kg dry air.  
Temperature of output air 27.0 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

Empty section

Dimensions Length 340 mm

Cooling with Drop eliminator

Volume flow 18750 m<sup>3</sup>/h  
Cooling capacity 314.5 kW  
Temperature of intake air 34.0 °C  
Humidity of intake air 20.0 g/kg dry air  
Temperature of output air 12.4 °C  
Humidity of output air 9.0 g/kg dry air  
Medium Water  
Advance flow temperature 6 °C  
Return flow temperature 12 °C

Reheater

Volume flow 18750 m<sup>3</sup>/h  
Heating capacity 93.4 kW

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Temperature of intake air 12.4 °C  
Humidity of intake air 9.0 g/kg dry air  
Temperature of output air 27.0 °C  
Humidity of output air 9.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

### Fan unit

Volume flow 18750 m³/h  
Pressure loss (external) 2000 Pa  
Pressure loss, total 2700 Pa  
Output requirement 17.3 kW  
Speed 2512 1/min  
Efficiency 81.4 %  
Impeller version double-side suction

### Motor

Speed range rpm-controlled  
ventilator speed operating data: 20 - 100%  
Rated output 22 kW  
Rated speed 1460 1/min  
Voltage 3x400 V  
Rated frequency 50 Hz

### Sound conduction data

max. permissible sound capacity level total:  
near casing 66.6 dB(A)  
at air intake 94.6 dB(A)  
at air outlet 93.9 dB(A)

### Flexible connection

Dimensions 765 x 765 mm

### **Accessories**

- 1 Repair switch
- 1 Frequency converter
- Frequency converter installed in front of device and completely cabled with the motor and repair switch.
- 1 set tension bridge for all flexible canvas
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open"

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Complete delivery and installation.

**8.1.20.** accord. To Design Description 8001  
**Air handling unit, Combustion air right wing (dyno 11-15)**  
Unit type and size: single-unit  
Volume flow rate: 15375 m<sup>3</sup>/h  
Length x Width x Height: 5500 x 1300 x 1300 mm

### Supply air Unit

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Preheater
- Empty section
- Cooling with Drop eliminator
- Reheater
- Fan unit
- Flexible connection

#### Flexible connection

Dimensions 770 x1110 mm

#### Louvre flap

Dimensions 770 x 1110 mm

#### Empty section

Dimensions Length 910 mm

#### Bag Filter

Filter class F 5  
Initial pressure loss 64 Pa  
Design pressure loss 132 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

#### Preheater

Volume flow 15375 m<sup>3</sup>/h  
Heating capacity 180.9 kW  
Temperature of intake air -8.0 °C

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Humidity of intake air	1.0 g/kg dry air
Temperature of output air	27.0 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C
Return flow temperature	50 °C

Empty section

Dimensions Length	340 mm
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Cooling with Drop eliminator

Volume flow	15375 m³/h
Cooling capacity	257.9 kW
Temperature of intake air	34.0 °C
Humidity of intake air	20.0 g/kg dry air
Temperature of output air	12.4 °C
Humidity of output air	9.0 g/kg dry air
Medium	Water
Advance flow temperature	6 °C
Return flow temperature	12 °C

Reheater

Volume flow	15375 m³/h
Heating capacity	76.6 kW
Temperature of intake air	12.4 °C
Humidity of intake air	9.0 g/kg dry air
Temperature of output air	27.0 °C
Humidity of output air	9.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C
Return flow temperature	50 °C

Fan unit

Volume flow	15375 m³/h
Pressure loss (external)	2000 Pa
Pressure loss, total	2990 Pa
Output requirement	16.2 kW
Speed	2990 1/min
Efficiency	80.6 %
Impeller version	double-side suction

Motor

Speed range	rpm-controlled
ventilator speed operating data:	20 - 100%
Rated output	18.5 kW
Rated speed	1460 1/min
Voltage	3x400 V
Rated frequency	50 Hz



## Specification

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Sound conduction data  
max. permissible sound capacity level total:  
near casing 68.6 dB(A)  
at air intake 96.6 dB(A)  
at air outlet 95.9 dB(A)

### Flexible connection

Dimensions 619 x 619 mm

### **Accessories**

- 1 Repair switch
- 1 Frequency converter
- Frequency converter installed in front of device and completely cabled with the motor and Repair switch.
- 1 set tension bridge for all flexible canvas.
- 1 drive unit for Louvre flap, 24V, AC, with Limit switch "Shut" and "Open"

Complete delivery and installation.

**8.1.30.** accord. To Design Description 8001  
**Air handling unit, Admixture air left wing**  
Unit type and size: single-unit  
Volume flow rate: 35000 m<sup>3</sup>/h  
Length x Width x Height: 6300 x 2000 x 2000 mm

Supply air

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heater
- Empty section
- Cooling with drop eliminator
- Fan unit
- Flexible connection

Flexible connection

## Specification

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Dimensions 1295 x1740 mm

Louvre flap

Dimensions 1295 x 1740 mm

Empty section

Dimensions Length 1495 mm

Bag Filter

Filter class F 5  
Initial pressure loss 51 Pa  
Design pressure loss 126 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

Heater

Volume flow 35000 m<sup>3</sup>/h  
Heating capacity 341.2 kW  
Temperature of intake air -8 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 21.0 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

Empty section

Dimensions Length 580 mm

Cooling with Drop eliminator

Volume flow 35000 m<sup>3</sup>/h  
Cooling capacity 291.8 kW  
Temperature of intake air 34.0 °C  
Humidity of intake air 20.0 g/kg dry air  
Temperature of output air 21.0 °C  
Humidity of output air 15.5 g/kg dry air  
Medium Water  
Advance flow temperature 15 °C  
Return flow temperature 21 °C

Fan unit

Volume flow 35000 m<sup>3</sup>/h  
Pressure loss (external) 1100 Pa  
Pressure loss, total 1830 Pa

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Output requirement 22 kW  
Speed 1812 1/min  
Efficiency 80.7 %  
Impeller version double-side suction

Motor  
Speed range rpm-controlled  
ventilator speed operating data: 20 - 100%  
Rated output 30 kW  
Rated speed 1465 1/min  
Voltage 3x400 V  
Rated frequency 50 Hz

Sound conduction data  
max. permissible sound capacity level total:  
near casing 67.6 dB(A)  
at air inmtake 95.6 dB(A)  
at air outlet 94.9 dB(A)

Flexible Connection  
Dimensions 910 x 910 mm

### Accessories

- 1 Repair switch
- 1 Frequency converter
- Frequency converter installed in front of device and completely cabled with the motor and Repair switch.
- 1 set tension bridge for all flexible canvas.
- 1 drive unit for Louvre flap, 24V, AC, with Limit switch "Shut" and "Open"

Complete delivery and installation.

**8.1.40.** accord. To Design Description 8001  
**Air handling unit, Admixture air right wing**  
Unit type and size: single-unit  
Volume flow rate: 14000 m<sup>3</sup>/h  
Length x Width x Height: 4600 x 1300 x 1300 mm

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Supply air

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heater
- Empty section
- Cooling with drop eliminator
- Fan unit
- Flexible connection

Flexible connection

Dimensions 770 x 1110 mm

Louvre flap

Dimensions 770 x 1110 mm

Empty section

Dimensions Length 950 mm

Bag Filter

Filter class F 5  
Initial pressure loss 54 Pa  
Design pressure loss 127 Pa  
End pressure loss 200 Pa

Additional Accessories: 1 set filter

Heater

Volume flow 14000 m<sup>3</sup>/h  
Heating capacity 136.5 kW  
Temperature of intake air -8.0 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 21.0 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

Empty section

Dimensions Length 580 mm

## Specification

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### Cooling with Drop eliminator

Volume flow	14000 m <sup>3</sup> /h
Cooling capacity	116.7 kW
Temperature of intake air	34.0 °C
Humidity of intake air	20.0 g/kg dry air
Temperature of output air	21.0 °C
Humidity of output air	15.5 g/kg dry air
Medium	Water
Advance flow temperature	15 °C
Return flow temperature	21 °C

### Fan unit

Volume flow	14000 m <sup>3</sup> /h
Pressure loss (external)	1100 Pa
Pressure loss, total	1700 Pa
Output requirement	8.2 kW
Speed	2350 1/min
Efficiency	80.8 %
Impeller version	double-side suction

### Motor

Speed range	rpm-controlled
ventilator speed operating data:	20 - 100%
Rated output	11 kW
Rated speed	1460 1/min
Voltage	3x400 V
Rated frequency	50 Hz

### Sound conduction data

max. permissible sound capacity level total:	
near casing	62.6 dB(A)
at air inmtake	90.6 dB(A)
at air outlet	89.9 dB(A)

### Flexible connection

Dimensions:	619 x 619 mm
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### **Accessories**

- 1 Repair switch
- 1 Frequency converter
- Frequency converter installed in front of device and completely cabled with the motor and Repair switch.
- 1 set tension bridge for all flexible canvas.

## Specification

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- 1 drive unit for Louvre flap, 24V, AC, with Limit switch "Shut" and "Open"

Complete delivery and installation.

**8.1.50.** accord. To Design Description 8001  
**Air handling unit, Chassis dyno**  
Unit type and size: Combi-unit  
Volume flow rate supply air: 22000 m<sup>3</sup>/h (design)  
Volume flow rate supply air: 22000/9000 m<sup>3</sup>/h (operation)  
Volume flow rate extraction air: 22000 m<sup>3</sup>/h (design)  
Volume flow rate extraction air: 16000/7000 m<sup>3</sup>/h (operation)

### Supply air Unit

Length x Width x Height: 6400 x 1600 x 1600 mm

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heat recovery
- Empty section
- Preheater
- Empty section
- Cooling with drop eliminator
- Empty section
- Reheater
- Fan unit
- Flexible connection

#### Flexible connection

Dimensions 950 x 1460 mm

#### Louvre flap

Dimensions 950 x 1460 mm

#### Empty section

Dimensions Length 1090 mm

## Specification

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### Bag Filter

Filter class	F 5
Initial pressure loss	44 Pa
Design pressure loss	122 Pa
End pressure loss	200 Pa

Addinional Accessories: 1 set filter

### Heat recovery

Volume flow	22000 m <sup>3</sup> /h
Heating capacity	106 kW
Efficiency	48 %
Temperature of intake air	-8 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	6.4 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water / Ethylen Glycol
Frost protection amount	30 %
Advance flow temperature	11.75 °C
Return flow temperature	3.15 °C

### Empty section

Dimensions Lengh	340 mm
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### Preheating

Volume flow	22000 m <sup>3</sup> /h
Heating capacity	281.0 kW
Temperature of intake air	-8.0 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	30.0 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C
Return flow temperature	50 °C

### Empty section

Dimensions Length	340 mm
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### Cooling with Drop eliminator

Volume flow	22000 m <sup>3</sup> /h
Cooling capacity	369.0 kW
Temperature of intake air	34.0 °C
Humidity of intake air	20.0 g/kg dry air
Temperature of output air	12.4 °C
Humidity of output air	9.0 g/kg dry air

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Medium Water  
Advance flow temperature 6 °C  
Return flow temperature 12 °C

Empty section

Dimensions Length 340 mm

Reheating

Volume flow 22000 m³/h  
Heating capacity 132.1 kW  
Temperature of intake air 12.4 °C  
Humidity of intake air 9.0 g/kg dry air  
Temperature of output air 30.0 °C  
Humidity of output air 9.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

Fan unit

Volume flow 22000 m³/h  
Pressure loss (external) 1000 Pa  
Pressure loss, total 1750 Pa  
Output requirement 13.0 kW  
Speed 1864 1/min  
Efficiency 81.4 %  
Impeller version double-side suction

Motor

Speed range 2n, rpm-controlled  
Rated output 15 kW  
Rated speed 1460 1/min  
Voltage 3x400V  
Rated frequency 50 Hz

Sound conduction data

max. permissible sound capacity level total:  
near casing 63.6 dB(A)  
at air intake 91.6 dB(A)  
at air outlet 90.9 dB(A)

Flexible connection

Dimensions: 765 x 765 mm

**Accessories**

- 1 Repair switch



## Specification

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- 1 Frequency converter
- Frequency converter, installed in front of device and completely cabled with the motor and repair switch,
- 1 set tension bridge for all flexible canvas
- 1 drive unit for Louvre flap, 24V, AC, with Limit switch "Shut" and "Open"

### Extraction air

Length x Width x Height: 4500 x 1600 x 1600mm

Assembly of components in air flow direction:

- Flexible connection-
- Empty section
- Filter
- Empty section
- Heat recovery with Drop eliminator
- Fan unit
- Louvre flap
- Flexible connection

#### Flexible connection

Dimensions 950 x 1460 mm

#### Empty section

Dimensions Length 1090 mm

#### Bag Filter

Filter class F 5  
Initial pressure loss 44 Pa  
Design pressure loss 122 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

#### Empty section

## Specification

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Dimensions Length 340 mm

### Heat recovery with drop eliminator

Volume flow 22000 m<sup>3</sup>/h  
Heating capacity 106 kW  
Temperature of intake air 22 °C  
Humidity of intake air 40 %  
airTemperature of output air 8.2 °C  
Humidity of output air 90 %  
Medium Water / Ethylen Glycol  
Frost protection amount 30 %  
Advance flow temperature 3.15 °C  
Return flow temperature 11.75 °C

### Fan unit

Volume flow 22000 m<sup>3</sup>/h  
Pressure loss (external) 1000 Pa  
Pressure loss, total 1380 Pa  
Output requirement 10.5 kW  
Speed 1721 1/min  
Efficiency 80.3 %  
Impeller version double-side suction

### Motor

Speed range 2n, rpm-controlled  
Rated output 15.0 kW  
Rated speed 1460 1/min  
Voltage 3x400 V  
Rated frequency 50 Hz  
Type

### Sound conduction data

max. permissable sound capacity level total:  
near casing 62.6 dB(A)  
at air intake 90.6 dB(A)  
at air outlet 89.9 dB(A)

### Louvre flap

Dimensions 950 x 1460 mm

### Flexible connection

Dimensions 765 x 765 mm

### **Accessories**

- 1 Repair switch

## Specification

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- 1 Frequency converter
- Frequency converter, installed in front of device and completely cabled with the motor and Repair switch, Interface to the electrical traft is the frequency converter.
- 1 Set tension bridge for all flexible canvas
- 1 Drive unit for louvre flap, 24V, AC, with Limit switch "Shut" and "Open"

Complete delivery and installation.

**8.1.60.** accord. To Design Description 8001

**Air handling unit, Soak Area**

Unit type and size: Combi-unit  
Volume flow rate supply air: 10000 m<sup>3</sup>/h  
Volume flow rate extraction air: 10000 m<sup>3</sup>/h

### Supply air Unit

Length x Width x Height: 5000 x 1300 x 1300 mm

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heat recovery
- Empty section
- Heater
- Cooling with drop eliminator
- Fan unit
- Flexible connection

Flexible connection

Dimensions: 770 x 1110 mm

Empty section

Dimensions Length 910 mm

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### Bag Filter

Filter class	F 5
Initial pressure loss	37 Pa
Design pressure loss	119 Pa
End pressure loss	200 Pa

Addinional Accessories: 1 set filter

### Heat recovery

Volume flow	10000 m <sup>3</sup> /h
Heating capacity	48 kW
Efficiency	48 %
Temperature of intake air	-8 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	6.5 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water / Ethylen Glycol
Frost protection amount	30 %
Advance flow temperature	10.3 °C
Return flow temperature	3.7 °C

### Empty section

Dimensions Length	340 mm
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### Heating

Volume flow	10000 m <sup>3</sup> /h
Heating capacity	110.9 kW
Temperature of intake air	-8.0 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	25.0 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C
Return flow temperature	50 °C

### Cooling with drop eliminator

Volume flow	10000 m <sup>3</sup> /h
Cooling capacity	31.3 kW
Temperature of intake air	34.0 °C
Humidity of intake air	20.0 g/kg dry air
Temperature of output air	25.0 °C
Humidity of output air	20.0 g/kg dry air
Medium	Water
Advance flow temperature	6 °C
Return flow temperature	12 °C

### Empty section

Dimensions Length	340 mm
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### Fan unit

Volume flow	10000 m <sup>3</sup> /h
Pressure loss (external)	900 Pa
Pressure loss, total	1370 Pa
Output requirement	4.73 kW
Speed	2359 1/min
Efficiency	80.4 %
Impeller version	double-side suction

### Motor

Speed range	1n
Rated output	5.5 kW
Rated speed	1460 1/min
Voltage	3x400V
Rated frequency	50 Hz

### Sound conduction data

max. permissible sound capacity level total:

near casing	60.6 dB(A)
at air intake	88.6 dB(A)
at air outlet	87.9 dB(A)

### Louvre flap

Dimensions:	770 x 1110 mm
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### Flexible connection

Dimensions	619 x 619 mm
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### **Accessories**

- 1 Repair switch, completely cabled and installed of device.
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open".
- 1 Set tension bridge for all flexible canvas.

### **Extraction air**

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Length x Width x Height: 3800 x 1300 x 1300mm

Assembly of components in air flow direction:

- Flexible connection
- Empty section
- Filter
- Empty section
- Heat recovery with drop eliminator
- Fan unit
- Louvre flap
- Flexible connection

Flexible connection

Dimensions 770 x1110 mm

Empty section

Dimensions Length 910 mm

Bag Filter

Filter class F 5  
Initial pressure loss 37 Pa  
Design pressure loss 119 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

Heat recovery with drop eliminator

Volume flow 10000 m<sup>3</sup>/h  
Heating capacity 48 kW  
Temperature of intake air 22 °C  
Humidity of intake air 40 %  
Temperature of output air 7.8 °C  
Humidity of output air 100 %  
Medium Water / Ethylen Glycol  
Frost protection amount 30 %  
Advance flow temperature 3.7 °C  
Return flow temperature 10.3 °C

Empty section

Dimensions Length 340 mm

Fan unit

Volume flow 10000 m<sup>3</sup>/h  
Pressure loss (external) 900 Pa  
Pressure loss, total 1220 Pa

## Specification

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Output requirement 4.22 kW  
Speed 1907 1/min  
Efficiency 80.1 %  
Impeller version double-side suction

Motor  
Speed range 1n  
Rated output 5.5 kW  
Rated speed 1460 1/min  
Voltage 3x400V  
Rated frequency 50 Hz  
Type

Sound conduction data  
max. permissible sound capacity level total:  
near casing 56.6 dB(A)  
at air inmtake 84.6 dB(A)  
at air outlet 83.9 dB(A)

Louvre flap  
Dimensions 770 x1110 mm

Flexible connection  
Dimensions 619 x 619 mm

### Accessories

- 1 Repair switch, completely cabled an installed of device
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open"
- 1 Set tension bridge for all flexible canvas

Complete delivery and installation.

**8.1.70.** accord. To Design Description 8001  
**Air handling unit, Control room, left wing**  
Unit type and size: Combi-unit  
Volume flow rate supply air: 22000 m<sup>3</sup>/h  
Volume flow rate extraction air: 22000m<sup>3</sup>/h

## Specification

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### Supply air Unit

Length x Width x Height: 6500 x 1600 x 1600 mm

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heat recovery
- Empty section
- Heaterl
- Empty section
- Cooling with Drop eliminator
- Empty section (Option Reheater)
- Fan unit
- Flexible connection

#### Flexible connection

Dimensions 960 x1460 mm

#### Louvre flap

Dimensions 960 x1460 mm

#### Empty section

Dimensions Length 1090 mm

#### Bag Filter

Filter class F 5  
Initial pressure loss 44 Pa  
Design pressure loss 122 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

#### Heat recovery

Volume flow 22000 m<sup>3</sup>/h  
Heating capacity 106 kW  
Efficiency 48 %  
Temperature of intake air -8 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 6.4 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water / Ethylen Glycol



## Specification

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Frost protection amount 30 %  
Advance flow temperature 11.8 °C  
Return flow temperature 3.1 °C

Empty section

Dimensions Length 340 mm

Heater

Volume flow 22000m<sup>3</sup>/h  
Heating capacity 214.5 kW  
Temperature of intake air -8.0 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 21.0°C  
Humidity of output air 1.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

Empty section

Dimensions Length 340 mm

Cooler with drop eliminator

Volume flow 22000 m<sup>3</sup>/h  
Cooling capacity 121.6 kW  
Temperature of intake air 34.0 °C  
Humidity of intake air 20.0 g/kg dry air  
Temperature of output air 23.0 °C  
Humidity of output air 18.0 g/kg dry air  
Medium Water  
Advance flow temperature 15 °C  
Return flow temperature 21 °C

Empty section (Option Reheater)

Dimensions Length 340 mm

Fan unit

Volume flow 22000 m<sup>3</sup>/h  
Pressure loss (external) 1000 Pa  
Pressure loss, total 1700 Pa  
Output requirement 12.8 kW  
Speed 1853 1/min  
Efficiency 81.4 %  
Impeller version double-side suction

Motor

Speed range 2n (50/100%, pole-

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changing switch, number of poles 8/4)  
Rated output 15 kW  
Rated speed 1460 1/min  
Voltage 3x400 V  
Rated frequency 50 Hz

Sound conduction data  
max. permissible sound capacity level total:  
near casing 63.6 dB(A)  
at air intake 91.6 dB(A)  
at air outlet 90.9 dB(A)

Flexible connection  
Dimensions 765 x 765 mm

### Accessories

- 1 Repair switch, completely cabled and installed of device.
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open".
- 1 Set tension bridge for all flexible canvas.

### Extraction air

Length x Width x Height: 4500 x1600 x1600mm

Assembly of components in air flow direction:

- Flexible connection
- Empty section
- Filter
- Empty section
- Heat recovery with drop eliminator
- Fan unit
- Louvre flap
- Flexible connection

Flexible connection  
Dimensions 960 x 1460 mm

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Empty section

Dimensions Length 1090 mm

Bag Filter

Filter class F 5  
Initial pressure loss 44 Pa  
Design pressure loss 122 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

Empty section

Dimensions Length 340 mm

Heat recovery with drop eliminator

Volume flow: 22000m<sup>3</sup>/h  
Heating capacity 106 kW  
Temperature of intake air 22 °C  
Humidity of intake air 40 %  
Temperature of output air 8.2 °C  
Humidity of output air 96 %  
Medium Water / Ethylen Glycol  
Frost protection amount 30 %  
Advance flow temperature 3.1 °C  
Return flow temperature 11.8 °C

Fan unit

Volume flow 22000 m<sup>3</sup>/h  
Pressure loss (external) 1000 Pa  
Pressure loss, total 1380 Pa  
Output requirement 10.5 kW  
Speed 1720 1/min  
Efficiency 80.3 %  
Impeller version double-side suction

Motor

Speed range 2n (50/100%, pole-changing switch, number of poles 8/4)  
Rated output 15.0 kW  
Rated speed 1460 1/min  
Voltage 3x400 V  
Rated frequency 50 Hz

Sound conduction data

max. permissible sound capacity level total:  
near casing 62.6 dB(A)  
at air inmtake 90.6 dB(A)

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at air outlet 89.9 dB(A)

Louvre flap  
Dimensions 960 x 1460 mm

Flexible connection  
Dimensions: 765 x 765 mm

### Accessories

- 1 Repair switch, completely cabled and installed of device
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open"
- 1 Set tension bridge for all flexible canvas

Complete delivery and installation.

**8.1.80.** accord. To Design Description 8001  
**Air handling unit, Control room, right wing**  
Unit type and size: Combi-unit  
Volume flow rate supply air: 14000 m<sup>3</sup>/h  
Volume flow rate exhaust Air: 14000m<sup>3</sup>/h

### Supply air Unit

Length x Width x Height: 5500 x 1300 x 1300 mm

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heat recovery
- Empty section
- Heaterl
- Empty section
- Cooling with drop eliminator
- Empty section (Option Reheater)
- Fan unit
- Flexible connection

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Flexible connection

Dimensions 770 x 1110 mm

Louvre flap

Dimension 770 x 1110 mm

Empty section

Dimensions Length 910 mm

Bag Filter

Filter class F 5  
Initial pressure loss 42 Pa  
Design pressure loss 121 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

Heat recovery

Volume flow 14000 m<sup>3</sup>/h  
Heating capacity 68 kW  
Efficiency 48 %  
Temperature of intake air -8 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 6.4 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water / Ethylen Glycol  
Frost protection amount 30 %  
Advance flow temperature 10.9 °C  
Return flow temperature 3.1 °C

Empty section

Dimensions Length 340 mm

Heater

Volume flow 14000 m<sup>3</sup>/h  
Heating capacity 136.5 kW  
Temperature of intake air -8.0 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 21.0 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

Empty section

Dimensions Length 340 mm

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Cooling with drop eliminator

Volume flow	14000 m <sup>3</sup> /h
Cooling capacity	77.4 kW
Temperature of intake air	34.0 °C
Humidity of intake air	20.0 g/kg dry air
Temperature of output air	23.0 °C
Humidity of output air	18.0 g/kg dry air
Medium	Water
Advance flow temperature	15 °C
Return flow temperature	21 °C

Empty section (Option Reheater)

Dimensions Length	340 mm
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Fan unit

Volume flow	14000 m <sup>3</sup> /h
Pressure loss (external)	1000 Pa
Pressure loss, total	1550 Pa
Output requirement	7.5 kW
Speed	2272 1/min
Efficiency	80.4 %
Impeller version	double-side suction

Motor

Speed range	2n (50/100%, pole-changing switch, number of poles 8/4)
Rated output	11 kW
Rated speed	1470 1/min
Voltage	3x400 V
Rated frequency	50 Hz

Sound conduction data

max. permissible sound capacity level total:	
near casing	62.6 dB(A)
at air intake	90.6 dB(A)
at air outlet	89.9 dB(A)

Flexible connection

Dimensions	619 x 619 mm
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## Accessories

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- 1 Repair switch, completely cabled and installed of device
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open"
- 1 Set tension bridge for all flexible canvas

### Extraction air

Length x Width x Height: 3800 x 1300 x 1300mm

Assembly of components in air flow direction:

- Flexible connection
- Empty section
- Filter
- Empty section
- Heat recovery with drop eliminator
- Fan unit
- Louvre flap
- Flexible connection

#### Flexible connection

Dimensions 770 x 1110 mm

#### Empty section

Dimensions Length 910 mm

#### Bag Filter

Filter class	F 5
Initial pressure loss	42 Pa
Design pressure loss	121 Pa
End pressure loss	200 Pa

Addinional Accessories: 1 set filter

#### Empty section

Dimensions Length 340 mm

#### Heat recovery with drop eliminator

Volume flow	14000m <sup>3</sup> /h
Heating capacity	68 kW

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Temperature of intake air	22 °C
Temperature of output air	7.8 °C
Humidity of output air	100
Medium	Water / Ethylen Glycol
Frost protection amount	30 %
Advance flow temperature	3.1°C
Return flow temperature	10.9 °C

### Fan unit

Volume flow	14000 m³/h
Pressure loss (external)	1000 Pa
Pressure loss, total	1350 Pa
Output requirement	6.44 kW
Speed	1795 1/min
Efficiency	81.5 %
Impeller version	double-side suction

### Motor

Speed range	2n (50/100%, pole- changing switch, number of poles 8/4)
Rated output	11 kW
Rated speed	1470 1/min
Voltage	3x400 V
Rated frequency	50 Hz

### Sound conduction data

max. permissible sound capacity level total:	
near casing	58.6 dB(A)
at air intake	86.6 dB(A)
at air outlet	85.9 dB(A)

### Louvre flap

Dimensions	770 x 1110 mm
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### Flexible connection

Dimensions:	619 x 619 mm
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## Accessories

- 1 Repair switch, completely cabled and installed of device
  
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open"



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- 1 Set tension bridge for all flexible canvas

Complete delivery and installation.

**8.1.90.** accord. To Design Description 8001  
**Air handling unit, Ground floor, left wing**  
Unit type and size: Combi-unit  
Volume flow rate supply air: 33950 m<sup>3</sup>/h  
Volume flow rate extraction air: 32650 m<sup>3</sup>/h

### Supply air Unit

Length x Width x Height: 7400 x 2000 x 2000 mm

Assembly of components in air flow direction:

- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heat recovery
- Empty section
- Heater
- Empty section
- Cooling with Drop eliminator
- Fan unit
- Flexible connection

#### Flexible connection

Dimensions: 1295 x 1740 mm

#### Louvre flap

Dimensions: 1295 x 1740 mm

#### Empty section

Dimensions Length 1495 mm

#### Bag Filter

Filter class F 5  
Initial pressure loss 42 Pa

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Design pressure loss 121 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

### Heat recovery

Volume flow: 33950 m<sup>3</sup>/h  
Heating capacity 152 kW  
Efficiency 44 %  
Temperature of intake air -8 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 5.3 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water / Ethylen Glycol  
Frost protection amount 30 %  
Advance flow temperature 9.9 °C  
Return flow temperature 2.9 °C

### Empty section

Dimensions Length 580 mm

### Heater

Volume flow: 33950m<sup>3</sup>/h  
Heating capacity 319.5 kW  
Temperature of intake air -8 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 20.0 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water  
Advance flow temperature 70 °C  
Return flow temperature 50 °C

### Empty section

Dimensions Length 580 mm

### Cooling with drop eliminator

Volume flow: 33950 m<sup>3</sup>/h  
Cooling capacity 172.5 kW  
Temperature of intake air 34 °C  
Humidity of intake air 20.3 g/kg dry air  
Temperature of output air 26.0 °C  
Humidity of output air 20.3 g/kg dry air  
Medium Water  
Advance flow temperature 15 °C  
Return flow temperature 21 °C

## Specification

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### Fan unit

Volume flow:		33950 m <sup>3</sup> /h
Pressure loss (external)		1000 Pa
Pressure loss, total		1510 Pa
Output requirement		17.2 kW
Speed		1389 1/min
Efficiency	82.3 %	
Impeller version		double-side suction

### Motor

Speed range		1n
Rated output		22 kW
Rated speed		1460 1/min
Voltage		3x400 V
Rated frequency		50 Hz

### Sound conduction data

max. permissible sound capacity level total:		
near casing:		62.6 dB(A)
at air intake:		90.6 dB(A)
at air outlet:		89.9 dB(A)

### Flexible connection

Dimensions:		910 x 910 mm
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### **Accessories**

- 1 Repair switch, completely cabled and installed of device
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open"
- 1 Set tension bridge for all flexible canvas

### **Extraction air**

Length x Width x Height:		5700 x 2000 x 2000mm
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Assembly of components in air flow direction:

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- Flexible connection
- Empty section
- Filter
- Heat recovery with drop eliminator
- Empty section
- Fan unit
- Louvre flap
- Flexible connection

Flexible connection

Dimensions: 910 x 910 mm

Empty section

Dimensions Length 1495 mm

Bag Filter

Filter class F 5  
Initial pressure loss 39 Pa  
Design pressure loss 120 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter

Heat recovery with drop eliminator

Volume flow 32650 m<sup>3</sup>/h  
Heating capacity 152 kW  
Temperature of intake air 22 °C  
Humidity of intake air 40 %  
Temperature of output air 7.8 °C  
Humidity of output air 100%  
Medium Water / Ethylen Glycol  
Frost protection amount 30 %  
Advance flow temperature 2.9 °C  
Return flow temperature 9.9 °C

Fan unit

Volume flow 32650 m<sup>3</sup>/h  
Pressure loss (external) 1070 Pa  
Pressure loss, total 1410 Pa  
Output requirement 15.0 kW  
Speed 1332 1/min  
Efficiency 82.4 %  
Impeller version double-side suction

Motor

Speed range 1n  
Rated output 18.5 kW

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Rated speed 1460 1/min  
Voltage 3x400V  
Rated frequency 50 Hz

Sound conduction data  
max. permissible sound capacity level total:  
near casing 61.6 dB(A)  
at air intake 89.6 dB(A)  
at air outlet 88.9 dB(A)

Louvre flap  
Dimension 910 x 910 mm

Flexible connection  
Dimensions 910 x 910 mm

### Accessories

- 1 Repair switch, completely cabled and installed of device
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut" and "Open"
- 1 Set tension bridge for all flexible canvas

Complete delivery and installation.

**8.1.100.** accord. To Design Description 8001  
**Air handling unit, Ground floor, right wing**  
Unit type and size: Combi-unit  
Volume flow rate supply air: 19800 m<sup>3</sup>/h  
Volume flow rate exhaust air: 15150 m<sup>3</sup>/h

### Supply air Unit

Length x Width x Height: 5700 x 1600 x 1600 mm

Assembly of components in air flow direction:

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- Flexible connection
- Louvre flap
- Empty section
- Filter
- Heat recovery
- Empty section
- Heaterl
- Empty section
- Cooling with drop eliminator
- Fan unit
- Flexible connection

Flexible connection

Dimensions: 960 x 1460 mm

Louvre flap

Dimensions 960 x 1460 mm

Empty section

Dimensions Length 1090 mm

Bag Filter

Filter class F 5  
Initial pressure loss 50 Pa  
Design pressure loss 125 Pa  
End pressure loss 200 Pa

Additional Accessories: 1 set filter

Heat recovery

Volume flow 19800 m<sup>3</sup>/h  
Heating capacity 85kW  
Efficiency 43 %  
Temperature of intake air -8 °C  
Humidity of intake air 1.0 g/kg dry air  
Temperature of output air 4.8 °C  
Humidity of output air 1.0 g/kg dry air  
Medium Water / Ethylen Glycol  
Frost protection amount 30 %  
Advance flow temperature 10.6 °C  
Return flow temperature 1.7 °C

Empty section

Dimensions Length 340 mm

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### Heater

Volume flow	19800m <sup>3</sup> /h
Heating capacity	186.4 kW
Temperature of intake air	-8 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	20.0 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C
Return flow temperature	50 °C

### Empty section

Dimensions Length 580 mm

### Cooling with drop eliminator

Volume flow	19800 m <sup>3</sup> /h
Cooling capacity	100.6 kW
Temperature of intake air	34.0 °C
Humidity of intake air	20.3 g/kg dry air
Temperature of output air	26.0 °C
Humidity of output air	20.3 g/kg dry air
Medium	Water
Advance flow temperature	15 °C
Return flow temperature	21 °C

### Fan unit

Volume flow	19800 m <sup>3</sup> /h
Pressure loss (external)	970 Pa
Pressure loss, total	1520 Pa
Output requirement	10.4 kW
Speed	1487 1/min
Efficiency	80 %
Impeller version	double-side suction

### Motor

Seed range	1n
Rated output	15 kW
Rated speed	1470 1/min
Voltage	3x400V
Rated frequency	50 Hz
Type	

### Sound conduction data

max. permissable sound capacity level total:	
near casing	60.6 dB(A)
at air intake	88.6 dB(A)
at air outlet	87.9 dB(A)

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### Flexible connection

Dimensions 765 x 765 mm

### **Accessories**

- 1 Repair switch, completely cabled and installed of device  
Interface to the electrical traft is the repair switch.
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut"  
and "Open"
- 1 Set tension bridge for all flexible canvas

### Extraction air

Length x Width x Height: 4500 x 1600 x 1600mm

Assembly of components in air flow direction:

- Flexible connection
- Empty section
- Filter
- Heat recovery with drop eliminator
- Empty section
- Fan unit
- Louvre flap
- Flexible connection

### Flexible connection

Dimensions 960 x 1460 mm

### Empty section

Dimensions Length 1090 mm

### Bag Filter

Filter class F 5  
Initial pressure loss 38 Pa  
Design pressure loss 119 Pa  
End pressure loss 200 Pa

Addinional Accessories: 1 set filter



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### Heat recovery with drop eliminator

Volume flow	15150 m <sup>3</sup> /h
Heating capacity	85 kW
Temperature of intake air	22 °C
Humidity of intake air	40 %
Temperature of output air	6.8 °C
Humidity of output air	99 %
Medium	Water / Ethylen Glycol
Frost protection amount	30 %
Advance flow temperature	1.7 °C
Return flow temperature	10.6 °C

### Fan unit

Volume flow	15150 m <sup>3</sup> /h
Pressure loss (external)	1000 Pa
Pressure loss, total	1365 Pa
Output requirement	7.03 kW
Speed	1834 1/min
Efficiency	81.5 %
Impeller version	double-side suction

### Motor

Speed range	1n
Rated output	11 kW
Rated speed	1470 1/min
Voltage	3x400V
Rated frequency	50 Hz

### Sound conduction data

max. permissible sound capacity level total:	
near casing	58.6 dB(A)
at air inmtake	86.6 dB(A)
at air outlet	85.9 dB(A)

### Louvre flap

Dimension:	960 x 1460 mm
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### Flexible connection

Dimensions:	
0 x 1460 mm	

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### **Accessories**

- 1 Repair switch, completely cabled and installed of device.
- 1 Drive unit for louvre flap, 24V, AC, with limit switch "Shut"

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and "Open"

- 1 Set tension bridge for all flexible canvas

Complete delivery and installation.

**8.1.110.** accord. To Design Description 8001  
**Recirculation air cooling AHU test cells ETB 1-15**  
Unit type and size: single-unit  
Volume flow rate: 11800 m<sup>3</sup>/h  
Length x Width x Height: 1950 x 1350 x 1050 mm  
(without duct for air outlet)

Assembly of components in air flow direction:

- Intake grille
- Cooling with drop eliminator
- Fan unit
- Duct for air outlet

### Intake grille

Mesh wire, galvanized with frame

Mesh size: 25 mm  
Width: 1350 mm  
Height: 1050 mm

### Cooling with Drop eliminator

Volume flow: 11800 m<sup>3</sup>/h  
Cooling capacity 79 kW  
Temperature of intake air 40 °C  
Humidity of intake air 12.0 g/kg dry air  
Temperature of output air 20.4 °C  
Humidity of output air 12.0 g/kg dry air  
Medium Water  
Advance flow temperature 15 °C  
Return flow temperature 21 °C

### Fan unit

Volume flow: 11800 m<sup>3</sup>/h  
Pressure loss (external) 800 Pa  
Pressure loss, total 1150 Pa  
Output requirement 4.7 kW  
Speed 1944 1/min  
Efficiency 80.4 %

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Impeller version double-side suction

Motor

Speed range 2n (50/100%, pole-changing switch, number of poles 8/4)

Rated output 5.5 kW

Rated speed 1460 1/min

Voltage 3x400 V

Rated frequency Hz 50

Sound conduction data

max. permissible sound capacity level total:

near casing: 58.6 dB(A)

at air intake: 86.6 dB(A)

at air outlet: 85.9 dB(A)

Duct for air outlet

Duct, galvanized, thickness 2 mm, with final cover for install the following long range nozzles.

Width: 1350 mm

Height: 1050 mm

Lenght: 800 mm

Long range nozzles

for airconditioning large areas. The cone shaped body of the nozzle increases air velocity ensuring a stable core jet. In this way long throws are achieved. The dynamic internal construction of the jet nozzle allows a very high exit velocity at low noise levels. Made from aluminium painted RAL 9010. For direct duct installation, with mounting ring. Swivel head for adjusting air direction, made from painted aluminium RAL 9010 (white)

Quantity: 8 each

Size: 200

### Accessories

- 1 Repair switch, completely cabled and installed of device  
Interface to the elctrical trade is the repair switch.

- 1 bearing edge, suitable for hanging up splicing the AHU,  
described below consisting of galvanized structural steel

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construction distance between upper edge AHU and ceiling: 2  
- 2.5 meters

Complete delivery and installation.

**8.1.120. Silent swingout centrifugal Fan**  
Calibration supply and return air

High performance centrifugal impeller with backward curved blades in galvanised sheet-steel. Rectangular casing in galvanised sheet steel. Acoustically lined with 50 mm mineral wool retained by perforated steel plate. Fan and scroll area are easily accessible as impeller and motor assembly swings out. Rectangular flanges at both ends connect to standard rectangular ducting.  
Totally enclosed 3-phase external rotor motor. Built-in thermal contacts wired to a terminal block.  
Completely maintenance free with sealed for life low noise ball bearings. Protection type IP 44, statically and dynamically balanced. Balancing quality Q 2.5 acc. to DIN ISO 1940.  
Ready for installation with terminal boxes.  
Speed controllable by electronic speed controller (in separate position).

Technical data:

Volume flow	3450 m <sup>3</sup> /h
Pressure loss of air	350 Pa
Speed	1410 1/min
Speed range	2n, rpm-electronic speed controller
Power	0.7 kW
Voltage	230 / 400 V / 3 ph. / 50 Hz
Max. temp.	70 °C (50 °C if controlled)

Maximal Sound power level tube obtained  
Lwa at air intake: 72 dB(A)  
Lwa at air outlet: 83 dB(A)  
Lwa near casing: 60 dB(A)

Diameter:	450
Manufacturer:	Helios, Maico, Rosenberg, or equivalent

### Accessories

-1 Electrical switch for power circuit, with 2 auxiliary and floating

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contacts for message to DDC

- 2 Flexible attenuator

- Potential compensation

Complete delivery and installation.

**8.1.130. Silent swingout centrifugal Fan**  
Converter room left / right wing, return air

High performance centrifugal impeller with backward curved blades in galvanised sheet-steel. Rectangular casing in galvanised sheet steel. Acoustically lined with 50 mm mineral wool retained by perforated steel plate. Fan and scroll area are easily accessible as impeller and motor assembly swings out. Rectangular flanges at both ends connect to standard rectangular ducting.

Totally enclosed 3-phase external rotor motor. Built-in thermal contacts wired to a terminal block.

Completely maintenance free with sealed for life low noise ball bearings. Protection type IP 44, statically and dynamically balanced. Balancing quality Q 2.5 acc. to DIN ISO 1940.

Ready for installation with terminal boxes.

Speed controllable by electronic speed controller (in separate position).

### Technical data:

Volume flow	7850 m <sup>3</sup> /h
Pressure loss of air	300 Pa
Speed	1390 1/min
Speed range	rpm-electronic speed controller
ventilator speed operating data:	20 - 100%
Power	1.9 kW
Voltage	230 / 400 V / 3 ph. / 50 Hz
Max. temp.	70 °C (50 °C if controlled)

Maximal Sound power level tube obtained	
Lwa at air intake:	76 dB(A)
Lwa at air outlet:	88 dB(A)
Lwa near casing:	69 dB(A)
Diameter:	500

**Manufacturer:** Helios, Maico, Rosenberg,

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or equivalent

### Accessories

- 1 Electrical switch for power circuit, with 2 auxiliary and floating contacts for message to DDC
- 2 Flexible attenuator
  
- Potential compensation

Complete delivery and installation.

**8.1.140. Silent swingout centrifugal Fan**  
Utility room left / right wing, supply air  
Utility right wing supply and return air  
3Utility area left wing supply air  
Utility area left wing return air chiller

High performance centrifugal impeller with backward curved blades in galvanised sheet-steel. Rectangular casing in galvanised sheet steel. Acoustically lined with 50 mm mineral wool retained by perforated steel plate. Fan and scroll area are easily accessible as impeller and motor assembly swings out. Rectangular flanges at both ends connect to standard rectangular ducting.  
Totally enclosed 3-phase external rotor motor. Built-in thermal contacts wired to a terminal block.  
Completely maintenance free with sealed for life low noise ball bearings. Protection type IP 44, statically and dynamically balanced. Balancing quality Q 2.5 acc. to DIN ISO 1940.  
Ready for installation with terminal boxes.  
Speed controllable by electronic speed controller (in separate position).

#### Technical data:

Volume flow	10000 m <sup>3</sup> /h
Pressure loss of air	350 Pa
Speed	1355 1/min
Speed range	rpm-electronic speed controller
ventilator speed operating data:	20 - 100%
Power	3 kW
Voltage	230 / 400 V / 3 ph. / 50 Hz
Max. temp.	70 °C (50 °C if controlled)

Maximal Sound power level tube obtained

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Lwa at air intake: 77 dB(A)  
Lwa at air outlet: 92 dB(A)  
Lwa near casing: 69 dB(A)  
Diameter: 560

Manufacturer: Helios, Maico, Rosenberg,  
or equivalent

### Accessories

-1 Electrical switch for power circuit, with 2 auxiliary and floating contacts for message to DDC

- 2 Flexible attenuator

- Potential compensation

Complete delivery and installation.

**8.1.150. Silentbox Centrifugal Fan**  
Ground floor, welding equipment  
Ground floor, calibration  
Ground floor, thermal camber  
Diesel Baril  
Diesel daytank

High performance centrifugal impeller with forward curved blades in galvanised sheet-steel.

Casing in galvanised sheet-steel with round spigot for standard ducting. Acoustically lined with 50 mm mineral fibreboard retained by perforated steel plate. Fan and scroll area easily accessible as impeller and motor swing out.

Totally enclosed single-phase external rotor motor with built-in thermal contacts.

Completely maintenance free with sealed for life low noise ball bearings. Protection type IP 44, statically and dynamically balanced. Balancing quality Q 2.5 acc. to DIN ISO 1940.

Ready for installation with terminal boxes.

### Technical data:

Volume flow max. 500, 700 m<sup>3</sup>/h  
Pressure loss of air 400 Pa  
Speed 1400 1/min  
Speed range 1n

## Specification

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Power 0.62 kW  
Voltage 230 V / 1 ph. / 50 Hz  
Max. temp. 50 °C

Maximal Sound power level tube obtained  
Lwa at air intake: 63 dB(A)  
Lwa at air outlet: 76 dB(A)  
Lwa near casing: 52 dB(A)  
Diameter: 315

Manufacturer: Helios, Maico, Rosenberg,  
or equivalent

### Accessories

- 1 Electrical switch for power circuit, with 2 auxiliary and floating contact for message to DDC

- 1 Full motor protection unit, Operation and protection unit in polymer casing for surface mounting. on/off operation via push button. Manual reset after failure. Volt free contact for connection of alarm. Protection IP 54

- 2 Flexible attenuator

- Potential compensation

Complete delivery and installation.

**8.1.160.** \*\*\* Item N/A

**8.1.170. Silentbox Centrifugal Fan**  
Ground floor, elektronik lab  
Ground floor, hydraulic lab  
Converterroom chassis dyno  
Center, utility

High performance centrifugal impeller with forward curved blades in galvanised sheet-steel.  
Casing in galvanised sheet-steel with round spigot for standard ducting. Acoustically lined with 50 mm mineral fibreboard retained by perforated steel plate. Fan and scroll area easily accessible as impeller and motor swing out.  
Totally enclosed single-phase external rotor motor with built-in thermal contacts.



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Completely maintenance free with sealed for life low noise ball bearings. Protection type IP 44, statically and dynamically balanced. Balancing quality Q 2.5 acc. to DIN ISO 1940. Ready for installation with terminal boxes.

### Technical data

Volume flow, max.	2000 m <sup>3</sup> /h
Pressure loss of air	400 Pa
Speed max	1290 1/min
Speed range	1n
Power	0.99 kW
Voltage	230 V / 1 ph. / 50 Hz
Max. temp.	50 °C ( 40 °C if controlled )

Maximal Sound power level tube obtained

Lwa at air intake:	62 dB(A)
Lwa at air outlet:	77 dB(A)
Lwa near casing:	51 dB(A)
Diameter:	400

Manufacturer: Helios, Maico, Rosenberg,  
or equivalent

### **Accessories**

-1 Electrical switch for power circuit, with 2 auxiliary and floating contact electrical for message to DDC

- 1 Full motor protection unit, Operation and protection unit in polymer casing for surface mounting. on/off operation via push button. Manual reset after failure. Volt free contact for connection of alarm. Protection IP 54

- 2 Flexible attenuator

- Potential compensation

Complete delivery and installation.

\*\*\* Design-Description 8002  
**Rectangular Centrifugal Fan (Ex)**

## Specification

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High performance centrifugal impeller with forward curved blades in galvanised sheet-steel. Dynamically balanced. Rectangular casing in galvanised sheet-steel. Rectangular flanges at each end connect to standard ducting. Explosionproof E Exe II 3-phase external rotor motor, compact design, maintenance free, sealed, silent ball bearings with long life lubrication. The built - in PTC thermistor has to be connected to the tripping device ancillary this speed is controllable. Statically and dynamically balanced. Balancing quality Q 2.5 acc. to DIN ISO 1940. Ready with cable exit.

**8.1.180.** accord. To Design Description 8002  
**Rectangular Centrifugal Fan**  
Ground floor, engine components  
Ground floor, labs area storage

Technical data:

Volume flow max.	500 m <sup>3</sup> /h
Pressure loss of air	300 Pa
Speed	1410 1/min
Speed range	1n
Power	0.47 kW
Voltage	230 400 V / 3 ph. / 50 Hz
Delivery	Ex works

Maximal Sound power level tube obtained

Lwa at air intake:	72 dB(A)
Lwa at air outlet:	76 dB(A)
Lwa near casing:	62 dB(A)
Diameter:	225

Manufacturer: Helios, Maico, Rosenberg,  
or equivalent

### Accessories

-1 Electrical switch for power circuit, with 2 auxiliary and floating contact for message to DDC.

- 1 Full motor protection unit, Operation and protection unit in polymer casing for surface mounting. on/off operation via push button. Manual reset after failure. Volt free contact for connection of alarm. Protection IP 54.

- 2 Flexible attenuator

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- Potential compensation

Complete delivery and installation.

**8.1.190.** accord. To Design Description 8002  
**Rectangular Centrifugal Fan**  
Locale Bombole infiammabili  
Speed controllable by electronic speed controller (in separat position).

Technical data:

Volume flow max.	750/1500 m <sup>3</sup> /h
Pressure loss of air	350 Pa
Speed	1410 1/min
Speed range	2n, rpm-electronic speed controller
Power	0.95 kW
Voltage	230 400 V / 3 ph. / 50 Hz
Delivery	Ex works

Maximal Sound power level tube obtained	
Lwa at air intake:	76 dB(A)
Lwa at air outlet:	79 dB(A)
Lwa near casing:	64 dB(A)
Diameter:	250

Manufacturer:	Helios, Maico, Rosenberg, or equivalent
---------------	-----------------------------------------

**Accessories**

-1 Electrical switch for power circuit, with 2 auxiliary and floating contact for message to DDC. Place of mounting is in the adjoining room.

- 2 Flexible attenuator

- Potential compensation

Complete delivery and installation.

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\*\*\* Design-Description 8003  
**Electronic speed controller**

### Operation and Function

Speed controllers are durable electronic controllers for the speed adjustment of 3 - asynchronous motors. The operational principle is based on a phase-control by thyristors. The control input "kick-start" provides that the motor voltage after starting via ramp function initially will run up to a higher voltage. Only then the voltage and thus the motor speed decreases / increases to the adjusted desired value. This can be made by a potentiometer on the front or over an external value input 0 .. + 10V. The control input with the higher voltage always takes over the speed control.

Input: On / Off switch on the front

Stepless speed adjustment

0 - 10V Input, Connecting terminal X5 / X6

Full motor protection by monitoring the thermal contacts of the motor.

Output: Two Relays

Type of protection: IP 65  
Voltage 230 / 400 V / 3 ph. / 50 Hz

**8.1.200.** accord. To Design Description 8003  
**Electronic speed controller (2.2 kW)**  
Max. motor output 2.2 kW

Complete delivery and installation.

**8.1.210.** accord. To Design Description 8003  
**Electronic speed controller (5.5 kW)**  
Max. motor output 5.5 kW

Complete delivery and installation.

**8.1.220.** **Transformer speed controller**  
for fuse board installation with terminals for 5 output voltages.  
for fans, 230 V / 1 ph. / 50 / 60 Hz

- Terminals for 5 step control
- Attached fixing bracket for simple installation
- Fully impregnated transformers ISO class II, T 40 E

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Current: max. 5.0 A

Complete delivery and installation.

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### 8.2. Ducts and Accessories

#### General Guide note for pipe installation

The pipelines have to be stored in impact - sound damping mounting plates.  
Impact-sound damping rate > 30 dB by reference swing velocity  $v_0 = 5 \times (10 E^{-8})$  m/s.

Continuous pipe mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with mineral fibre fire protection measures.

These fire protection measures are described in a separate specification.

\*\*\* Design-Description 8004

#### Straight air ducts

##### Straight Air Ducts

Straight rectangular air ducts of galvanized sheet metal, foldet, according to DIN EN 1505 and DIN EN 12237

Tightness - category: C (DIN EN 12237)

Connections out of galvanized flanges, sealing by self adhesive tape. Air ducts sufficiently reinforced (diagonal tilting), large dimensions additionally with reinforced constructions air ducts for static pressure up to 2000 Pa and air velocity up to 15 m/s, an occasional increase in pressure up to 25%, constantly or swelling has to be considered as security elbows and fittings in aerodynamically favourable form incl. inserted guide plates incl. connections between the air ducts and/or equipment incl. mounting material consisting of galvanized steel hanging systems secured by self locking screws/nuts or with lock nuts, hanging system with oscillation damping elements, incl. special construction such as fixing points, sliding or rolling bearings, and cut outs in all kinds.

Duct edges and hanging construction below 2 meters have to be secured against accident danger, special constructions have to be provided with doubled painting of rust protection.

Ducts with edge length greater than 60 cm are equipped with reinforced flanges to protect the air ducts against deforming.

Air ducts with a side ratio greater 1:5 are equipped with partition

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plates, which are inserted in vibration free construction all used materials have to be inflammable according to DIN EN 13238

Thickness of the sheet metal:

Air duct and moulded part,

Height and weight 100 - 530 mm :  $\geq 0.7$  mm

Height and weight 531 - 2000 mm :  $\geq 1.1$  mm

Height and weight 2001 - 4000 mm :  $\geq 1.2$  mm

Financial statements for straight air duct and moulded part, according to the requirement of italian law and regulation.

**8.2.10.** accord. To Design Description 8004  
**Straight air ducts**  
Complete delivery and installation.

**8.2.20.** accord. To Design Description 8004  
**Moulded part**  
Complete delivery and installation.

**8.2.30.** accord. To Design Description 8004  
**Air duct and fittings formed as water tight pan for humidified supply air, material no. 1.4571**

use for the combustion air supply left wing, right wing and chassis dyno air supply, incl. humidifying distance,

Straight air duct

even though, as pan, material no. 1.4571, foldet at the upper side, folds at the bottom of the ducts are not allowd.

Molded part

even though, as pan, material no. 1.4571, welding seam preparations and welding seams, wall thickness  $\geq 1.5$  mm.

incl.

- Water tight connections
- Draining points DN 40
- Check valve with self-filling by siphon
- Air duct laid to falls to the draining points
- Draining point at every room entrance to with cap
- Draining point at every 20 m in the duct system 2. floor
- Draining point at every elbow

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Complete delivery and installation.

\*\*\* Design-Description 8005  
**Folded spiral-seam pipes**

Folded spiral-seam pipe incl. fittings, consisting of galvanized sheet metal according to DIN EN 12237

Tightness - category: C (DIN EN 12237)

Minimal thickness of the sheet metal:  
up to DN 100: 0.6 mm  
from DN 125 up to DN 500: 0.8 mm

Pipes and fittings are connected leak proved by PVC shrink-on sleeve shrink-on sleeve in the same colour as the pipes.

Fitting with different diameters (reduction, wyes a.s.o.) are described only with the greatest diameter.

This positions includes:

- Reductions in all kinds
- Connection fittings in all kinds
- Cut outs in all kinds
- End caps
- Sound absorbing galvanized mounting material
- Sealing material

Fittings are described in separate positions.

**8.2.40.** accord. To Design Description 8005  
**Folded spiral-seam pipes DN 100**  
Complete delivery and installation.

**8.2.50.** accord. To Design Description 8005  
**Folded spiral-seam pipes DN 125**  
Complete delivery and installation.

**8.2.60.** accord. To Design Description 8005  
**Folded spiral-seam pipes DN 150**  
Complete delivery and installation.



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8.2.70. accord. To Design Description 8005  
**Folded spiral-seam pipes DN 160**  
Complete delivery and installation.

8.2.80. accord. To Design Description 8005  
**Folded spiral-seam pipes DN 180**  
Complete delivery and installation.

8.2.90. accord. To Design Description 8005  
**Folded spiral-seam pipes DN 200**  
Complete delivery and installation.

8.2.100. \*\*\* Item N/A

8.2.110. accord. To Design Description 8005  
**Folded spiral-seam pipes DN 250**  
Complete delivery and installation.

8.2.120. accord. To Design Description 8005  
**Folded spiral-seam pipes DN 315**  
Complete delivery and installation.

8.2.130. accord. To Design Description 8005  
**Folded spiral-seam pipes DN 355**  
Complete delivery and installation.

8.2.140. accord. To Design Description 8005  
**Folded spiral-seam pipes DN 400**  
Complete delivery and installation.

8.2.150. accord. To Design Description 8005  
**Elbow 15° - 90°, DN 100**  
Complete delivery and installation.

8.2.160. accord. To Design Description 8005  
**Elbow 15° - 90°, DN 125**  
Complete delivery and installation.

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**8.2.170.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 150**  
Complete delivery and installation.

**8.2.180.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 160**  
Complete delivery and installation.

**8.2.190.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 180**  
Complete delivery and installation.

**8.2.200.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 200**  
Complete delivery and installation.

**8.2.210.** \*\*\* Item N/A

**8.2.220.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 250**  
Complete delivery and installation.

**8.2.230.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 315**  
Complete delivery and installation.

**8.2.240.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 355**

**8.2.250.** accord. To Design Description 8005  
**Elbow 15° - 90°, DN 400**  
Complete delivery and installation.

**8.2.260.** accord. To Design Description 8005  
**T-pice, 45° and 90° DN 100**  
Complete delivery and installation.

**8.2.270.** accord. To Design Description 8005  
**T-pice, 45° and 90° DN 125**  
Complete delivery and installation.

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**8.2.280.** accord. To Design Description 8005  
**T-pice, 45° and 90° DN 150**  
Complete delivery and installation.

**8.2.290.** \*\*\* Item N/A

**8.2.300.** accord. To Design Description 8005  
**T-pice, 45° and 90° DN 180**  
Complete delivery and installation.

**8.2.310.** \*\*\* Item N/A

**8.2.320.** \*\*\* Item N/A

**8.2.330.** accord. To Design Description 8005  
**T-pice, 45° and 90° DN 250**  
Complete delivery and installation.

**8.2.340.** accord. To Design Description 8005  
**T-pice, 45° and 90° DN 315**  
Complete delivery and installation.

**8.2.350.** \*\*\* Item N/A

**8.2.360.** accord. To Design Description 8005  
**T-pice, 45° and 90° DN 400**  
Complete delivery and installation.

**8.2.370.** **Flexible connection, duct circumference to 5 m**  
piece of PVC coated polyester material with rigid galvanised connection profile with potential compensation. The bellows is fitted with a welded sealing lip. Temperature resistance from - 20°C to + 80°C. Material class at least B2 to DIN E N 13238. Flexible connection pieces must be inserted in bellowed condition (fitted measure 100 mm). Length in stretched condition < 160 mm.

Complete delivery and installation.

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\*\*\* Design-Description 8006

### Louvre flap

comprising of dimensionally stable shaped frames made of 1.5 mm galvanised sheet steel, frame depth 180 mm with profile connection frame (4 screws duct connector) with flow-efficient hollow-body blades, with block adjustment in opposing directions, made of profiled galvanised sheet steel. Suitable for pressures up to 2000 Pa. These blades are adjusted via external, actuating lever, actuator.

Sealing class (EN 1751): 2

With plastic bearing, temperature resistant up to + 80°C.

**Manufacturer:** Schako, Trox, Wildeboer,  
or equivalent

#### Accessories:

- 1 Drive unit, installed with console, 24 V, AC (torque according to the necessary setting forces), limit switch "Shut" and "Open".

**8.2.380.** accord. To Design Description 8006  
**Louvre flap, Wight x Height: 252 x 252 mm**  
Complete delivery and installation.

**8.2.390.** accord. To Design Description 8006  
**Louvre flap, Wight x Height: 318 x 318 mm**  
Complete delivery and installation.

**8.2.400.** accord. To Design Description 8006  
**Louvre flap, Wight x Height: 400 x 357 mm**  
Complete delivery and installation.

**8.2.410.** \*\*\* Item N/A

**8.2.420.** accord. To Design Description 8006  
**Louvre flap, Wight x Height: 634 x 565 mm**  
Complete delivery and installation.

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8.2.430. \*\*\* Item N/A

8.2.440. accord. To Design Description 8006  
**Louvre flap, Wight x Height: 1003 x 565 mm**  
Complete delivery and installation.

8.2.450. accord. To Design Description 8006  
**Louvre flap, Wight x Height: 201 x 201 mm**  
Complete delivery and installation.

8.2.460. \*\*\* Item N/A

8.2.470. accord. To Design Description 8006  
**Louvre flap, Wight x Height: 400 x 357 mm (ex)**  
but additionally, drive unit and limit switch in explosion-proofed  
  
Complete delivery and installation.

8.2.480. accord. To Design Description 8006  
**Louvre flap, Wight x Height: 565 x 318 mm**  
Complete delivery and installation.

\*\*\* Design-Description 8007  
**Throttle blade**

Manual adjustable perforated sheet damper to fit in round supply air and return air ducts. The housing and adjustable shutter panel are made of galvanised sheet steel. The hand adjusting device with position indicator and axis bearing are made of plastic. Damper with age resistant rubber seal.

Manufacturer: Schako, Trox, Wildeboer,  
or equivalent

8.2.490. accord. To Design Description 8007  
**Throttle blade, DN 100**  
Accessories:  
- 1 End cap in diameter of the throttle blade

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Complete delivery and installation.

**8.2.500.** accord. To Design Description 8007  
**Throttle blade, DN 125**  
Accessories:  
- 1 End cap in diameter of the throttle blade

Complete delivery and installation.

**8.2.510.** accord. To Design Description 8007  
**Throttle blade, DN 150**  
Accessories:  
- 1 End cap in diameter of the throttle blade

Complete delivery and installation.

**8.2.520.** accord. To Design Description 8007  
**Throttle blade, DN 200**  
Accessories:  
- 1 End cap in diameter of the throttle blade

Complete delivery and installation.

**8.2.530.** accord. To Design Description 8007  
**Throttle blade, DN 400**  
Complete delivery and installation.

\*\*\* Design-Description 8008  
**Mineral wool sound absorber**

Silencer consisting of baffles and housing with connection frame made of air duct profile.  
The insulating materials must also be protected by galvanized perforated sheetmetal and PE film underneath. The materials used comply with construction materials class A acc. to DIN EN 13238 certified by building authority approval, test certificate

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or test symbol.

Pressure loss: max. 100 Pa  
Air rate in baffle gap: max. 20 m/s

Minimum distance to integrated units:  
- inflow side: 1 x maximum baffle width  
- outflow side: 1.5 x maximum baffle width

### Baffle:

- Profiled, galvanized steel sheet frame
- Material:
  - non-rotting
  - moisture repellent
  - abrasion-resistant up to 20 m/s
- Galvanized perforated sheetmetal and PE film underneath as abrasion protection for insulation material

### Housing:

- Galvanized steel sheet, of min.1.25 thick, with additional stiffenings

Incl. bearing edge, suitable for hanging up and/or splicing the sound absorbers, described below.

Consisting of galvanized structural steel construction

Distance between:  
- upper edge sound absorber and ceiling: 1 - 1.5 meters  
- lower edge sound absorber and floor: 1 - 1.5 meters  
- sound absorber up to wall: 0.1 - 0.5 meters

**8.2.540.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 308 x 450 x 1470**

Width: 308 mm  
Height: 450 mm  
Length: 1470 mm

Volume flow rate: 1400 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 32 kg  
Coulisse: 1 each  
Pressure drop: 25 Pa

Sound conduction data

## Specification

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fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	5	14	29	31	33	23	15	13	dB
airstream whisper									
LW	40	36	32	28	24	20	16	12	dB

Complete delivery and installation.

**8.2.550.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 305 x 300 x 1000**  
Width: 305 mm  
Height: 300 mm  
Length: 1000 mm  
  
Volume flow rate: 250 m<sup>3</sup>/h  
Speed, air: 2 m/s  
Weight: 19 kg  
Coulisse: 1 each  
Pressure drop: 2 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	10	21	22	25	18	13	10	dB
airstream whisper									
LW	9	5	-	-	-	-	-	-	dB

Complete delivery and installation.

**8.2.560.** \*\*\* Item N/A

**8.2.570.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 508 x 450 x 1225**  
Width: 508 mm  
Height: 450 mm  
Length: 1225 mm  
  
Volume flow rate: 1400 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 42 kg  
Coulisse: 2 each  
Pressure drop: 43 Pa



## Specification

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### Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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#### insertion loss

De	7	18	36	43	45	42	27	20	dB
----	---	----	----	----	----	----	----	----	----

#### airstream whisper

LW	42	38	34	30	26	22	18	14	dB
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Complete delivery and installation.

### 8.2.580.

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 508 x 600 x 1470**

Width: 508 mm  
Height: 600 mm  
Length: 1470 mm

Volume flow rate: 1875 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 58 kg  
Coulisse: 2 each  
Pressure drop: 46 Pa

### Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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#### insertion loss

De	8	21	41	49	50	49	31	22	dB
----	---	----	----	----	----	----	----	----	----

#### airstream whisper

LW	43	39	35	31	27	23	19	15	dB
----	----	----	----	----	----	----	----	----	----

Complete delivery and installation.

### 8.2.590.

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 508 x 600 x 1470, stainless steel**

Width: 508 mm  
Height: 600 mm  
Length: 1470 mm

but additionally material completely in stainless steel No. 1.4571

Volume flow rate: 1875 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 58 kg  
Coulisse: 2 each  
Pressure drop: 46 Pa

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

### Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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#### insertion loss

De	8	21	41	49	50	49	31	22	dB
----	---	----	----	----	----	----	----	----	----

#### airstream whisper

LW	43	39	35	31	27	23	19	15	dB
----	----	----	----	----	----	----	----	----	----

Complete delivery and installation.

**8.2.600.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 508 x 900 x 1225**

Width: 508 mm  
Height: 900 mm  
Length: 1225 mm

Volume flow rate: 2800 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 67 kg  
Coulisse: 2 each  
Pressure drop: 43 Pa

### Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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#### insertion loss

De	7	18	36	43	45	42	27	20	dB
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#### airstream whisper

LW	45	41	37	33	29	25	21	17	dB
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Complete delivery and installation.

**8.2.610.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 516 x 600 x 980**

Width: 516 mm  
Height: 600 mm  
Length: 980 mm

Volume flow rate: 2000 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 43 kg  
Coulisse: 2 each  
Pressure drop: 38 Pa

### Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

insertion loss

De	5	14	29	34	36	33	22	17	dB
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airstream whisper

LW	42	38	33	29	26	22	19	16	dB
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Complete delivery and installation.

**8.2.620.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 530 x 450 x 980**

Width: 530 mm  
Height: 450 mm  
Length: 980 mm

Volume flow rate: 2000 m<sup>3</sup>/h  
Speed, air: 9 m/s  
Weight: 36 kg  
Coulisse: 2 each  
Pressure drop: 48 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
----	----	-----	-----	-----	------	------	------	------	----

insertion loss

De	5	13	27	31	34	29	20	15	dB
----	---	----	----	----	----	----	----	----	----

airstream whisper

LW	44	40	35	31	28	24	21	18	dB
----	----	----	----	----	----	----	----	----	----

Complete delivery and installation.

**8.2.630.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 542 x 450 x 1470, stainless steel**

Width: 542 mm  
Height: 450 mm  
Length: 1470 mm

but additionally material completely in stainless steel No. 1.4571

Volume flow rate: 1875 m<sup>3</sup>/h  
Speed, air: 8.2 m/s  
Weight: 50 kg  
Coulisse: 2 each  
Pressure drop: 37 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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insertion loss

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

De	6	17	36	41	44	36	23	18	dB
airstream whisper									
LW	43	39	35	31	27	23	19	15	dB

Complete delivery and installation.

**8.2.640.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 600 x 300 x 1250**

Width: 600 mm  
Height: 300 mm  
Length: 1250 mm

Volume flow rate: 1500 m<sup>3</sup>/h  
Speed, air: 7 m/s  
Weight: 37 kg  
Coulisse: 2 each  
Pressure drop: 19 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	12	27	28	31	22	14	12	dB
airstream whisper									
LW	29	24	20	16	13	10	7	4	dB

Complete delivery and installation.

**8.2.650.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 600 x 400 x 1500**

Width: 600 mm  
Height: 400 mm  
Length: 1500 mm

Volume flow rate: 2400 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 49 kg  
Coulisse: 2 each  
Pressure drop: 29 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	5	15	32	33	36	25	16	14	dB
airstream whisper									

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

LW	41	37	32	28	25	21	18	15	dB
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Complete delivery and installation.

**8.2.660.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 600 x 400 x 1800**

Width: 600 mm  
Height: 400 mm  
Length: 1800 mm

Volume flow rate: 3000 m<sup>3</sup>/h  
Speed, air: 10 m/s  
Weight: 66 kg  
Coulisse: 2 each  
Pressure drop: 49 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
----	----	-----	-----	-----	------	------	------	------	----

insertion loss

De	6	17	38	39	43	29	17	15	dB
----	---	----	----	----	----	----	----	----	----

airstream whisper

LW	47	43	38	34	31	27	24	21	dB
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Complete delivery and installation.

**8.2.670.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 600 x 900 x 1000**

Width: 600 mm  
Height: 900 mm  
Length: 1000 mm

Volume flow rate: 4200 m<sup>3</sup>/h  
Speed, air: 6 m/s  
Weight: 59 kg  
Coulisse: 2 each  
Pressure drop: 15 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
----	----	-----	-----	-----	------	------	------	------	----

insertion loss

De	4	10	22	23	26	19	13	11	dB
----	---	----	----	----	----	----	----	----	----

airstream whisper

LW	38	33	29	25	22	19	16	12	dB
----	----	----	----	----	----	----	----	----	----

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

Complete delivery and installation.

**8.2.680.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 610 x 450 x 1000**  
Width: 610 mm  
Height: 450 mm  
Length: 1000 mm  
  
Volume flow rate: 2500 m³/h  
Speed, air: 7 m/s  
Weight: 38 kg  
Coulisse: 2 each  
Pressure drop: 19 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	10	21	22	25	18	13	10	dB
airstream whisper									
LW	39	35	30	26	23	20	17	13	dB

Complete delivery and installation.

**8.2.690.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 660 x 450 x 1200**  
Width: 660 mm  
Height: 450 mm  
Length: 1200 mm  
  
Volume flow rate: 2900 m³/h  
Speed, air: 6 m/s  
Weight: 45 kg  
Coulisse: 2 each  
Pressure drop: 13 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	3	10	21	21	23	17	11	9	dB
airstream whisper									
LW	35	30	26	22	19	16	13	9	dB

## Specification

**Project:** 0602 Cittadella Politecnico  
**WBS:** spec1 Specification 2. tender -state of design 2007-02..

**Ref.No.** Specification

Complete delivery and installation.

**8.2.700.** accord. To Design Description 8008  
**Mineral wool sound absorber. W x H x L = 660 x 600 x 1200**  
Width: 660 mm  
Height: 600 mm  
Length: 1200 mm  
  
Volume flow rate: 3850 m³/h  
Speed, air: 7 m/s  
Weight: 53 kg  
Coulisse: 2 each  
Pressure drop: 14 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	10	22	22	24	17	12	10	dB
airstream whisper									
LW	40	36	31	27	24	21	17	14	dB

Complete delivery and installation.

**8.2.710.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 650 x 550 x 1200**  
Width: 650 mm  
Height: 550 mm  
Length: 1200 mm  
  
Volume flow rate: 4600 m³/h  
Speed, air: 9 m/s  
Weight: 50 kg  
Coulisse: 2 each  
Pressure drop: 28 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	10	22	22	24	17	12	10	dB
airstream whisper									
LW	46	42	37	33	30	26	23	20	dB

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

Complete delivery and installation.

**8.2.720.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 678 x 600 x 1300**  
Width: 678 mm  
Height: 600 mm  
Length: 1300 mm  
  
Volume flow rate: 6000 m<sup>3</sup>/h  
Speed, air: 10 m/s  
Weight: 57 kg  
Coulisse: 2 each  
Pressure drop: 30 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	3	10	21	22	16	11	9		dB
airstream whisper									
LW	49	45	40	36	33	29	26	23	dB

Complete delivery and installation.

**8.2.730.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 753 x 1500 x 1225**  
Width: 753 mm  
Height: 1500 mm  
Length: 1225 mm  
  
Volume flow rate: 10000 m<sup>3</sup>/h  
Speed, air: 12 m/s  
Weight: 132 kg  
Coulisse: 3 each  
Pressure drop: 100 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	18	37	45	47	45	29	21	dB
airstream whisper									
LW	59	54	50	45	41	38	35	32	dB



## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

Complete delivery and installation.

### 8.2.740.

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 762 x 600 x 1470**

Width: 762 mm  
Height: 600 mm  
Length: 1470 mm

Volume flow rate: 2800 m³/h  
Speed, air: 8 m/s  
Weight: 79 kg  
Coulisse: 3 each  
Pressure drop: 46 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	8	21	41	49	50	49	31	22	dB
airstream whisper									
LW	44	40	35	31	28	24	21	18	dB

Complete delivery and installation.

### 8.2.750.

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 879 x 600 x 1225, stainless steel**

Width: 879 mm  
Height: 600 mm  
Length: 1225 mm

but additionally material completely in stainless steel No. 1.4571

Volume flow rate: 6000 m³/h  
Speed, air: 10 m/s  
Weight: 71 kg  
Coulisse: 3 each  
Pressure drop: 41 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	5	12	27	29	32	24	15	13	dB
airstream whisper									
LW	51	47	43	39	35	31	27	23	dB

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

Complete delivery and installation.

**8.2.760.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 882 x 900 x 1470**  
Width: 882 mm  
Height: 900 mm  
Length: 1470 mm  
  
Volume flow rate: 11000 m<sup>3</sup>/h  
Speed, air: 12 m/s  
Weight: 107 kg  
Coulisse: 3 each  
Pressure drop: 62 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	5	15	32	34	37	27	17	14	dB
airstream whisper									
LW	57	52	48	43	39	36	33	30	dB

Complete delivery and installation.

**8.2.770.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 882 x 900 x 1470, stainless steel**  
Width: 882 mm  
Height: 900 mm  
Length: 1470 mm  
  
but additionally material completely in stainless steel No. 1.4571  
  
Volume flow rate: 11000 m<sup>3</sup>/h  
Speed, air: 12 m/s  
Weight: 107 kg  
Coulisse: 3 each  
Pressure drop: 62 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	5	15	32	34	37	27	17	14	dB
airstream whisper									
LW	57	52	48	43	39	36	33	30	dB

## Specification

**Project:** 0602 Cittadella Politecnico  
**WBS:** spec1 Specification 2. tender -state of design 2007-02..

**Ref.No.** Specification

Complete delivery and installation.

**8.2.780.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 915 x 1800 x 2205**  
Width: 915 mm  
Height: 1800 mm  
Length: 2205 mm  
  
Volume flow rate: 16325 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 346 kg  
Coulisse: 3 each  
Pressure drop: 28 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	21	43	45	48	32	19	16	dB
airstream whisper									
LW	50	46	41	37	34	30	27	24	dB

Complete delivery and installation.

**8.2.790.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 927 x 1200 x 1960**  
Width: 927 mm  
Height: 1200 mm  
Length: 1960 mm  
  
Volume flow rate: 14000 m<sup>3</sup>/h  
Speed, air: 10 m/s  
Weight: 194 kg  
Coulisse: 3 each  
Pressure drop: 40 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	18	38	39	41	28	17	15	dB
airstream whisper									
LW	54	50	45	41	38	34	31	28	dB

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

Complete delivery and installation.

**8.2.800.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1000 x 700 x 1500**  
Width: 1000 mm  
Height: 700 mm  
Length: 1500 mm  
  
Volume flow rate: 10000 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 95 kg  
Coulisse: 3 each  
Pressure drop: 20 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	12	25	26	26	19	13	11	dB
airstream whisper									
LW	46	42	37	33	30	26	23	20	dB

Complete delivery and installation.

**8.2.810.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1020 x 450 x 1500**  
Width: 1020 mm  
Height: 450 mm  
Length: 1500 mm  
  
Volume flow rate: 4650 m<sup>3</sup>/h  
Speed, air: 7 m/s  
Weight: 75 kg  
Coulisse: 3 each  
Pressure drop: 15 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	12	24	24	24	18	12	10	dB
airstream whisper									
LW	41	37	32	28	25	22	19	15	dB

## Specification

**Project:** 0602 Cittadella Politecnico  
**WBS:** spec1 Specification 2. tender -state of design 2007-02..

**Ref.No.** Specification

Complete delivery and installation.

**8.2.820.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1080 x 600 x 1500**  
Width: 1080 mm  
Height: 600 mm  
Length: 1500 mm  
  
Volume flow rate: 6450 m<sup>3</sup>/h  
Speed, air: 6 m/s  
Weight: 89 kg  
Coulisse: 3 each  
Pressure drop: 11 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	3	11	22	22	21	16	11	9	dB
airstream whisper									
LW	39	34	30	26	23	20	17	13	dB

Complete delivery and installation.

**8.2.830.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1120 x 800 x 1500**  
Width: 1120 mm  
Height: 800 mm  
Length: 1500 mm  
  
Volume flow rate: 10000 m<sup>3</sup>/h  
Speed, air: 11 m/s  
Weight: 125 kg  
Coulisse: 4 each  
Pressure drop: 58 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	16	35	38	41	32	20	16	dB
airstream whisper									
LW	56	51	46	42	39	35	32	29	dB

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

Complete delivery and installation.

**8.2.840.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1220 x 600 x 1750**  
Width: 1220 mm  
Height: 600 mm  
Length: 1750 mm  
  
Volume flow rate: 10000 m<sup>3</sup>/h  
Speed, air: 11 m/s  
Weight: 142 kg  
Coulisse: 4 each  
Pressure drop: 51 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	16	35	37	39	27	16	14	dB
airstream whisper									
LW	55	50	45	41	38	34	31	28	dB

Complete delivery and installation.

**8.2.850.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1420 x 750 x 1500**  
Width: 1420 mm  
Height: 750 mm  
Length: 1500 mm  
  
Volume flow rate: 9900 m<sup>3</sup>/h  
Speed, air: 6 m/s  
Weight: 128 kg  
Coulisse: 4 each  
Pressure drop: 10 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	4	11	23	22	21	16	11	9	dB
airstream whisper									
LW	41	36	32	28	25	22	19	15	dB

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

**Ref.No.** **Specification**

Complete delivery and installation.

**8.2.860.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1450 x 800 x 1700**  
Width: 1450 mm  
Height: 800 mm  
Length: 1700 mm  
  
Volume flow rate: 11000 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 196 kg  
Coulisse: 5 each  
Pressure drop: 34 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	17	37	40	43	31	19	16	dB
airstream whisper									
LW	48	44	39	35	32	28	25	22	dB

Complete delivery and installation.

**8.2.870.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1485 x 750 x 1470**  
Width: 1485 mm  
Height: 750 mm  
Length: 1470 mm

but additionally material completely in stainless steel No. 1.4571

Volume flow rate: 11000 m<sup>3</sup>/h  
Speed, air: 8 m/s  
Weight: 144 kg  
Coulisse: 5 each  
Pressure drop: 29 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	5	14	32	33	36	26	16	14	dB
airstream whisper									
LW	48	44	39	35	32	28	25	22	dB

## Specification

**Project:** 0602 Cittadella Politecnico  
**WBS:** spec1 Specification 2. tender -state of design 2007-02..

**Ref.No.** Specification

Complete delivery and installation.

**8.2.880.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1500 x 900 x 1800**

Width: 1500 mm  
Height: 900 mm  
Length: 1800 mm

Volume flow rate: 14000 m<sup>3</sup>/h  
Speed, air: 9 m/s  
Weight: 222 kg  
Coulisse: 5 each  
Pressure drop: 32 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	17	38	39	43	29	17	15	dB
airstream whisper									
LW	52	48	43	39	36	32	29	26	dB

Complete delivery and installation.

**8.2.890.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1515 x 900 x 2205**

Width: 1515 mm  
Height: 900 mm  
Length: 2205 mm

Volume flow rate: 19800 m<sup>3</sup>/h  
Speed, air: 12 m/s  
Weight: 260 kg  
Coulisse: 5 each  
Pressure drop: 64 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	21	44	46	49	32	20	16	dB
airstream whisper									
LW	60	55	51	46	42	39	36	33	dB



## Specification

**Project:** 0602 Cittadella Politecnico  
**WBS:** spec1 Specification 2. tender -state of design 2007-02..

**Ref.No.** Specification

Complete delivery and installation.

**8.2.900.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1830 x 900 x 2205**  
Width: 1830 mm  
Height: 900 mm  
Length: 2205 mm  
  
Volume flow rate: 15150 m<sup>3</sup>/h  
Speed, air: 7 m/s  
Weight: 304 kg  
Coulisse: 6 each  
Pressure drop: 25 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	21	43	45	48	32	19	16	dB
airstream whisper									
LW	47	43	38	34	31	28	25	21	dB

Complete delivery and installation.

**8.2.910.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 1830 x 900 x 2000**  
Width: 1830mm  
Height: 900 mm  
Length: 2000 mm  
  
Volume flow rate: 22000 m<sup>3</sup>/h  
Speed, air: 11 m/s  
Weight: 282 kg  
Coulisse: 6 each  
Pressure drop: 50 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	19	40	42	44	29	18	16	dB
airstream whisper									
LW	59	54	49	45	42	38	35	32	dB

## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

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Complete delivery and installation.

**8.2.920.**

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 1980 x 900 x 2205**

Width: 1980mm  
Height: 900 mm  
Length: 2205 mm

Volume flow rate: 22000 m<sup>3</sup>/h  
Speed, air: 9 m/s  
Weight: 310 kg  
Coulisse: 6 each  
Pressure drop: 28 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	18	36	37	37	25	16	13	dB
airstream whisper									
LW	53	49	44	40	37	33	33	27	dB

Complete delivery and installation.

**8.2.930.**

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 2100 x 900 x 1900**

Width: 2100 mm  
Height: 900 mm  
Length: 1900 mm

Volume flow rate: 15150 m<sup>3</sup>/h  
Speed, air: 7 m/s  
Weight: 310 kg  
Coulisse: 7 each  
Pressure drop: 20 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	6	18	40	41	45	30	18	16	dB
airstream whisper									
LW	47	43	38	34	31	28	25	21	dB

## Specification

**Project:** 0602 Cittadella Politecnico  
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Complete delivery and installation.

**8.2.940.**

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 2135 x 1500 x 2205**

Width: 2135 mm  
Height: 1500 mm  
Length: 2205 mm

Volume flow rate: 35000 m<sup>3</sup>/h  
Speed, air: 8.8 m/s  
Weight: 496 kg  
Coulisse: 7 each  
Pressure drop: 34 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	21	43	45	48	32	19	16	dB
airstream whisper									
LW	56	52	48	44	40	36	32	28	dB

Complete delivery and installation.

**8.2.950.**

accord. To Design Description 8008

**Mineral wool sound absorber, W x H x L = 2205 x 900 x 2450**

Width: 2135 mm  
Height: 1500 mm  
Length: 2450 mm

Volume flow rate: 18750 m<sup>3</sup>/h  
Speed, air: 7.2 m/s  
Weight: 380 kg  
Coulisse: 7 each  
Pressure drop: 22 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	22	43	46	47	31	20	15	dB
airstream whisper									
LW	49	45	41	37	33	29	25	21	dB

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Complete delivery and installation.

**8.2.960.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 2205 x 900 x 1715**  
Width: 2205 mm  
Height: 900 mm  
Length: 1715 mm  
  
Volume flow rate: 19800 m<sup>3</sup>/h  
Speed, air: 10 m/s  
Weight: 362 kg  
Coulisse: 8 each  
Pressure drop: 55 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	19	40	44	48	38	23	19	dB
airstream whisper									
LW	56	52	47	43	40	36	33	30	dB

Complete delivery and installation.

**8.2.970.** accord. To Design Description 8008  
**Mineral wool sound absorber, W x H x L = 2525 x 1500 x 1715**  
Width: 2525 mm  
Height: 1500 mm  
Length: 1715 mm  
  
Volume flow rate: 33950 m<sup>3</sup>/h  
Speed, air: 9 m/s  
Weight: 560 kg  
Coulisse: 9 each  
Pressure drop: 38 Pa

Sound conduction data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	7	19	39	43	46	35	22	18	dB
airstream whisper									
LW	56	52	47	43	40	36	33	30	dB

## Specification

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Complete delivery and installation.

\*\*\* Design-Description 8009

### Round silencer

Connection DIN EN 1506, galvanized steel sheet.

Noise dampener comprising core and housing with connection flange.

The insulation materials must be protected by galvanized perforated sheetmetal and PE film underneath.

The materials used comply with construction materials class A acc. to DIN EN 13238 certified by building authority approval, test certificate or test symbol.

Insulation materials 50 mm thick.

Pressure loss: max. 100 Pa

Air rate in baffle gap: max. 20 m/s

Outer mantle, perforated inside tube, ring baffle and core (if required) made of galvanized steel sheet.

Material:

- non-rotting
- moisture repellent
- abrasion-resistant up to 20 m/s

Galvanized perforated sheetmetal and PE film underneath as abrasion protection for insulation material.

Incl. bearing edge, suitable for hanging up and/or splicing the sound absorbers.

Consisting of galvanized structural steel construction.

**8.2.980.** accord. To Design Description 8009  
**Round silencer NW 150, L = 950 mm**

Air Volume:	50 m <sup>3</sup> /h
Sound insulation value at 250 Hz:	34 dB
Pressure loss of air:	4 Pa
Length:	950 mm
Dimensions:	NW 150

## Specification

**Project:** 0602 Cittadella Politecnico  
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Complete delivery and installation.

**8.2.990.** accord. To Design Description 8009  
**Round silencer NW 160, L = 950 mm**  
Air Volume: 150 m<sup>3</sup>/h  
Sound insulation value at 250 Hz: 30 dB  
Pressure loss of air: 6 Pa  
Lenght: 950 mm  
Dimensions: NW 160

Complete delivery and installation.

**8.2.1000.** accord. To Design Description 8009  
**Round silencer NW 200, L = 950 mm**  
Air Volume: 550 m<sup>3</sup>/h  
Sound insulation value at 250 Hz: 26 dB  
Pressure loss of air: 6 Pa  
Lenght: 950 mm  
Dimensions: NW 200

Complete delivery and installation.

**8.2.1010.** accord. To Design Description 8009  
**Round silencer NW 250, L = 1450 mm**  
Air Volume: 300 m<sup>3</sup>/h  
Sound insulation value at 250 Hz: 22 dB  
Pressure loss of air: 4 Pa  
Lenght: 1450 mm  
Dimensions: NW 250

Complete delivery and installation.

**8.2.1020.** accord. To Design Description 8009  
**Round silencer NW 315, L = 1450 mm**  
Air Volume: 500 m<sup>3</sup>/h  
Sound insulation value at 250 Hz: 15 dB  
Pressure loss of air: 4 Pa  
Lenght: 1450 mm  
Dimensions: NW 315

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Complete delivery and installation.

**8.2.1030.** \*\*\* Item N/A

**8.2.1040.** accord. To Design Description 8009  
**Round silencer NW 400, L = 1450 mm**

Air Volume:	1500 m <sup>3</sup> /h
Sound insulation value at 250 Hz:	12 dB
Pressure loss of air:	4 Pa
Length:	1450 mm
Dimensions:	NW 400

Complete delivery and installation.

\*\*\* Design-Description 8010  
**ventilation grille**

Supply and extract grille with vertical adjustable blades, with screw fixing.

Frame and blades from stove enamelled sheet steel from galvanised sheet steel. Assembly parts are made from galvanised sheet steel. Additional with horizontal pivoting assembled blades.

**Manufacturer:** Schako, Trox, Wildeboer,  
or equivalent

### Accessories

- With assembly frame, made of electrolytically galvanised sheet steel.

**8.2.1050.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 325 x 125 mm**  
Complete delivery and installation.

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**Project:** 0602 Cittadella Politecnico  
**WBS:** spec1 Specification 2. tender -state of design 2007-02..

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**8.2.1060.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 625 x 125 mm**  
Complete delivery and installation.

**8.2.1070.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 625 x 225 mm**  
Complete delivery and installation.

**8.2.1080.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 825 x 75 mm**  
Complete delivery and installation.

**8.2.1090.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 825 x 325 mm**  
Complete delivery and installation.

**8.2.1100.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 1025 x 75 mm**  
Complete delivery and installation.

**8.2.1110.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 1025 x 125 mm**  
Complete delivery and installation.

**8.2.1120.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 1025 x 225 mm**  
Complete delivery and installation.

**8.2.1130.** accord. To Design Description 8010  
**ventilation grille, duct, Wight x Height: 1025 x 325 mm**  
Complete delivery and installation.

\*\*\* Design-Description 8011  
**ventilation grille, pipe**

Supply and extract grille for installation in exposed spiral round ductwork. Consists of front frame and individually adjustable horizontal air guidance blades.

Frame and blades made from painted sheet steel, with vertical adjustable blades, with screw fixing.

Manufacturer: Schako, Trox, Wildeboer,



## Specification

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or equivalent

### Accessories

With assembly frame, made of electrolytically galvanised sheet steel.

**8.2.1140.** accord. To Design Description 8011  
**ventilation grille, pipe, Wight x Height: 315 x 65 mm**  
Complete delivery and installation.

**8.2.1150.** accord. To Design Description 8011  
**ventilation grille, pipe, Wight x Height: 615 x 65 mm**  
Complete delivery and installation.

**8.2.1160.** accord. To Design Description 8011  
**ventilation grille, pipe, Wight x Height: 815 x 65 mm**  
Complete delivery and installation.

\*\*\* Design-Description 8012

### Roof hood

rectangular roof hood with frame, blades, wire mesh and connection flanges for extract air.

The hood is completely supplied in galvanised sheet steel.

For connection with roof bushing.

Mesh size: 40 mm

### Accessories

- Flat roof bushing in galvanised sheet steel with insulation, height 500 mm
- sealing to the roof by 2 layers of bitumen, incl. all necessary equipments

**8.2.1161.** accord. To Design Description 8012  
**Roof hood, Wight x Lenght x Height: 300 x 300 x 370**  
Open cross section, min.: 0.216m<sup>2</sup>

## Specification

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Number of ribs: 5

Complete delivery and installation.

**8.2.1162.** accord. To Design Description 8012  
**Roof hood, Wight x Lenght x Height: 500 x 500 x 490**  
Open cross section, min.: 0.60 m<sup>2</sup>  
Number of ribs: 7

Complete delivery and installation.

**8.2.1163.** accord. To Design Description 8012  
**Roof hood, Wight x Lenght x Height: 600 x 600 x 490**

Open cross section, min.: 0.720 m<sup>2</sup>  
Number of ribs: 7

Complete delivery and installation.

**8.2.1164.** accord. To Design Description 8012  
**Roof hood, Wight x Lenght x Height: 1000 x 1000 x 730**  
Open cross section, min.: 2.16 m<sup>2</sup>  
Number of ribs: 11

Complete delivery and installation.

\*\*\* Design-Description 8013

### **Weatherproof grille**

External-air intake or exhaust air grille with fixed rain-pelling blades and wire mesh.

Frame and blades made of galvanised sheet steel with wire mesh made of galvanised steel.

Mesh size: 40 mm  
Air rate in open cross section, max.: 2.9 m/s

The grill can be installed next to each other.  
The weatherproof grill are combined to a strip.

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Manufacturer: Schako, Trox, Wildeboer,  
or equivalent

### Accessories

- 1 Mounting frame made of primed angular 30/30/3 steel.

**8.2.1170.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 2000 x 1830 mm**  
Open cross section, min.: 2.084 m<sup>2</sup>

Complete delivery and installation.

**8.2.1180.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 1600 x 1830 mm**  
Open cross section, min.: 1.66 m<sup>2</sup>

Complete delivery and installation.

**8.2.1190.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 1400 x 1830 mm**  
Open cross section, min.: 1.45 m<sup>2</sup>

Complete delivery and installation.

**8.2.1200.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 2000 x 840 mm**  
Open cross section, min.: 0.89 m<sup>2</sup>

Complete delivery and installation.

**8.2.1210.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 800 x 840 mm**  
Open cross section, min.: 0.35 m<sup>2</sup>

Complete delivery and installation.

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**8.2.1220.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 600 x 840 mm**  
Open cross section, min.: 0.26 m<sup>2</sup>

Complete delivery and installation.

**8.2.1230.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 600 x 510 mm**  
Open cross section, min.: 0.146 m<sup>2</sup>

Complete delivery and installation.

**8.2.1240.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 400 x 675 mm**  
Open cross section, min.: 0.134 m<sup>2</sup>

Complete delivery and installation.

**8.2.1250.** accord. To Design Description 8013  
**Weatherproof grille, Wight x Height: 400 x 345 mm**  
Open cross section, min.: 0.058 m<sup>2</sup>

Complete delivery and installation.

**8.2.1260.** \*\*\* Item N/A

**8.2.1261.** accord. To Design Description 8010  
**Flow over grille, Wight x Height: 1025 x 325 mm**  
Supply and return air grille with front frame and continuous foam seal. Grille made of plastic, colour: grey. With frontside individually adjustable horizontal air deflection blades and visible screw mounting, with mounting frame made of electrolytically galvanised sheet steel.

Manufacturer: Schako, Trox, Wildeboer,  
or equivalent

Complete delivery and installation.

## Specification

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**8.2.1270. Rectangular air filter, 500/250**  
Barili Diesel

Air filter housed in a galvanised casing with flanges at both ends. Fits in - line with ducting. Bag filter cassette held in a metal frame and with a large cross section area for high dust storage capacity. The access panel is situated on the bottom of the casing. Through this opening the rail guided filter cassette can be removed.

Technical Data:

Volume flow:	500 m <sup>3</sup> /h
Equipment width:	520 mm
Equipment height:	270 mm
Initial pressure differential	
At rated air volume:	30 Pa
Filter class to EN779	F 5
particle separatio:	91.3 %
Weight:	10 kg

**Accessories**

- 1 Set filter media

Complete delivery and installation.

**8.2.1280. Rectangular air filter, 700/400**  
Calibration

Air filter housed in a galvanised casing with flanges at both ends. Fits in - line with ducting. Bag filter cassette held in a metal frame and with a large cross section area for high dust storage capacity. The access panel is situated on the bottom of the casing. Through this opening the rail guided filter cassette can be removed.

Technical Data:

Volume flow:	2400 m <sup>3</sup> /h
Equipment width:	720 mm
Equipment height:	420 mm
Initial pressure differential	
At rated air volume:	90 Pa
Filter class to EN779	F 5

## Specification

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particle separatio: 91.3 %  
Weight: 11.5 kg

### Accessories

- 1 Set filter media

Complete delivery and installation.

\*\*\* Design-Description 8014

### Ducted bag filter

Duct housing in galvanized sheet steel with side access door for changing filter media positioned on right or left hand side related to air flow.

Standard cell frame with sealing strip and quick release claps for the fittings and tight sealing of bag filters inserets.

Depending on equipment size in ducted bag filters supplied completely assembled or supplied in component form with fixing and sealing materials, and assembly instructions.

Surface characteristics: in steel sheet sendzimir-galvanized

Permanent sealing seat (e.g. spring and clamps filter fastening must not all work against the airstream)

Dimensioning resistance:  
(delta pressure begin + pressure delta end) / 2

Final resistance: 200 Pa

Surface characteristics

Filter frame: Steel sheet, Sendzimir-galvanized

### Air filter

Bag filter consisting of the bag filter W x H x L 592 x 592 x 635 mm (entire filter) with 12 filter bags in conical form made of glass fibre medium with pure-airside gauze rigidity element.

Effective filter surface ia at least 9 m<sup>2</sup> per filter bag.

Half filters W x H x L 287 x 592 x 635 are to be used, for which the effective filter surface is at least 4.5 m<sup>2</sup>.

Long life, economical pressure loss and operating reliability are ensures by the following design features:

Each bag has 8 conical seams to maintain distance.

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These seams are sealed with adhesive.  
The bag seams at the top and bottom are also sealed with adhesive.  
The bag-end seams are rigidified with a single strip of gauze to maintain distance.  
The inflow profiles with special edges at the bag entry prevent medium erosion.  
The front frame made of galvanized steel sheet, 25 mm thick, is overlapped at the squaring cuts.  
The bags are glued to the front frame.  
The entire construction is silicone-free.  
Filter frame, drilled, with internal permanently elastic gasket and press- in elements.  
Sheetmetal rigidity element upright between every second row of filters.

**8.2.1290.** accord. To Design Description 8014  
**Ducted bag filter, Wight x Height: 1109 x 1109**  
Converter

Technical Data:

Volume flow:	7850 m <sup>3</sup> /h
Equipment width:	1109 mm
Equipment height:	1109 mm
Initial pressure loss:	70 Pa
Design pressure loss:	135 Pa
End pressure loss:	200 Pa
Filter class to EN779	F 5
Average synthetic dust weight arrestance ca.	98 %
average atmospheric dust spot efficiency ca.	55 %
Max. operating temperature	45 °C
Max. relative humidity	90 %
Net. Weight	60 kg

**Accessories**

- 1 Set filter media

Complete delivery and installation.

**8.2.1291.** accord. To Design Description 8014  
**Ducted bag filter, Wight x Height: 1428 x 1109**  
Utility area

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### Technical Data:

Volume flow:	10000 m <sup>3</sup> /h
Equipment width:	1428 mm
Equipment height:	1109 mm
Initial pressure loss:	70 Pa
Design pressure loss:	135 Pa
End pressure loss:	200 Pa
Filter class to EN779	F 5
Average synthetic dust weight arrestance ca.	98 %
average atmospheric dust spot efficiency ca.	55 %
Max. operating temperature	45 °C
Max. relative humidity	90 %
Net. Weight	60 kg

### **Accessories**

- 1 Set filter media

Complete delivery and installation.

**8.2.1300. Air filter box, 400**  
Converter room chassis dyno

For in-line installation with circular ducting. Spigots on the both ends are fitted with double lip rubber seals, matching nominal size ducting. Casing made from galvanised steel. Access panel fitted with clamb for easy filter change.

### Technical Data:

Volume flow:	1500 m <sup>3</sup> /h
Equipment width:	515 mm
Equipment height:	495 mm
Initial pressure differential At rated air volume:	25 Pa
Filter class to EN779	F 5
particle separatio:	93.8 %
Weight:	12 kg

### **Accessories**

- 1 Set filter media



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Complete delivery and installation.

\*\*\* Design-Description 8015

### **Air heater channel**

Copper / aluminium heat exchanger

The heat exchange surfaces consist of round copper core pipes with collared aluminium or copper lamellae. Using a special mechanical expansion process on the core pipe and the form of the lamella collar, a solid connection is created between the the core pipes and the lamellae. Brazing in copper deflection bottoms binds the core pipes on the water side. The connection between the core pipes and the collector pipes - made of copper in the series version - is also soldered (brazed). The diameter of the collector pipes is determined by the air flow volume.

Pipe collector copper.

Connection of parts by brazing.

Venting and emptying with closure plugs at highest and lowest point in heat transfer unit.

Air heater

Channel connection frame: steel, galvanized

Heating medium connection: welding neck flange.

Installation:

Horizontal core pipe with horizontal airflow

Maximum no. of pipe rows: 4

Pressure stage: PN 16

Maximum register width: 800 mm

Hot water operating temp: max.: 70°C (mix reg.)

Minimum lamella gap: 2.5 mm

Maximum weight per heating:

register unit (per element)

Max. pressure loss, water side:  $\leq 20$  kPa

Max. pressure loss, air side:  $\leq 150$  Pa

Factory pressure test at 1.3 times operating pressure for legal expertsl.

**Manufacturer:** Hombach, Helios, Güntner,  
or equivalent

**8.2.1310.** accord. To Design Description 8015  
**Air heater channel 3.8 kW**

Volume flow 500 m<sup>3</sup>/h

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Pressure loss of air	34 Pa
Heating capacity	3.8 kW
Temperature of intake air	- 8 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	15.0 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C
Return flow temperature	50 °C
Pressure loss of medium	11.9 kPa
Width:	300 mm
Height:	200 mm
Length:	300 mm

Complete delivery and installation.

**8.2.1320.** accord. To Design Description 8015

**Air heater channel 11.5 kW**

Volume flow	1500 m³/h
Pressure loss of air	47 Pa
Heating capacity	11.5 kW
Temperature of intake air	- 8 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	15.0 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C
Return flow temperature	50 °C
Pressure loss of medium	0.78 kPa
Width:	500 mm
Height:	300 mm
Length:	300 mm

Complete delivery and installation.

**8.2.1330.** accord. To Design Description 8015

**Air heater channel 26 kW**

Volume flow	3450 m³/h
Pressure loss of air	54 Pa
Heating capacity	26.5 kW
Temperature of intake air	- 8 °C
Humidity of intake air	1.0 g/kg dry air
Temperature of output air	15.0 °C
Humidity of output air	1.0 g/kg dry air
Medium	Water
Advance flow temperature	70 °C

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Return flow temperature 50 °C  
Pressure loss of medium 0.96 kPa  
Width: 700 mm  
Height: 450 mm  
Length: 300 mm

Complete delivery and installation.

**8.2.1340. Ideal displacement outlet**

Ideal displacement diffuser, for cooling and heating applications, made of perforated, galvanised sheet steel. With manually adjustable baffle plate to adjust the air jet direction from horizontal through to vertical.

Connection spigot to fit DIN EN 1505 pipes from, above (folded spiralseam tube).

Supply air volume flow: 1500 - 2100 m<sup>3</sup>/h  
max. permissible sound level: 45 dB(A)  
Pressure loss of air max. 15 Pa  
Material: galvanized Steel  
Quality paint, colour in RAL: to specification contract awarder  
Height: 590 mm  
Size and nominal diameter of connection spigot: 400 mm  
Casing diameter: 600 mm

Complete delivery and installation.

**8.2.1350. Semi-circular displacement outlet**

Semi-Circular displacement outlet for floor installation, for extremely low-turbulence displacement flow and large penetration depth in commercial rooms, Air distribution via integrated distribution mat, air outlet housing easy to open for maintenance of the air distribution mat.

Mad up of:  
Sheet steel housing, finely perforated sheet casing and built-in air distribution devices.  
Connection spigot to fit DIN EN 1505 pipes from, above or below (folded spiralseam tube).

Technical data:

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Supply air volume flow: 900 - 1200 m3/h  
max. permissible sound level: 30 dB(A)  
Pressure loss of air max. 25 Pa  
Material: galvanized Steel  
Quality paint, colour in RAL: to specification contract  
awarder  
  
Size and nominal diameter  
of connection spigot: 315 DN  
Casing diameter: 630 mm  
Height: 1500 mm

Complete delivery and installation.

\*\*\* Design-Description 8016

### **Fire damper**

All devices depicted below have to be realized according to the requirement of Italian newest technical laws and regulations.

Fire damper casing made of galvanized metal sheet  
resistance class REI 180 - RE 180

Installed with vertical or horizontal shutter axis. Two opposite  
laying maintenance opening additionally to the trigger device.  
Front face of shutter panel protected with an envelope out of  
metal sheet, equipped with additional stiffening angles out metal  
sheet, maintenance free bearings by special coated bushes.

Fixed setting when damper is open. Damper is large  
dimensioned and is permanently lubricated.

Installation in gas and lightweight concrete, other concrete or  
masonry, plasterboard and lightweight partition walls or outside  
walls and ceilings.

For connection to non-flammable ventilation ducts. Installation  
flange-to-flange or with one or two sides of mineral wool filling  
for installation in difficult to access openings. Installation without  
duct connection with protective grille and necessary extension  
piece for damper protrusion. The damper isolation and  
suspension for installation in front of walls are arranged by the  
customer on site.

Attention:

By using the fire damper as overflow flap, a approval of a  
supervising authority is necessary.

Length: 500 mm

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**Manufacturer:** Schako, Trox, Wildeboer,  
or equivalent

### Accessories

- 1 electrical spring back actuator (closed circuit current principle), 24 V AC, to open and close the shut-off damper, with thermal trigger 72°C, with integrated limit switches for "OPEN" and "SHUT", indicators, floating contact.

**8.2.1360.** accord. To Design Description 8016  
**Fire damper, Width x Height = 201 x 201 mm**  
Complete delivery and installation.

**8.2.1370.** accord. To Design Description 8016  
**Fire damper, Width x Height = 201 x 252 mm**  
Complete delivery and installation.

**8.2.1380.** accord. To Design Description 8016  
**Fire damper, Width x Height = 318 x 252 mm**  
Complete delivery and installation.

**8.2.1390.** accord. To Design Description 8016  
**Fire damper, Width x Height = 318 x 318 mm**  
Complete delivery and installation.

**8.2.1400.** accord. To Design Description 8016  
**Fire damper, Width x Height = 318 x 318 mm (FC)**  
Accessories:  
Flexible connection piece of PVC coated polyester material with rigid galvanised connection profile, with potential compensation. The bellows is fitted with a welded sealing lip. Temperature resistance from -20°C to + 80°C. Material class at least B2 to DIN EN 13238. Flexible connection pieces must be inserted in bellowed condition (fitted measure 100 mm). Length in stretched condition < 160 mm.

Complete delivery and installation.

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- 8.2.1410.** accord. To Design Description 8016  
**Fire damper, Width x Height = 357 x 318 mm (FC)**  
Accessories:  
Flexible connection piece of PVC coated polyester material with rigid galvanised connection profile with potential compensation..  
The bellows is fitted with a welded sealing lip. Temperature resistance from -20°C to + 80°C. Material class at least B2 to DIN EN 13238. Flexible connection pieces must be inserted in bellowed condition (fitted measure 100 mm). Length in stretched condition < 160 mm.
- Complete delivery and installation.
- 8.2.1420.** accord. To Design Description 8016  
**Fire damper, Width x Height = 357 x 318 mm**  
Complete delivery and installation.
- 8.2.1430.** accord. To Design Description 8016  
**Fire damper, Width x Height = 357 x 357 mm**  
Complete delivery and installation.
- 8.2.1440.** accord. To Design Description 8016  
**Fire damper, Width x Height = 449 x 357 mm**  
Complete delivery and installation.
- 8.2.1450.** accord. To Design Description 8016  
**Fire damper, Width x Height = 449 x 400 mm**  
Complete delivery and installation.
- 8.2.1460.** accord. To Design Description 8016  
**Fire damper, Width x Height = 565 x 357 mm**  
Complete delivery and installation.
- 8.2.1470.** accord. To Design Description 8016  
**Fire damper, Width x Height = 503 x 503 mm (protective grille)**  
Accessories:  
Installation without duct connection with protective grille and necessary extension piece for damper protrusion.  
Finishing safety grille for fire damper, consisting of wire or pressed screen with a mesh width of 25 mm.

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Complete delivery and installation.

**8.2.1480.** accord. To Design Description 8016  
**Fire damper, Width x Height = 565 x 503 mm**  
Complete delivery and installation.

**8.2.1490.** accord. To Design Description 8016  
**Fire damper, Width x Height = 634 x 634 mm**  
Complete delivery and installation.

**8.2.1500.** accord. To Design Description 8016  
**Fire damper, Width x Height = 634 x 797 mm**  
Complete delivery and installation.

**8.2.1510.** accord. To Design Description 8016  
**Fire damper, Width x Height = 634 x 1125 mm**  
Complete delivery and installation.

**8.2.1520.** accord. To Design Description 8016  
**Fire damper, Width x Height = 711 x 318 mm**  
Complete delivery and installation.

**8.2.1530.** accord. To Design Description 8016  
**Fire damper, Width x Height = 711 x 318 mm (protective grille)**  
Accessories:  
Installation without duct connection with protective grille and necessary extension piece for damper protrusion.  
Finishing safety grille for fire damper, consisting of wire or pressed screen with a mesh width of 25 mm.

Complete delivery and installation.

**8.2.1540.** accord. To Design Description 8016  
**Fire damper, Width x Height = 797 x 797 mm**  
Complete delivery and installation.

**8.2.1550.** accord. To Design Description 8016  
**Fire damper, Width x Height = 1003 x 711 mm**  
Complete delivery and installation.

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**8.2.1560.** accord. To Design Description 8016  
**Fire damper, Width x Height = 1003 x 797 mm**  
Complete delivery and installation.

**8.2.1570.** accord. To Design Description 8016  
**Fire damper, Width x Height = 1262 x 634 mm**  
Complete delivery and installation.

**8.2.1580.** accord. To Design Description 8016  
**Fire damper, Width x Height = 1262 x 711 mm**  
Complete delivery and installation.

\*\*\* Design-Description 8017

**Flow rate controller, rectangular, variable**

Rectangular flow rate controllers for connection to square ducts according to DIN EN 1505, for use in supply / return air systems for constant or variable volume flow, room or duct pressure control. With positive control Vmin, Vmax or "SHUT". Permitted pressure tolerance range: 20-1000 pa, permitted surrounding temperatures 0-55°C. Suitable for use with duct velocities of 2-12 m/s. Operating volume flows set at factory may be changed. Start signal 0-10 V DC, equal to 0-100 % of set Vmax in DDC/MAC systems.

Casing made from galvanised sheet steel, opposed blades, airtight, in plastic bearings, measuring cross from aluminium extrusion profile, measuring cross sensor from plastic (PA6). With electric controller, control voltage 24 V AC, 50/60 Hz, temperature compensation of 10-40°C, wired and adjusted in factory. Right hand model.

Opposed blades, airtight according to DIN EN 1505, part 4 from aluminium extrusion profile.

**Manufacturer:** Schako, Trox, Wildeboer,  
or equivalent

**8.2.1590.** accord. To Design Description 8017  
**Flow rate controller, rectangular, variable, Width x Height= 252 x 252 mm**  
Volume flow: 577 - 3462 m<sup>3</sup>/h

Complete delivery and installation.



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**8.2.1600.** accord. To Design Description 8017  
**Flow rate controler, rectangular, variable, Wight x Height= 252 x 400 mm**  
Volume flow: 762 - 4355 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1610.** accord. To Design Description 8017  
**Flow rate controler, rectangular, variable, Wight x Height= 318 x 252 mm**  
Volume flow: 728 - 4369 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1620.** accord. To Design Description 8017  
**Flow rate controler, rectangular, variable, Wight x Height= 449 x 400 mm**  
Volume flow: 1293 - 7759 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1630.** accord. To Design Description 8017  
**Flow rate controler, rectangular, variable, Wight x Height= 503 x 503 mm**  
Volume flow: 1822 - 10930 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1640.** accord. To Design Description 8017  
**Flow rate controler, rectangular, variable, Wight x Height= 503 x 634 mm**  
Volume flow: 2296 - 13777 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1650.** accord. To Design Description 8017  
**Flow rate controler, rectangular, variable, Wight x Height= 565 x 503 mm**  
Volume flow: 2046 - 12277 m<sup>3</sup>/h

Complete delivery and installation.

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**8.2.1660.** accord. To Design Description 8017  
**Flow rate controller, rectangular, variable, Wight x Height= 634 x 400 mm**  
Volume flow: 1836 - 10956 m<sup>3</sup>/h

Complete delivery and installation.

\*\*\* Design-Description 8018  
**Flow Rate Controller rectangular, constant**

Rectangular volume flow rate controller for constant volume systems, mechanical system powered, external power supply not required. For supply or extract air, differential pressure range 50 to 1000 Pa. Control blade shaft supported in bearings, control bellows also provides oscillation damper action, volume range 4:1.

Volume flow control, with low tolerance, external adjustment scale to set volume flow, maintenance free, independent of gravity (horizontal blade shaft). Material: Casing made of galvanised sheet steel, control blade supported in bearings with PTFE lining. Polyurethane bellows.

Manufacturer: Schako, Trox, Wildeboer,  
or equivalent

**8.2.1670.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 200 x 100 mm**  
Volume flow: 144 - 576 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1680.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 400 x 200 mm**  
Volume flow: 756 - 3024 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1690.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 400 x 250 mm**  
Volume flow: 792 - 3168 m<sup>3</sup>/h

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Complete delivery and installation.

**8.2.1700.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 400 x 300 mm**  
Volume flow: 1134 - 4536 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1710.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 400 x 400 mm**  
Volume flow: 1512 - 6048 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1720.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 500 x 300 mm**  
Volume flow: 1350 - 5400 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1730.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 600 x 400 mm**  
Volume flow: 1836 - 7344 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1740.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 600 x 500 mm**  
Volume flow: 2304 - 9216 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1750.** accord. To Design Description 8018  
**Flow rate controller, rectangular, constant Wight x Height= 600 x 600 mm**  
Volume flow: 3024 - 12096 m<sup>3</sup>/h

Complete delivery and installation.

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\*\*\* Design-Description 8019  
**Flow rate controller round, constant**

Round volume control damper, can be installed at any location, for constant volume flow control up to maxy. 1000 Pa differential pressure, volume flow deviation of  $\pm 5\%$ , based on a voluem of Vmax. The housing is made of galvanised sheet steel, suitable for pipes to DIN EN 1505.

Plastic control damper and damper axis at  $\varnothing 100$  and  $\varnothing 125$ , otherwise galvanised sheet steel.

Manufacturer: Schako, Trox, Wildeboer,  
or equivalent

**8.2.1760.** accord. To Design Description 8019  
**Flow rate controller round, constant NW 100**  
Volume flow: 53 - 270 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1770.** accord. To Design Description 8019  
**Flow rate controller round, constant NW 125**  
Volume flow: 140 - 600 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1780.** accord. To Design Description 8019  
**Flow rate controller round, constant NW 160**  
Volume flow: 182 - 952 m<sup>3</sup>/h

Complete delivery and installation.

**8.2.1790.** accord. To Design Description 8019  
**Flow rate controller round, constant NW 200**  
Volume flow: 294 - 1418 m<sup>3</sup>/h

Complete delivery and installation.

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\*\*\* Design-Description 8020  
**Steam generator (electrical)**

Electro-automatic steam generator with inspection and cleaning lid, hard-foam insulated between cylinder and coating; electro-heating by two-step Cu and hard-Cr coated immersion heating bars corresponding to the steam performance required; target and difference setting pressure control 230 V; tubular spring gauge with maximum pressure mark 0.5 bar; water level indicator with level electrodes, weight or spring loaded excess pressure safety valve; solenoid valve 230 V for residue drain; solenoid valve 230 V for water level control; non-return valve; lucite covered steel switchboard, complete with flexible wiring, containing high voltage relays, timer, control and operating lamps, three-step safety level control, file and screw terminals for on-site connections.

All elements completely assembled and wired ready for operation, only water mains and drain, steam duct to distributor and electric mains to be connected on site.  
Both steam boilers supply one humidification system

### Accessories

- 5 m steam hose 22 x 28 mm, incl. clamp for steam hose
- 5 m condensate hose 15 x 21 mm, incl. clamp for condensate hose
- Incl. all necessary equipment (pipes, fittings, valves, dust trap, pressure reduction, insulation a.s.o)
- Floating contact service signal and failure signal, for message to DDC.

**8.2.1800.** accord. To Design Description 8020  
**Steam generator (electrical) for combustion air supply left wing (line 1 +2), combustion air supply right wing (line 1)**

Technical data:

Permanent steam performance	120 kg/h
Maximum operating pressure	0,5 bar
Operating data	120 kg/h to 0.3 bar
Pressure rate	0.3 - 0.5 bar (over pressure)
Electric input	90 kW
Control voltage	230 V 50 Hz
Heating voltage	230 V / 400 V / 500 V
External dimensions	
Length	720 cm
Width	450 cm

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Height 1320 cm  
Operating weight 170 kg

Complete delivery and installation.

**8.2.1810.** accord. To Design Description 8020  
**Steam generator (electrical) for combustion air supply right wing (line 2)**  
Technical data:

Permanent steam performace 73 kg/h  
Maximum operating pressure 0,5 bar  
Operating data 73 kg/h to 0.3 bar  
Pressure rate 0.3 - 0.5 bar (over pressure)  
Electric input 54 kW  
Control voltage 230 V 50 Hz  
Heating voltage 230 V / 400 V / 500 V  
External dimensions  
Length 720 cm  
Width 450 cm  
Height 1320 cm  
Operating weight 115 kg

Complete delivery and installation.

**8.2.1820.** accord. To Design Description 8020  
**Steam generator (electrical) for combustion air supply chassis dyno**  
Technical data:

Permanent steam performace 120 kg/h  
Maximum operating pressure 0,5 bar  
Operating data 120 kg/h to 0.3 bar  
Pressure rate 0.3 - 0.5 bar (over pressure)  
Electric input 90 kW  
Control voltage 230 V 50 Hz  
Heating voltage 230 V / 400 V / 500 V  
External dimensions  
Length 720 cm  
Width 450 cm  
Height 1320 cm  
Operating weight 170 kg

Complete delivery and installation.

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\*\*\* Design-Description 8021

### **Steam air humidifier**

Steam air humidifier, ready for connection to existing steam mains, consisting of a horizontal main distributor with vertical nozzle heads. The novel ceramic sliding vane valve shuts to form an absolutely leakproof seal, ensuring that no steam can emerge when the valve is closed, as well as avoiding water damage should the ventilation system be shut down. The special unit design without jacket heating prevents airflow heating (and the associated energy loss) when the humidifying system is not active. The linear valve characteristic covers the entire adjustment range of 0..100%, ensuring optimum control behaviour. Special patented steam nozzles are mounted on nozzle heads, enabling uniform humidifying free of condensation, even at low steam pressure and within the partial load range. The geometry of the humidifying system and the number of nozzle heads are adapted to suit plant conditions, and a defined humidification distance is guaranteed.

Consists of:

Spheroidal graphite cast iron steam connection unit with integrated dirt trap and automatic steam drying through multiple route diversion.

Ceramic sliding vane valve for absolutely leakproof closure.

Linear valve characteristic within the range 0..100%

Electric rotary actuator selectively available (accessory) for controlled steam output between 0..100%.

Horizontal main distributor with vertical nozzle heads and special stainless steel steam nozzles which blow saturated steam over the entire pipe length.

Primary steam trap (accessory) and secondary thermal steam trap.

### **Accessories**

Electrical rotary actuator, completely mounted, operating voltage 24 V, for control signal 0 - 10 V, incl. floating contacts for position indication and continuous position feedback signal 2 - 10 V, Pressure gauge 0 - 6 bar

**8.2.1830.** accord. To Design Description 8021  
**Steam air humidifier, Chassis dyno**  
Technical data

Humidifying output	240 kg/h
Air flow	22000 m³/h

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Steam pressure (gage)	0.5 bar
operating data	240 kg/h to 0.3 bar
Humidity intake	1.70 g/kg
Humidity discharge	11.0 g/kg
Air intake temperature	20 °C
Duct width (open)	1600 mm
Duct height (open)	600 mm
Wall thickness (incl. Isolation)	20 mm
Humidifying distance	> 2.5 m

Complete delivery and installation.

**8.2.1840.** accord. To Design Description 8021  
**Steam air humidifier, combustion air left wing (line 1+2), combustion air right wing (line 1)**

Technical data

Humidifying output	116 kg/h
Air flow	9375 m³/h
Steam pressure (gage)	0.5 bar
operating data	116 kg/h to 0.3 bar
Humidity intake	1.70 g/kg
Humidity discharge	12.0 g/kg
Air intake temperature	18 °C
Duct width (open)	700 mm
Duct height (open)	600 mm
Wall thickness (incl. Isolation)	20 mm
Humidifying distance	> 2.5 m

Complete delivery and installation.

\*\*\* Design-Description 8022

**Steam air humidifier**

consisting of 1 to max. 3 horizontal steam distributors. The novel ceramic sliding vane valve shuts to form an absolutely leakproof seal, ensuring that no steam can emerge when the valve is closed, as well as avoiding water damage should the ventilation system be shut down. The special unit design without jacket heating prevents airflow heating (and the associated energy loss) when the humidifying system is not active. The linear valve characteristic covers the entire adjustment range of 0..100%, ensuring optimum control behaviour. Special patented steam nozzles are mounted on nozzle heads, enabling uniform



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humidifying free of condensation, even at low steam pressure and within the partial load range. The number and length of the nozzle heads are selected to suit plant conditions, and a defined humidification distance is guaranteed.

Consists of:

Spheroidal graphite cast iron steam connection unit with integrated dirt trap and automatic steam drying through multiple route diversion

Ceramic sliding vane valve for absolutely leakproof closure.

Linear valve characteristic within the range 0..100%

Electric rotary actuator selectively available (accessory) for controlled steam output between 0..100%

1 to max. 3 stainless steel horizontal steam distribution pipes with stainless steel steam nozzles which blow saturated steam into the air flow over the entire pipe length.

The number of steam distribution pipes is selected to suit plant conditions

Primary steam trap (accessory) and secondary steam trap.

### Accessories

Electrical rotary actuator, completely mounted, operating voltage 24 V, for control signal 0..10V, continuous position feedback signal 2..10 V, Pressure gauge 0 - 6 bar

**8.2.1850.** accord. To Design Description 8022  
**Steam air humidifier, Combustion air right wing (line 2), Chassis dyno**  
Technical data:

Humidifying output	74 kg/h
Air flow	6000 m <sup>3</sup> /h
Steam pressure (absolute)	0.5 bar
operating data	74 kg/h to 0,3 bar
Humidity intake	1.7 g/kg
Humidity discharge	11.0 g/kg
Air intake temperature	18 °C
Duct width (open)	600 mm
Duct height (open)	600 mm
Wall thickness	20 mm
Humidifying distance	> 3.0 m

Complete delivery and installation.

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**8.2.1860. Pivoted arm Combustion Air Supply**

The pivoted arm consist of a swivel, powder-coated sectional steel beam. The joints are equipped with adjustable brakes. The pivoted arm pipes are connected to flexible hoses near the joints. An infinitely variable telescopic extension with the supply ventilation hood is attached to the suction crane at the front beam. For suction cranes of 250 mm in diameter with a reach of up to 3 metres it is possible to attach tools by means of the two-part support beam. Loads up to 50 kg (e.g. a mechanical wire box) can be supported on the first beam. The second beam can take loads of up to 10 kg (e.g. a set of hoses). The pivoted arm cranes are suitable for connecting central units.

Manufacturer: TEKA, Norfi, Nedermann  
or equivalent

Technical data:

Diameter: 250 mm  
Lenght: 3 m

Complete delivery and installation.

**8.2.1870. Structural steel construction**  
(according to the instruction of the supervisor)

In all kinds of special mounting constructions, welded and/or screwed.

Rust protection by ground and finished painting (in different paints), paint acc. to the instructions of the customer.

Incl. all necessary mounting materials, incl. drilling of fixing holes in concrete and/or masonry walls and ceilings.

Complete delivery and installation.

\*\*\* Design-Description 8023  
**Air duct connection**

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Connection of the air ducts to the fresh air suction and the extraction air outlet.

This positions includes:

- Cut outs in the suction and outlet chamber
- Sealing material
- Connection frame in galvanized, lenght = 125 mm

**8.2.1880.** accord. To Design Description 8023  
**Air duct connection, dimension of air duct: 0.30 - 1.00 m<sup>2</sup>**  
Complete delivery and installation.

**8.2.1890.** accord. To Design Description 8023  
**Air duct connection, dimension of air duct: 1.01 - 2.00 m<sup>2</sup>**  
Complete delivery and installation.

**8.2.1900.** accord. To Design Description 8023  
**Air duct connection, dimension of air duct: 2.01 - 4.00 m<sup>2</sup>**  
Complete delivery and installation.

**8.2.1910.** **Cleaning covers, 500 x 500 mm**  
for air duct system, inclusive cutout, impermeable to air,  
mounting frame, edge protector

Complete delivery and installation.

**8.2.1920.** **Cleaning covers, 300 x 200 mm**  
for air duct system, inclusive cutout, impermeable to air,  
mounting frame, edge protector

Complete delivery and installation.

**8.2.1930.** **Thermometer**  
Thermometer with mounting flange for ventilation an air-  
conditioning ducts  
Head stainless steel with F mounting flange in anodized  
aluminium, neutral color, Dial diameter 80 mm, helical bimetal,  
stabilized, external adjustment devbice.

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Measuring range: -20 + 60°C  
Fitting length of process  
connection: 150 mm  
Indication: linear, Class 1.5 similar to  
EN 13190

Accessories:

- Compensation washers
- Flange with extension tube

Complete delivery and installation.

**8.2.1940. Measuring hole**

Measuring hole

The positioning meets the relevant standards, consisting of the hole diameter = 22 mm and the stopper in plastic material.

Complete delivery and installation.

**8.2.1950. Direction indicator**

- In colored self-adhesive label
- To specification contract awarder
- Labeling approved plate list

Complete delivery and installation.

**8.2.1960. Identification plate 200 x 100 mm**

- In colored Resopal
- To specification contract awarder
- Inclusive fastening and platcarrier
- Labeling approved plate list

Complete delivery and installation.

**8.2.1970. Identification plate 100 x 50 mm**

- In colored Resopal
- To specification contract awarder
- Inclusive fastening and platcarrier
- Labeling approved plate list

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Complete delivery and installation.

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### General Guide note for pipe installation

The pipelines have to be stored in impact - sound damping mounting plates.  
Impact-sound damping rate > 30 dB by reference swing velocity  $v_0 = 5 \times (10 E^{-8})$  m/s.

The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components must be submitted to the constructor by the supplier before the work is carried out.

Continuous pipe mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with mineral fibre fire protection measures.

These fire protection measures are described in a separate specification.

### 8.3. Exhaust extraction chassis dyno

#### 8.3.10. Suction duct 10 m

Made of extruded aluminium, one-piece profile, complete with neoprene lip seals and reining strips to fix the lips. Including suction duct coupling, 2 encover, 2 limit stop, 3 brackets complete and duct connector "top" dia.160.

Manufacturer: Norfi, Nedermann,  
Plymovent, or equivalent

Complete delivery and installation.

#### 8.3.20. Suspension L= 1500 mm

for slotted suction duct, galvanized, with eye bolts for level-adjusting of duct, mounting profil, length = 200 mm.

Manufacturer: Norfi, Nedermann,  
Plymovent, or equivalent

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Complete delivery and installation.

**8.3.30.**

**Trolley Set**

with shutting valve, incl. balancer and accessories, made of aluminium sand cast, with 4 travel wheels and 2 supporting wheels, all ball beared, and 4 ball beared rollers for lateral guidance. Sliding plates made of stainless steel. With internal shutting valve, balancer 7 m exhaust hose dia 100 mm, up to 180°C, and hose suspension.

Manufacturer: Norfi, Nedermann,  
Plymovent, or equivalent

Complete delivery and installation.

**8.3.40.**

**Exhaust gas nozzle**

for car, dia. 100, incl. hose clamb and protection rubber for hose clamp, made of neoprene, oval, with manual clamping device right, hose connection dia. 100 mm.

Manufacturer: Norfi, Nedermann,  
Plymovent, or equivalent

Complete delivery and installation.

**8.3.50.**

**Centrifugal fan**

for duct installation, radial impeller one-sided suctioning, backwards bent circular bow loops, with suction and pressure joint dia 160, rubber collar dia. 160, vibration damper dia. 160

Technical data:

Volume flow max.	2000 m <sup>3</sup> /h
Pressure loss of air	1700 Pa
Speed	2850 1/min
Power	1.2 kW
Voltage	400 V / 3 ph / 50 Hz

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Max. temp. 180 °C  
max. permissible sound level: <87 dB(A)

Manufacturer: Norfi, Nedermann,  
Plymovent, or equivalent

### Accessories

- 1 Electrical switch for power circuit, with 2 auxiliary and floating contact for message to DDC.
- 1 Full motor protection unit, Operation and protection unit in polymer casing for surface mounting. on/off operation via push button. Manual reset after failure. Volt free contact for connection of alarm. Protection IP 54.
- 1 Floor consoles
- 1 Fan silence box (sound damping >12 dB)
- 2 Flexible attenuator
- Potential compensation.

Complete delivery and installation.



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### 8.4. Insulation

\*\*\* Design-Description 8024

#### Insulation

The bill of quantity bases on the summary of air duct surfaces.

The accounting will be based on the summary of the real erected insulation surfaces.

A part of the air ducts has to be insulated before assembling.  
The scope of these works is described in the following positions.

The extent of the work is specified by the supervisor of the customer, the coordination has to be done by the involved suppliers.

The insulation as vapour barrier and/ or heat installation will be done with flexible closed celled natural rubber plates.

Hardly inflammable acc. To DIN EN 13823

Thermal conductivity: < 0.033 W/(m\*K)  
Vapour resistance: 10000 acc. to EN 13469

Thickness: 19 mm

Using for:  
Air duct and moulded part,  
height and weight: 200 - 4000 mm

Medium (inside air temperature / Humidity):  
max. + 45 °C / 10 - 100 %  
min. - 8 °C / 5 - 100 %

Surrounding (air) temperature/Humidity:  
max. + 40 °C / 20 - 100 %  
min. + 10 °C / 20 - 100 %

Notches and gaps glued diffusion tight, additionally glued with diffusion - tight tape, plates have to be glued allover with the air ducts.

Incl. Connection of insulation to:  
- Welding sleeve  
- Measuring pipe

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- Pipe sleeve  
- Fixed bearing construction

**8.4.10.** accord. To Design Description 8024  
**Insulation straight air ducts syntetic rubber**  
Complete delivery and installation.

**8.4.20.** accord. To Design Description 8024  
**Insulation mouldet part syntetic rubber**  
Complete delivery and installation.

**8.4.30.** accord. To Design Description 8024  
**Insulation straight air ducts syntetic rubber with sheet metal shroud**  
for the piping, same as described above, however with coating made of sgalvanized sheet steel 1.0 mm, with all required connection and fastening material, support constructions, metal ridges as well as thermally and acoustically decoupled pipe holding devices.  
The material compatibility (pipeline made of stainless steel, coating made of galvanized sheet steel) of entire insulation shall be guaranteed.

Distance between, lower edge and floor to 2.5 meters

Complete delivery and installation.

**8.4.40.** accord. To Design Description 8024  
**Insulation moulded part syntetic rubber with sheet metal shroud**  
for the piping same as described above, however with coating made of sgalvanized sheet steel 1.0 mm, with all required connection and fastening material, support constructions, metal ridges as well as thermally and acoustically decoupled pipe holding devices.  
The material compatibility (pipeline made of stainless steel, coating made of galvanized sheet steel) of entire insulation shall be guaranteed.

Distance between, lower edge and floor to 2.5 meters

Complete delivery and installation.

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**8.4.50. Sound insulation of air ducts false floor**

From wall (fire damper) up to the middle of the sound absorber  
for:

Combustion, Admixture, CVS

Surface of insulation.  $\leq 5.0 \text{ m}^2$

Insulation with sheet metal shroud,  
additionally with anti-drumming-treatment, sticks together on air  
duct surface, thickness  $d = 2.4 \text{ mm}$  and 2 each maintenance  
opening to operate the fire damper.

Sound absorbing insulation mat ( $> 20 \text{ dB}$ ), thickness  $d = 30$   
mm.

supply and install acc. to specific erection regulations

Complete delivery and installation.

**8.4.60. Sound insulation of air ducts shaft**

from fire damper in the corner of the shaft up to the middle of  
the sound absorber

for:

Combustion, Admixture, CVS

Surface of insulation.  $\leq 5.0 \text{ m}^2$

insulation with sheet metal shroud,  
additionally with anti-drumming-treatment, sticks together on air  
duct surface, thickness  $d = 2.4 \text{ mm}$  and 2each maintenance  
opening to operate the fire damper.

Sound absorbing insulation mat ( $> 20 \text{ dB}$ ), thickness  $d = 30$   
mm.

Supply and install acc. to specific erection regulations

Complete delivery and installation.

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**8.4.70. Self supporting fire resistant straight air duct**  
self supporting fire resistant air duct,  
incl. mounting material,  
promaduct 500 plates incl. test certification acc. to DIN EN 13238 / 13501-  
1, fire resistance class REI 90, incl. connection to fire damper, wall, etc.

Complete delivery and installation.

**8.4.80. Self supporting fire resistant moldet part**  
self supporting fire resistant air duct,  
incl. mounting material,  
promaduct 500 plates incl. test certification acc. to DIN EN 13238 / 13501-  
1, fire resistance class REI 90, incl. connection to fire damper, wall, etc.

Complete delivery and installation.

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### General Guide note for pipe installation

The pipelines have to be stored in impact - sound damping mounting plates.  
Impact-sound damping rate > 30 dB by reference swing velocity  $v_0 = 5 \times (10 \text{ E } -8) \text{ m/s}$ .

The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components must be submitted to the constructor by the supplier before the work is carried out.

Continuous pipe mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with mineral fibre fire protection measures.

These fire protection measures are described in a separate specification.

### 8.5. Drainage of condens water

\*\*\* Design-Description 8025

#### Drainage condens water, Ventilation systems 2. floor

for:

- Air duct an fitting formed aus water tight pan for humidified supply air (combusten air and chassis dyno)
- Air handling units VEN01-VEN10
- Steam generator
- Steam air humidifier

Sewage pipe out of tempered PE tubes and fittings with planed sides,

Mounting in the technical floor.

Connections with electrical welding sleeves.

Mounting acc. to the requirements of the producer and to DIN EN 12056, DIN EN 752 and DIN EN 1610.

Mounting with clamps out of galvanize steel with sound absorbing rubber ply.

Single mounting acc. to the static requirements.

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The pipe system has to be separated form the structure for damping impact sound.

**8.5.10.** accord. To Design Description 8025  
**PE Pipe, DN 40**  
Complete delivery and installation.

**8.5.20.** accord. To Design Description 8025  
**PE Elbow, DN40, 45°-90°**  
Complete delivery and installation.

**8.5.30.** accord. To Design Description 8025  
**Pipe - connection**  
Fitting formed out of water tight pan for  
Draining points DN 40:

- Humidified supply air (combustion air and chassis dyno)
- Air handling units VEN01 - VEN10
- Steam generator
- Steam air humidifier

incl. mounting, connecting and sealing material and reductions

Complete delivery and installation.

**8.5.40.** accord. To Design Description 8025  
**PE T-Pice, DN 40, 45°**  
Complete delivery and installation.

**8.5.50.** accord. To Design Description 8025  
**PE Electrical welding sleeves, DN 40**  
Complete delivery and installation.

\*\*\* Design-Description 8026

**Drainage condens water, ventilation systems air cooling AHU test cells 1-15**

for:

- Air handling units VEN11

Sides, sleeveless

## Specification

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Produced acc. to DIN EN 877.

Tube, laid to falls,  
inside coated with interlaced 2-componet epoxy resin.  
Tube outside coated with red brown primer painting.  
Fittings inside and outside coated with red brown primer painting.

Connection system acc. to the requirements of the producer.

Fittings must not be shortened, separating cuts of tube must be done by special equipment.

Mounting with clamps out of galvanize steel with sound absorbing rubber ply.

Single mounting acc. to the static requirements.

The pipe system has to be separated form the structure for damping impact sound.

**8.5.60.** accord. To Design Description 8026  
**Pipe, DN40**  
Complete delivery and installation.

**8.5.70.** accord. To Design Description 8026  
**Pipe, DN100**  
Complete delivery and installation.

**8.5.80.** accord. To Design Description 8026  
**Elbow, DN 40, 45°-90°**  
Complete delivery and installation.

**8.5.90.** accord. To Design Description 8026  
**Elbow, DN 100, 45°-90°**  
Complete delivery and installation.

**8.5.100.** accord. To Design Description 8026  
**T-Pice, DN 100, x 40, 45°**  
Complete delivery and installation.

## Specification

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- 8.5.110.** accord. To Design Description 8026  
**T-Pice, DN 100, x 100, 45°**  
Complete delivery and installation.
- 8.5.120.** accord. To Design Description 8026  
**Cap DN 100**  
Complete delivery and installation.
- 8.5.130.** accord. To Design Description 8026  
**Pipe - Connection to AHUS test cells 1-15**  
Incl. all reductions, connecting and mounting material, bolting, siphons  
  
Nominal diameter: DN 40 - DN 50  
  
Complete delivery and installation.
- 8.5.140.** accord. To Design Description 8026  
**Fall Pipe Bearing, DN 100**  
Out of cast iron incl. top ring and rubber ring  
  
Incl. ground primer coat  
  
Nominal diameter: DN 100  
  
Supply and mounting  
  
Complete delivery and installation.
- 8.5.150.** accord. To Design Description 8026  
**Connection to ground pipe**  
Connection to ground pipe  
  
Ground pipe in earth or bottom or wall sparing  
  
Incl. all connection and mounting materials  
  
Pipe: DN 100  
Ground pipe: DN 100  
  
Complete delivery and installation.



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**8.5.160.** accord. To Design Description 8026  
**Drain trap, DN 100**  
Complete delivery and installation.

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### 8.6. Special reatings

#### 8.6.10. Revision Documentation

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass.

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

#### 8.6.20. Starting UP and Test Operation

Test procedures and measuring methods for handing over installed ventilation and air conditionig systems acc. to DIN EN 12599

After finishing installation, the systems have to be started up.

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The systems and the components must be adjusted, so that the functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
  - Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the testl operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

### **8.6.30. Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

### **8.6.40. Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate files.

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The customer has to supply these inspections by sending his commissioning personal so much as it is necessary.

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**9. Exhaust gas system**

**9.1. Ventilators and flaps**

\*\*\* Design-Description 9001

**Radial ventilator, exhaust extraction**

Radial ventilator

V-belt driven, suitable for exhaust gas air mixtures up to max.  
300°C permanent temperature.

Consisting of:

Inherently stable spiral shape casing (sheet steel 3 mm) with stable reinforcement frame, with inspection flap, degreased, iron-phosphate treated and coated, bracket, basic frame made of stable welded sheet steel.

Inflow nozzle as stable pressure part, aerodynamically optimized and screwed.

Radial impeller in reinforced type one-sided suctioning with welded, backwards bent circular bow loops, degreased, iron-phosphate treated and coated, with corrosion resistant hub in well-ried Taper-Lock-tension socket system.

Statically and dynamically balanced acc. to DIN ISO 1940, balancing quality Q 2.5 < 4.0 mm/s for subassembly elastically.

Drive indirectly via block bearing with cooling disk.

High-capacity drive with narrow V-belt acc. to ISO 2790.

Belt disks acc. to ISO 255 with Taper-Lock-tension socket system.

True-running shaft, shouldered to standardized diameter, one end for attachment of V-belt pulley. Cast steel bearing housing with integrated selfaligning ball bearings on stable bearing console attached outside flow stream. Lubricant can be refilled when at standstill, or during operation.

The bearing housing is to be fitted with a metering nipple for bearing monitoring. The integrated self-aligning ball bearings are dimensioned for a minimum useful life of 40000 operating hours.

Drive belt selection must take permissible belt tensile forces in account so as not to exceed permissible bearing loads.

Three-phase current motor / IEC standard motor mounted to tension device, in construction shape B3 in fan type, located outside of volume flow protective type IP 55 / iso-class F.

PTC - Thermistor per winding.

Ambient temperature: 40.0°C.

Motor capacity selected for cold start at 20°C.

Electrical wiring to clamp box located outside.

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### Accessories:

- Isolation collars (flexible connection) on suction and pressure side made of temperature resistant synthetic fabric with flanges
- Potential compensation
- Condensate connection pieces with lock
- Vibration dampener for vibration and structureborne noise insulation
- Belt protector as finger protection acc. to DIN EN 294 with lids for checking of belt tension and rpm measurements at motor and fan shaft
- Motor tensioning rails made of steel with adjustable tensioning jaws, bolted to the base frame.
- Thermal and sound insulation with exterior coat made of hot dip galvanized sheet steel
- Balancing quality G 1.0 for sub-assembly rigid
- Incl. counter flanges, screws and sealing.

**Make:** DLK Ventilatoren,  
Gebhardt, Pollrich, or equivalent

### Frequency converter:

Structural frequency converter for continuous speed control with speed dependent load moment.  
Accomplished as voltage intermediate circuit converter without capacity reduction at converter exit.  
Operation and programming unit with clear text display, programmable in two levels.  
Integrated PID controller, suitable for volume flow, pressure or level control.  
Display of control size in related size unit e.g. volume flow (m<sup>3</sup>/h), pressure (bar) or temperature (C).  
Optional display possibility in display of:

- control rated value (%)
- motor frequency (Hz)
- actual value (%)
- motor current (A)
- motor load moment (%)
- motor capacity (kW)
- electrical energy (kWh)
- motor voltage (V)
- intermediate circuit voltage (V)
- thermal motor and frequency converter load (%)
- display possibility of two data values at the same time
- as well as status and rotating direction display

**Rated voltage:** 3 x 400 V  
**Ambient temperature:** 40.0°C  
**Type of protection:** IP 54

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Radio shielded filter: class B

Network overvoltage and network transient protection  
Rated protective throttle in intermediate circuit for reduction of network harmonics.  
Control connections galvanically separated from power element.

Standard equipment:

- automatic energy optimization for optimum motor efficiency in partial load operation
- switching at exit
- operation hour meter
- minimum and maximum speed limit
- ramp functions
- motor trap
- d.c. brake
- variable cycle frequency
- PID controller
- multi-motor operation is possible
- same motor capacity as at direct operation at network
- V-belt monitoring
- motor PTC thermistor monitoring

Protective functions:

- motor protection (thermal copy)
- built-in motor coils (exit throttle / filter) for long motor lines and reduction of voltage increase speed du/dt
- short-circuit and ground-fault resistant
- overcurrent protection
- thermal frequency converter protection
- low voltage and overvoltage monitoring
- phase failure monitoring

Analog inputs:

0 - 10 V, 0(4) - 20 mA and inverted signal,

4 digital inputs:

start/stop, reversing, motor PTC thermistor,

quick stop/motor freewheel/d.c. brake,

receipt, fixed speed, electronical

motor potentiometer, MANUAL - 0 - AUTOMATIC

2 analog/digital output relays: 250 V AC or 24 V DC, 2 A

Profibus DP.

The manual/system book (immediately) as well as the programming and parameter list (after accomplished initial operation) shall be submitted to the Contracting Agency for each frequency converter.

The resonant frequencies shall be determined and faded out.

**Make:** Siemens, Danfoss, ABB, or equivalent

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**Accessories:**

- Frequency converter installed on a steel rack in the vicinity of ventilator
- Repair switch as main power switch completely cabled (shielded lead and flexible) with motor and frequency converter, incl. conduit installed on clamps.
- Interface to the electrical traft is the frequency inverter.
- Repair switch cutoff of drive, protection type IP 65, can be locked in "OFF" position with safety lock, with 2 auxiliary and floating contact for message to DDC,

**9.1.10.**

accord. To Design Description 9001

**Radial ventilator, exhaust extraction left wing**

Technical data:

Operation case 1

max. volume flow: 35000 m<sup>3</sup>/h at 100°C  
total pressure increase: 2100 Pa at 100°C

Operation case 2

max. volume flow: 27000 m<sup>3</sup>/h at 20°C  
min. volume flow: 7000 m<sup>3</sup>/h at 20°C

max. permanent media temperature: 170°C

ventilator speed: 1116 1/min (Operation case 1)  
A-eval. sound capacity level: 111.1 dB(A) (Operation case 1)  
capacity requirement at wave: 25.2 kW (Operation case 1)

ventilator speed operating data: 20 - 100%  
motor capacity: 30 kW  
motor speed: 1450 1/min  
speed range: rpm-controlled  
impeller diameter: 1120 mm  
fan and motor support  
base frame: 1360 x 2580 mm  
flange inlet side diameter: 1005 mm  
flange outlet side: 1002 x 902 mm

max. permissible sound capacity level LW

fm	63	125	250	500	1000	2000	4000	8000	Hz
Lw	112.4	113.4	114.4	109.4	104.4	99.4	94.4	89.4	dB



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complete delivery and installation.

### 9.1.20.

accord. To Design Description 9001

#### **Radial ventilator, exhaust extraction right wing**

##### Technical data:

Operation case 1

max. volume flow: 39000 m<sup>3</sup>/h at 100°C

total pressure increase: 2100 Pa at 100°C

Operation case 2

max. volume flow: 31000 m<sup>3</sup>/h at 20°C

min. volume flow: 7000 m<sup>3</sup>/h at 20°C

max. permanent media

temperature: 170°C

ventilator speed: 1116 1/min (Operation case 1)

A-eval. sound capacity level: 111.1 dB(A) (Operation case 1)

capacity requirement at wave: 26.9 kW (Operation case 1)

ventilator speed operating data: 20 - 100%

motor capacity: 30 kW

motor speed: 1450 1/min

speed range: rpm-controlled

impeller diameter: 1120 mm

fan and motor support

base frame: 1360 x 2580 mm

flange inlet side diameter: 1005 mm

flange outlet side: 1002 x 902 mm

max. permissible sound capacity level LW

fm	63	125	250	500	1000	2000	4000	8000	Hz
Lw	112.4	113.4	114.4	109.4	104.4	99.4	94.4	89.4	dB

complete delivery and installation.

\*\*\* Design-Description 9002

#### **Radial ventilator, exhaust analysis**

Radial ventilator, exhaust analysis

Directly driven chemical resistant

radial ventilator with backward bent radial

high-capacity impeller, 3-phase current 400 V, 50Hz.

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Impeller statically and dynamically balanced,  
installed to galvanized steel bearing stand.

Accessories:

- 1 set spring vibration damper
- 1 condensate drain connection piece with lock
- Motor circuit-breaker
- Ventilator basic frame
- Suction and blow out flange
- Flexible collar for suction and blow out
- Potential compensation
- Repair switch cutoff of drive as main power switch, housing for wall structure, protection type IP 65, can be locked in "OFF" position with safety lock, with 2 auxiliary and floating contact for message to DDC,

**9.1.30.** accord. To Design Description 9002  
**Radial ventilator, exhaust analysis left wing**

Technical data:

volume flow:	3000 m <sup>3</sup> /h at 20°C
total pressure increase at 1.2 kg/m <sup>3</sup> :	1000 Pa
ventilator speed / motor speed:	1450 1/min
Sound power level:	73 dB(A)
motor capacity:	4.0 kW
speed range:	1n
motor protection:	IP 55
material:	GFK
suction diameter:	400 mm
pipe outlet side diameter:	400 mm
casing diameter:	858 mm
fan and motor support base frame:	771 x 450 mm

complete delivery and installation.

**9.1.40.** accord. To Design Description 9002  
**Radial ventilator, exhaust analysis right wing**

Technical data:

volume flow:	1000 m <sup>3</sup> /h at 20°C
total pressure increase at 1.2 kg/m <sup>3</sup> :	1000 Pa
ventilator speed / motor speed:	2800 1/min
suction diameter:	200 mm
Sound power level:	70 dB(A)
motor capacity:	1.5 kW
speed range:	1n

## Specification

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motor protection:	IP 55
material:	PP
suction diameter:	200 mm
pipe outlet side diameter:	200 mm
casing diameter:	537 mm
fan and motor support base frame:	491 x 350 mm

complete delivery and installation.

\*\*\* Design-Description 9003

### **Electric shut-off valves**

Shut-off valve PN 6 for clamping between flange PN 6 acc. to DIN EN 1092, with metal stop strip, casing and valve made of 1.4301, spindle made of 1.4301, installation location of spindle horizontal, spindle sealing by readjustable gland glasses with asbestos-free package. With built-on electrical servo-drive (230 V AC), closing time 30 sec./90°, mech. end switches for OPEN / CLOSE position message (24 V, DC), with handwheel for "emergency" operation, incl. counter flanges, screws and sealing, welding seam preparations, welding seams and all welding work.

Leakage rate:	0.2 % of KVS-value
max. differential pressure:	2500 Pa
Media:	smoke gas up to T max. approx. 300°C

**9.1.50.** accord. To Design Description 9003  
**Electr. shut-off flap, DN 700**  
Complete delivery and installation

**9.1.60.** accord. To Design Description 9003  
**Electr. shut-off flap, DN 800**  
Complete delivery and installation

\*\*\* Design-Description 9004

### **Pneum. throttle valves**

acc. to DIN EN 1092, casing and valve made of 1.4301, spindle made of 1.4301, installation location of spindle horizontal, spindle sealing by readjustable gland glasses with asbestos-free package. With built-on pneum. control driv (5-10 bar) as swivel drive,

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pressureless CLOSE, with pressure reducing valve on compressed air side, closing speed 3-5 s, mech. end switches for CLOSE position message, with handwheel for "emergency" operation, incl. sealing and E/P-position controller, input signal (0)4 ... 20 mA.  
incl. counter flanges, screws and sealing, welding seam preparations, welding seams and all welding work.

The flap have to close by breakdown of the electrical auxiliary power and the compressed air.

Leakage rate: 1.0 % of KVS-value  
max. differential pressure: 2500 Pa  
Media: smoke gas up to T max. approx. 300°C

**9.1.70.** accord. To Design Description 9004  
**Pneum. throttle valve, DN 200**  
Complete delivery and installation

**9.1.80.** accord. To Design Description 9004  
**Pneum. throttle valve, DN 300**  
Complete delivery and installation

\*\*\* Design-Description 9005  
**Electrical Shut-Off flap**

hollow body lamellas made of stainless steel 1.4301, frame depth 180 mm, with profile connection frame, with joint mutually adjustable lamellas. Suitable for a pressure up to 2000 Pa.  
The adjustment of lamellas will be accomplished via a servo-drive located outside.

Media: analysis gas up to T max. approx. 40°C

Accessories:  
- 1 Drive unit, installed with console, 24 V, AC (turning moment according to the necessary setting forces), limit switch "Shut" and "Open".

Make: Schako, Trox, Wildeboer,  
or equivalent

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**9.1.90.** accord. To Design Description 9005  
**Electrical Shut-Off flap, 201 x 201**  
Complete delivery and installation

**9.1.100.** accord. To Design Description 9005  
**Electrical shut-off flap, 400 x 400**  
Complete delivery and installation

\*\*\* Design-Description 9006  
**Fire damper**

All devices decripted below have to be realize according to the requirement of Italien newest technical laws and regulations.

Fire damper made Casing made of stainless steel 1.4301 resistance class REI 180 - RE 180.  
Installed with vertical or horizontal shutter axis. Two opposite laying maintenance opening additionally to the trigger device. Front face of shutter panel protected with an envelope out of metal sheet, equipped with additional stiffening angles out metal sheet, maintenance free bearings by special coated bushes.

Fixed setting when damper is open. Damper is large dimensioned and is permanently lubricated.  
Installation in gas and lightweight concrete, other concrete or masonry, plasterboard and lightweight partition walls or outside walls and ceilings.  
For connection to non-flammable ventilation ducts. Installation flange-to-flange or with one or two sides of mineral wool filling for installation in difficult to access openings. Installation without duct connection with protective grille and necessary extension piece for damper protrusion. The damper isolation and suspension for installation in front of walls are arranged by the customer on site.

Length: 500 mm

### Accessories

- 1 electrical spring back actuator (closed circuit current principle), 24 V AC, to open and close the shut-off damper, with thermal trigger 72°C, with integrated limit switches for "OPEN" and "SHUT", indicators, floating contact.

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**Make:** Schako, Trox, Wildeboer,  
or equivalent

**9.1.110.** accord. To Design Description 9006  
**Fire damper, width x height = 400 x 400 mm**  
Exhaust analysis left wing

Complete delivery and installation

**9.1.120.** accord. To Design Description 9006  
**Fire damper, width x height = 252 x 252 mm**  
Exhaust analysis right wing

Complete delivery and installation

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### General Guide note for pipe installation

The pipelines have to be stored in impact - sound damping mounting plates.  
Impact-sound damping rate > 30 dB by reference swing velocity  $v_0 = 5 \times (10 \text{ E } -8) \text{ m/s}$ .

The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components must be submitted to the constructor by the supplier before the work is carried out.

Continuous pipe mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with mineral fibre fire protection measures.

These fire protection measures are described in a separate specification.

### 9.2. Pipelines and accessories

\*\*\* Design-Description 9007

#### Pipeline exhaust extraction

Exhaust gas pipeline in continuously welded make completely of stainless steel, material no. 1.4571 with a wall thickness of at least 3 mm, incl. welding seam preparations, welding seams, pipe recesses and adjustments to the flange connections.

**9.2.10.** accord. To Design Description 9007  
**Pipe rated width 200, exhaust extraction**  
Complete delivery and installation

**9.2.20.** accord. To Design Description 9007  
**Pipe rated width 300, exhaust extraction**  
Complete delivery and installation

**9.2.30.** accord. To Design Description 9007  
**Pipe rated width 700, exhaust extraction**  
Complete delivery and installation

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**9.2.40.** accord. To Design Description 9007  
**Pipe rated width 800, exhaust extraction**  
Complete delivery and installation

\*\*\* Design-Description 9008

**Stainless steel pipe elbows, exhaust extraction**

Continuously welded made of stainless steel, material no. 1.4571,  
construction type R = 1.5 x D, incl. welding seam preparations and  
welding seams, at welding elbows incl. pipe recesses and all  
welding work, wall thickness 3 mm.

**9.2.50.** accord. To Design Description 9008  
**Elbow DN 200, 90°, exhaust extraction**  
Complete delivery and installation

**9.2.60.** accord. To Design Description 9008  
**Elbow DN 300, 90°, exhaust extraction**  
Complete delivery and installation

**9.2.70.** accord. To Design Description 9008  
**Elbow DN 800, 90°, exhaust extraction**  
Complete delivery and installation

**9.2.80.** accord. To Design Description 9008  
**Elbow DN 200, 30 - 45°, exhaust extraction**  
Complete delivery and installation

**9.2.90.** accord. To Design Description 9008  
**Elbow DN 300, 30 - 45°, exhaust extraction**  
Complete delivery and installation

**9.2.100.** accord. To Design Description 9008  
**Elbow DN 800, 30 - 45°, exhaust extraction**  
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\*\*\* Design-Description 9009

**T-pieces, exhaust extraction**



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Continuously welded made of stainless steel, material no. 1.4571,  
incl. welding seam preparations, welding seams and all  
welding work, wall thickness 3 mm.

**9.2.110.** accord. To Design Description 9009  
**T-piece rated width 800 x 800 x 800, exhaust extraction**  
Complete delivery and installation

**9.2.120.** **Transition piece, L= 1750 mm**  
for the connection of ventilator to the sound absorber chamber  
for welding into pipeline, incl. welding seam preparations and welding  
seams, with flange PN 6, material no. 1.4571, wall thickness 3 mm.

Rated width ventilator flange: 1258 mm  
Dimension sound  
absorber chamber flange: 1258 mm  
Length: 1750 mm

- 1 Connection flange to the sound absorber chamber
- 1 Connection flange to the ventilator
- 2 Elbow, dimension 1258 mm, 30 - 45°

Complete delivery and installation

**9.2.130.** **Transition piece, L= 500 mm**  
for the connection of ventilator to the sound absorber chamber  
for welding into pipeline, incl. welding seam preparations and welding  
seams, with flange PN 6, material no. 1.4571, wall thickness 3 mm.

Rated width ventilator flange: 1258 mm  
Dimension sound  
absorber chamber flange: 1258 mm  
Length: 500 mm

- 1 Connection flange to the sound absorber chamber
- 1 Connection flange to the ventilator
- 1 Pipeline

Complete delivery and installation

\*\*\* Design-Description 9010  
**Welding saddle, exhaust extraction**

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Continuously welded made of stainless steel, material no. 1.4571,  
incl. welding seam preparations, welding seams and incl. pipe  
recess with all welding work, wall thickness 3 mm.

**9.2.140.** accord. To Design Description 9010  
**Welding saddle rated width 200 for pipe rated width 700, exhaust extraction**  
Complete delivery and installation

**9.2.150.** accord. To Design Description 9010  
**Welding saddle rated width 300 for pipe rated width 700, exhaust extraction**  
Complete delivery and installation

**9.2.160.** accord. To Design Description 9010  
**Welding saddle rated width 200 for pipe rated width 800, exhaust extraction**  
Complete delivery and installation

**9.2.170.** accord. To Design Description 9010  
**Welding saddle rated width 300 for pipe rated width 800, exhaust extraction**  
Complete delivery and installation

\*\*\* Design-Description 9011  
**Blind flange for pipe ends, exhaust extraction**

Blind flange and counter flange PN 6 made of stainless steel, with  
filled, sleeve 3/4", incl. screws and sealing, welding seam preparation  
and welding seam, material no. 1.4571.

**9.2.180.** accord. To Design Description 9011  
**Blind flange DN 700, exhaust extraction**  
Complete delivery and installation

**9.2.190.** **Flange revolving rated width 300, exhaust extraction**  
for the exhaust gas discharge in test stand, two flanges at 90° elbow  
for connection of pipe end of the false floor and connection pipe for  
"positioning" in 2 positions.

Consisting of:

- Each one flange, welded to related pipe piece, revolving by 360°,  
with arresting in any position.
- 2 Flange PN 6
- 1 Elbow DN 300, 90°
- 1 Elbow DN 300, 45°
- 1 Pipeline DN 300, L = 1000mm

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- Made of stainless steel, incl. screws and sealing for temperatures up to approx. 300 degrees, completely with welding preparation and welding.  
- Material no. 1.4571.

Complete delivery and installation.

**9.2.200.** **Support construction exhaust gas suction pipe, exhaust extraction**  
for support of pipe end in test stand in 2 positions, consisting of 1 pipe clamp rated width 300 (2-part), 2 stand pipes made of profile pipe and one base panel for installation of stand pipes, support height 300 - 400 mm (top edge floor up to center pipe axis), completely in stainless steel, material no. 1.4571.

Complete delivery and installation.

\*\*\* Design-Description 9012

**Reduction pieces, exhaust extraction**

Pipe reduction piece for welding into pipeline, incl. welding seam preparations and welding seams, concentric and/or eccentric shape, material no. 1.4571, wall thickness 3 mm.

**9.2.210.** accord. To Design Description 9012  
**Reduction piece rated width 800 - width 700, exhaust extraction**  
Complete delivery and installation

**9.2.220.** **Transition piece square to round, exhaust extraction**  
for the connection of ventilators to pipeline system for welding into pipeline, incl. welding seam preparations and welding seams, with flange PN 6 on rectangular side, concentric and/or eccentric shape, material no. 1.4571, wall thickness 3 mm.

Rated width:	800 mm
Dimension ventilator connection piece:	802 x 1002 mm
Length:	500 mm

Complete delivery and installation.

**9.2.230.** **Welding sleeve DN 25**  
150 mm long, with 1" plug, pipe 1", incl. locking connection piece, with all required welding preparations, pipe recesses and weldings,

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material no. 1.4571.

Complete delivery and installation.

**9.2.240. Measuring pipe 10 x 1.0 mm**

installation from measuring points to pressure consumers and/or to the pressure measuring units, 1.5 - 2 m. Material stainless steel. Incl. connection to welding sleeve and/or to measuring hose 10 x 1.0 mm with hose clamps, angle screw connections as well as other required form pieces. Incl. fastening material. In shape of L lines.

Complete delivery and installation.

\*\*\* Design-Description 9013

**Pipe sleeves for exhaust gas pipes**

for wall and ceiling passage, sleeve with 50 mm thick rock wool filling, construction length approx. 450 mm made of galvanized sheet steel, wall thickness 3 mm, with support flange for installation on unfinished concrete at ceiling passages.

**9.2.250.** accord. To Design Description 9013  
**Pipe sleeve for exhaust gas pipe DN 200**  
Complete delivery and installation.

**9.2.260.** accord. To Design Description 9013  
**Pipe sleeve for exhaust gas pipe DN 300**  
Complete delivery and installation.

**9.2.270.** accord. To Design Description 9013  
**Pipe sleeve for exhaust gas pipe DN 800**  
Complete delivery and installation.

\*\*\* Design-Description 9014

**Compensator**

Axial fabric compensator for expansion absorption of exhaust gas pipeline, 3-layered, in flange make, flange PN 6, flange made of stainless steel 1.4571, all media touched parts made of stainless steel 1.4571, expansion absorption ax. and lat. +/- 20 mm, operation temperature max. 300 degrees,

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installation length 150 mm, accomplishment with interior conduit.  
Incl. counter flanges, screws and sealing, potential compensation  
welding seam preparations and welding seams and all welding work.

**9.2.280.** accord. To Design Description 9014  
**Compensator 20/DN 200**  
Expansion absorption +/- 20 mm

Complete delivery and installation

**9.2.290.** accord. To Design Description 9014  
**Compensator 20/DN 300**  
Expansion absorption +/- 20 mm

Complete delivery and installation

**9.2.300.** accord. To Design Description 9014  
**Compensator 20/DN 700**  
Expansion absorption +/- 20 mm

Complete delivery and installation

**9.2.310.** accord. To Design Description 9014  
**Compensator 20/DN 800**  
Expansion absorption +/- 20 mm

Complete delivery and installation

**9.2.320.** accord. To Design Description 9014  
**Compensator 60/DN 800**  
however,  
Expansion absorption +/- 60 mm  
installation length: 300 mm

Complete delivery and installation

\*\*\* Design-Description 9015  
**Pipeline sound absorber**

for exhaust gas lines of engine internal combustion  
acc. to absorption principle.

Accomplishment:  
- Material completely in stainless steel 1.4571  
- Wall thickness 3 mm.

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- Cylindrical exterior coat with arched panes
- Gas-tight welded casing
- Perforated sheet made of stainless steel 1.4571
- Temperature resistant mineral wool with stainless steel needle fleece covering
- Connection pipe connection piece with flange PN 6
- Incl. counter flanges, screws and sealin, welding seam preparations, welding seams and all welding work.
- Condensate drain drillings and locking screw at lowest point (observe installation situation)

**9.2.330.** accord. To Design Description 9015  
**Pipeline sound absorber DN 300, L = 2265 mm**  
Dyno 1 -15  
Sound absorber in angle shape

Volume flow: 7000 B m<sup>3</sup>/h  
T max.: 170°C  
Pressure loss: < 300 Pa

Insertion insulation size as minimum requirement  
damping class: 25

Sound damping data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	9	23	38	45	40	20	15	15	dB

Connections: DN 300  
Construction length: 2265 mm  
Outside diameter: 730 mm  
Weight: approx. 290 kg

Installation type: horizontal  
Location of entrance  
connection piece: 25° towards top, against horizontal

Accessories: saddle legs

Complete delivery and installation.

**9.2.340.** accord. To Design Description 9015  
**Pipeline sound absorber DN 200, L = 1720 mm**  
CVS 1 - 5  
Sound absorber in angle shape

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Volume flow: 1944 B m<sup>3</sup>/h  
T max.: 135°C  
Pressure loss: < 135 Pa

Insertion insulation size as minimum requirement  
damping class: 25

Sound damping data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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insertion loss

De	7	20	40	45	48	36	21	21	dB
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Connections: DN 200  
Construction length: 1720 mm  
Outside diameter: 580 mm  
Weight: approx. 165 kg

Installation type: horizontal  
Location of entrance:  
Connection piece: 25° towards top, against horizontal

Accessories: saddle legs

Complete delivery and installation.

**9.2.350.** accord. To Design Description 9015  
**Pipeline sound absorber DN 300, L = 2350 mm**  
Dyno 21, chassis Dyno

Volume flow: 7000 B m<sup>3</sup>/h  
T max.: 170°C  
Pressure loss: < 300 Pa

Insertion insulation size as minimum requirement  
damping class: 25

Sound damping data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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insertion loss

De	9	23	38	45	40	20	15	15	dB
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Connections: DN 300  
Construction length: 2350 mm  
Outside diameter: 730 mm  
Weight: approx. 290 kg

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Installation type: horizontal  
Accessories: claws

Complete delivery and installation.

\*\*\* Design-Description 9016

**Crank sound absorber exhaust extraction**

for exhaust gas lines of engine internal combustion  
acc. to absorption principle.

Accomplishment:

- Material completely in stainless steel 1.4571
- Wall thickness 3 mm
- Gas-tight welded casing with bracing
- Perforated sheet made of stainless steel 1.4571
- Temperature resistant mineral wool with stainless steel needle fleece covering
- Connection for duct with flange
- With al required connection and fastening material

**9.2.360.**

accord. To Design Description 9016

**Crank sound absorber, exhaust extraction, left wing**

Width: 1300 mm  
Height: 2000 mm  
Length: 1700 mm

Volume flow: 35000 m<sup>3</sup>/h  
Max. temperature: 170°C  
Weight: approx. 1300 kg  
Crank: 3 each  
Pressure loss: approx. 200 Pa

Sound damping data

fm	63	125	250	500	1000	2000	4000	8000	Hz
insertion loss									
De	8	16	32	38	43	28	18	14	dB

Complete delivery and installation.

**9.2.370.**

accord. To Design Description 9016

**Crank sound absorber, exhaust extraction, right wing**

Width: 1300 mm  
Height: 2000 mm



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Length: 1700 mm  
Volume flow: 39000 m<sup>3</sup>/h  
Max. temperature: 170°C  
Weight: approx. 1300 kg  
Crank: 3 each  
Pressure loss: approx. 200 Pa

Sound damping data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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insertion loss

De	8	16	32	38	43	28	18	14	dB
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Complete delivery and installation.

**9.2.380. Sound absorber connection chamber**

for the connection to crank sound absorber,  
as duct piece with end bottom.

Dimensions:

- Width: 1300 mm
- Height: 2000 mm
- Length: 1500 mm

Accomplishment:

- Cleaning opening, opening size 300 x 300, with recess, connection piece, cover, screws and sealing, required welding preparations and welding seams
- Material completely in stainless steel 1.4571
- Wall thickness 3 mm
- Gas-tight welded casing
- 1 pipe connection piece DN 800/1258 mm, with flange PN 6
- 1 connection flange for sound damper
- Incl. counter flanges, screws and sealing
- Incl. welding seam preparations, welding seams and all welding work
- Location of connections see drawing
- Suitable for temperatures up to 170°C with all required connection, sealing and fastening material

Complete delivery and installation.

**9.2.390. Sound absorber connection chamber, chassis dyno**

for the connection to crank sound absorber,  
as duct piece with end bottom and one additional connection piece for chassis dyno.

Dimensions:

- Width: 1300 mm

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- Height: 2000 mm
- Length: 1500 mm

**Accomplishment:**

- Cleaning opening, opening size 300 x 300, with recess, connection piece, cover, screws and sealing, required welding preparations and welding seams
- Material completely in stainless steel 1.4571
- Wall thickness 3 mm
- Gas-tight welded casing
- 1 pipe connection piece DN 300 with flange PN 6
- 1 pipe connection piece DN 800/1258 mm, with flange PN 6
- 1 connection flange for sound damper
- Incl. counter flanges, screws and sealing
- Incl. welding seam preparations, welding seams and all welding work
- Location of connections see drawing
- Suitable for temperatures up to 170°C  
with all required connection, sealing and fastening material

Complete delivery and installation.

\*\*\* Design-Description 9017

### **Crank sound absorber exhaust analysis**

for exhaust gas lines of exhaust gas measuring stands

Silencer consisting of baffles and housing with connection frame made of air channel profile. The insulating materials must also be protected by stainless steel 1.4571 perforated sheetmetal and PE film underneath. The materials used comply with construction materials class A acc. to DIN EN 13238 certified by building authority approval, test certificate or test symbol.

Pressure loss: max. 100 Pa  
Air rate in baffle gap: max. 20 m/s

Minimum distance to integrated units:  
- inflow side: 1 x maximum baffle width  
- outflow side: 1.5 x maximum baffle width

### **Baffle:**

- Profiled, stainless steel 1.4571 frame
- Material:
  - non-rotting
  - moisture repellent
  - abrasion-resistant up to 20 m/s
- stainless steel 1.4571, perforated sheetmetal and PE film

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underneath as abrasion protection for insulation material

**Housing:**

- stainless steel 1.4571, of min.1.25 thick, with additional stiffenings

Incl. bearing edge, suitable for hanging up and/or splicing the sound absorbers, described below.

Consisting of stainless steel 1.4571 structural steel construction

Distance between:

- upper edge sound absorber and ceiling: 1 - 1.5 meters
- lower edge sound absorber and floor: 1 - 1.5 meters
- sound absorber up to wall: 0.1 - 0.5 meters

**9.2.400.** accord. To Design Description 9017

**Crank sound absorber, exhaust analysis, left wing**

Width: 760 mm  
Height: 700 mm  
Length: 2000 mm

Volume flow: 3000 m<sup>3</sup>/h  
Max. temperature: 40°C  
Speed air: 7.4 m/s  
Weight: 144 kg  
Crank: 2 each  
Pressure loss: 50 Pa

Sound damping data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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insertion loss

De	4	13	27	25	21	17	12	9	dB
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Complete delivery and installation.

**9.2.410.** accord. To Design Description 9017

**Crank sound absorber, exhaust analysis, right wing**

Width: 570 mm  
Height: 300 mm  
Length: 1750 mm

Volume flow: 1000 m<sup>3</sup>/h  
Max. temperature: 40°C  
Speed air: 5.4 m/s  
Weight: 84 kg

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Crank: 2 each  
Pressure loss: 30 Pa

Sound damping data

fm	63	125	250	500	1000	2000	4000	8000	Hz
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insertion loss

De	7	18	39	42	46	34	21	17	dB
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Complete delivery and installation.

\*\*\* Design-Description 9018

### **Fixed and sliding bearing construction made of sectional steel**

of various types as suspension and/or fastening and elevation constructions made of sectional steel for sliding bearing and fixed point bearing, for static, thermally and wind load fixed point bearing, thermally and acoustically > 35 dB separated.

Sliding bearing, force direction as longitudinal bearing with sliding bearing shell and sliding bolts, incl. Teflon sliding element for the guide bearing.

Completely processed, welded or screwed, with structural proof for the entire exhaust gas lines and a corrosion protection by hot dip galvanization, provision, delivery and installation.

Incl. required screws and fastening material as well as dowels and drilling of fastening holes. It shall be observed that no holding device shall be shot, only use of spreading and/or gluing dowels.

**9.2.420.**

accord. To Design Description 9018

### **Fixed point bearing, T-piece rated width 800 mm**

for the pipeline support at T-piece in false floor, support height 150 - 400 mm

Pipeline diameter: rated width 800

Forces to be induced

Rx max.: ± 2100 dN

Ry max.: 2900 dN

Rz max.: 5250 dN

Complete delivery and installation

**9.2.430.**

accord. To Design Description 9018

### **Fixed point bearing pipeline**

for a support height and/or wall distance of 100 up to 1500 mm for pipelines in rated width 200 up to 800 mm.

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Forces to be induced acc. to pipeline weight (with insulation) and fastening distance.

Complete delivery and installation

**9.2.440.**

accord. To Design Description 9018

**Fixed point bearing components**

for the crank sound absorbers with connection chambers,  
pipeline sound absorbers in false floor,  
pipeline sound absorbers below the ceiling in the area of soak area,  
escaping air ventilators exhaust analysis, however, with  
vibration dampers.

Support height, wall and/or ceiling distance from 100 up to 800 mm,  
connection point of pipeline sound absorber are the saddle legs and/or  
claws.

Forces to be induced acc. to related component weight and fastening  
distance.

Complete delivery and installation

**9.2.450.**

accord. To Design Description 9018

**Sliding bearing vertical pipeline**

at wall in the area of loading path below the ceiling (+2.3 m)  
pipelines in rated width 800 mm.

Forces to be induced

Rx max.:  $\pm 3030$  dN

Ry max.: - 2900 dN

Rz max.: 0 dN

Complete delivery and installation

**9.2.460.**

accord. To Design Description 9018

**Sliding bearing pipeline**

for a support height and/or wall distance from 100 up to 1500 mm for  
pipelines in rated width 200 up to 800 mm.

Forces to be induced acc. to pipeline weight and fastening distance.

Complete delivery and installation

**9.2.470.**

**Pendulum bearing made of sectional steel**

as support and/or stand construction and for discharge of pipeline  
thermally length expansion, for tare weight, and wind load.

Consisting of profile steel frame welded and bracketed, for pipeline  
fastening above roof in the area to axis 1 in front of entrance into  
center.

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Base bearing with fixed point constructions on roof level.  
Turn points in base and head point as link with bolt and sleeve,  
securing of bolt with securing ring cross to bolt axis, with fastening to  
pipeline on the roof. Support height from center pipeline up to top  
edge roof connection point = 4300 mm.  
Completely processed, welded or screwed, with structural calculation,  
with corrosion protection by hot dip galvanization, provision, delivery  
and installation. Incl. required screws and fastening material as well as  
dowels and drilling of fastening holes. It shall be observed that no  
holding device  
shall be shot, only use of spreading and/or gluing dowels.

### Head point

2 Bearing points, distance = 1.0 m

Forces to be induced total

Rx max.:	± 900 dN
Ry max.:	0 dN
Rz max.:	+ 2950 dN

### Points in base

2 Bearing points, distance = 1.5 m

Forces to be induced per point

Rx max.:	± 900 dN
Ry max.:	0 dN
Rz max.:	+ 3800 dN
Rz min.:	- 620 dN

Complete delivery and installation

**9.2.471. Reinforced concrete foundation, plendum bearing**  
on the top of the roof. Complicated transport of material has to  
be taken into account.

### Dimensions:

Length:	2000 mm
Width:	400 mm
Hight:	420 mm
top of slab:	+ 6.63 m

Minimum compressed strength class :  
C30/37 acc. DIN EN 206-1

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**9.2.472. Formwork, plendum bearing**  
out of plane wood or steel formwork

**9.2.473. Concrete reinforcement, plendum bearing**  
as round steel BST 500 S (IV S) in all dimensions.

**9.2.480. Bimetal dial thermometer**  
Casing and ring made of stainless steel, black, indicator arrangement centric, dial white, lettering and division black, tube made of 1.4571, back centrally outgoing, incl. dip sleeve with welding conduit, suitable for smoke gas, error +/- 1 % of temperature range. The installation length of dial thermometer and welding conduit shall be selected in such a manner that a minimum immersion depth of 100 mm will be achieved. Tube length 250 mm, temperature range 0-250 degrees C, welding material and welding.

Complete delivery and installation.

**9.2.490. Manometer**  
in chemical type, measuring material touched parts in 1.4571, casing diameter 100 mm, G 1/2", casing and ring made of steel, completely with connection pipe piece 1/2", welded in exhaust gas pipeline. A manometer shut-off cock 1/2" N 5008.3, a measuring unit holder with intermediate piece and a pressure impulse reducer D 7630.3, class 1.0, t max. 350 degrees C, display range - 100 mbar up to 600 mbar.

Complete delivery and installation.

**9.2.500. Temperature sensor, thermostats**  
Installation of Government furnished pressure consumers, pressostats, etc., with delivery of sealing, pipe recesses and fastening material.

Complete delivery and installation.

\*\*\* Design-Description 9019  
**Pipeline exhaust analysis**

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as longitudinal folded pipe, completely made of stainless steel, material no. 1.4571, connection with double lip sealing, wall thickness of 0.8 mm, installation always with seam towards top. The pipe without form parts is included in this item, however, with all conical or eccentric reduction pieces, collars, pipe clamps (with rubber insert), nipples and end bottoms. Incl. sound insulated, special stable fastening material. Suspensions shall be always secured with self-securing nuts or counter nuts. Vibration damping elements shall always be inserted between fastening and pipeline in order to prevent any sound transmissions.

**9.2.510.** accord. To Design Description 9019  
**Pipeline DN 100, exhaust analysis**  
Complete delivery and installation

**9.2.520.** accord. To Design Description 9019  
**Pipeline DN 125, exhaust analysis**  
Complete delivery and installation

**9.2.530.** accord. To Design Description 9019  
**Pipeline DN 160, exhaust analysis**  
Complete delivery and installation

**9.2.540.** accord. To Design Description 9019  
**Pipeline DN 200, exhaust analysis**  
Complete delivery and installation

**9.2.550.** accord. To Design Description 9019  
**Pipeline DN 250, exhaust analysis**  
Complete delivery and installation

**9.2.560.** accord. To Design Description 9019  
**Pipeline DN 400, exhaust analysis**  
Complete delivery and installation

\*\*\* Design-Description 9020  
**Stainless steel pipe bows, exhaust analysis**

made of stainless steel, material no. 1.4571, wall thickness of 0.8 mm, in segment construction,  $r = 1.5 \times D$ , plug-in connection with factory firmly mounted double lip sealing made of age resistant EPDM rubber, temperature resistant from -30 up to +100°C.



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**9.2.570.** accord. To Design Description 9020  
**Elbow DN 100, 45 - 90°, exhaust analysis**  
Complete delivery and installation

**9.2.580.** accord. To Design Description 9020  
**Elbow DN 125, 45 - 90°, exhaust analysis**  
Complete delivery and installation

**9.2.590.** accord. To Design Description 9020  
**Elbow DN 160, 45 - 90°, exhaust analysis**  
Complete delivery and installation

**9.2.600.** accord. To Design Description 9020  
**Elbow DN 200, 45 - 90°, exhaust analysis**  
Complete delivery and installation

**9.2.610.** accord. To Design Description 9020  
**Elbow DN 250, 45 - 90°, exhaust analysis**  
Complete delivery and installation

**9.2.620.** accord. To Design Description 9020  
**Elbow DN 400, 45 - 90°, exhaust analysis**  
Complete delivery and installation

\*\*\* Design-Description 9021  
**T-pieces, exhaust analysis**

with exit below 90 degrees made of stainless steel, material no. 1.4571, wall thickness of 0.8 mm, blunt welding saddles, plug-in ends with factory firmly mounted double lip sealing made of age resistant EPDM rubber, temperature resistant from -30 up to +100°C.

**9.2.630.** accord. To Design Description 9022  
**T-piece NW 100 x 100 x 100, exhaust analysis**  
Complete delivery and installation

**9.2.640.** accord. To Design Description 9022  
**T-piece NW 100 x 125 x 100, exhaust analysis**  
Complete delivery and installation

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**9.2.650.** accord. To Design Description 9022  
**T-piece NW 250 x 100 x 250, exhaust analysis**  
Complete delivery and installation

**9.2.660.** accord. To Design Description 9022  
**T-piece NW 250 x 250 x 250, exhaust analysis**  
Complete delivery and installation

**9.2.670.** accord. To Design Description 9022  
**T-piece NW 400 x 200 x 400, exhaust analysis**  
Complete delivery and installation

**9.2.680.** accord. To Design Description 9022  
**T-piece NW 400 x 400 x 400, exhaust analysis**  
Complete delivery and installation

\*\*\* Design-Description 9022  
**Weatherproof grille, exhaust analysis**

External-air intake or exhaust air grille with fixed rain-pelling blades and wire mesh.  
Frame and blades made of stainless steel with wire mesh made of stainless steel.

Mesh size: 40 mm  
Air rate in open cross section, max.: 3.0 m/s

The grill can be installed next to each other.  
The weatherproof grill are combined to a strip.

Accessories:  
- mounting frame made of primed angular 30/30/3.

**9.2.690.** accord. To Design Description 9022  
**Weatherproof grille, exhaust analysis, Wight x Height: 800 x 840 mm**  
Complete delivery and installation

**9.2.700.** accord. To Design Description 9022  
**Weatherproof grille, exhaust analysis, Wight x Height: 400 x 675 mm**  
Complete delivery and installation

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\*\*\* Design-Description 9023

### Transition pieces, exhaust analysis

for the connection of components to the pipeline system,  
for insertion into pipeline, incl. welding seam preparations and  
welding seams, with flange on rectangular side, concentric shape,  
material no. 1.4571, wall thickness 1.0 mm.

**9.2.710.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 760 x 700 mm**  
for the connection of sound damper to the pipeline system

rated width pipe: 400 mm  
dimension sound absorber: 760 x 700 mm  
length: 500 mm

Complete delivery and installation

**9.2.720.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 570 x 300 mm**  
for the connection of sound damper to the pipeline system

rated width pipe: 250 mm  
dimension sound absorber: 570 x 300 mm  
length: 500 mm

Complete delivery and installation

**9.2.730.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 252 x 252 mm**  
for the connection of fire dampers to the pipeline system

rated width pipe: 250 mm  
dimension fire damper: 252 x 252 mm  
length: 500 mm

Complete delivery and installation

**9.2.740.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 400 x 400 mm**  
for the connection of fire dampers to the pipeline system

rated width pipe: 400 mm  
dimension fire damper: 400 x 400 mm

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length: 500 mm

Complete delivery and installation

**9.2.750.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 201 x 201 mm**  
for the connection of louver flaps to the pipeline system

rated width pipe: 250 mm  
dimension louver flaps : 201 x 201 mm  
length: 500 mm

Complete delivery and installation

**9.2.760.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 400 x 400 mm**  
for the connection of louver flaps to the pipeline system

rated width pipe: 400 mm  
dimension sound absorber: 400 x 400 mm  
length: 500 mm

Complete delivery and installation

**9.2.770.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 800 x 840 mm**  
for the connection of weatherproof grill to the pipeline system  
as duct pipe with end bottom.

rated width pipe: 400 mm  
dimension sound absorber: 800 x 840 mm  
length: 300 mm

Complete delivery and installation

**9.2.780.** accord. To Design Description 9023  
**Transition piece square to round, exhaust analysis, 400 x 675 mm**  
for the connection of weatherproof grill to the pipeline system,  
as duct pipe with end bottom.

rated width pipe: 250 mm  
dimension sound absorber: 400 x 675 mm  
length: 300 mm

Complete delivery and installation

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**9.2.790.** accord. To Design Description 9023

**Extraction false floor**  
for the extraction false floor

Consisting of:

- 1 Welding saddle rated 80 for pipe width 700, length 200 mm
- made of stainless steel (Material no. 1.4571)
- incl. screws and sealing for temperatures up to approx. 170 degrees
- completely with welding preparation and welding.
- 1 Self opening and closing pressure-operated shutter, adjustable for 300 m<sup>3</sup>/h to pressure 1000 Pa.

Complete delivery and installation

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### 9.3. Insulation of exhaust

\*\*\* Design-Description 9024

#### Insulation of exhaust

as thermal insulation made of temperature resistant mineral wool on wire fabric, insulation thickness 100 mm, coating of insulation made of galvanized sheet steel 1.0 mm, with all required connection and fastening material, support constructions, metal ridges as well as thermally and acoustically decoupled pipe holding devices. The material compatibility (pipeline made of stainless steel, coating made of galvanized sheet steel) of entire insulation shall be guaranteed.

Media temperature: up to 200°C

Surrounding (air) temperature/Humidity:

max. + 60 °C / 20 - 100 %

min. + 10 °C / 20 - 100 %

Incl. connection of insulation to

- welding sleeve
- measuring pipe
- pipe sleeve
- fixed and sliding bearing construction

**9.3.10.** accord. To Design Description 9024  
**Insulation, Pipe rated width 200, exhaust extraction**  
Complete delivery and installation

**9.3.20.** accord. To Design Description 9024  
**Insulation, Pipe rated width 300, exhaust extraction**  
Complete delivery and installation

**9.3.30.** accord. To Design Description 9024  
**Insulation, Pipe rated width 700, exhaust extraction**  
Complete delivery and installation

**9.3.40.** accord. To Design Description 9024  
**Insulation, Pipe rated width 800, exhaust extraction**  
Complete delivery and installation

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- 9.3.50.** accord. To Design Description 9024  
**Insulation, Elbow DN 200, 90°, exhaust extraction**  
Complete delivery and installation
- 9.3.60.** accord. To Design Description 9024  
**Insulation, Elbow DN 300, 90°, exhaust extraction**  
Complete delivery and installation
- 9.3.70.** accord. To Design Description 9024  
**Insulation, Elbow DN 800, 90°, exhaust extraction**  
Complete delivery and installation
- 9.3.80.** accord. To Design Description 9024  
**Insulation, Elbow DN 200, 30 - 45°, exhaust extraction**  
Complete delivery and installation
- 9.3.90.** accord. To Design Description 9024  
**Insulation, Elbow DN 300, 30 - 45°, exhaust extraction**  
Complete delivery and installation
- 9.3.100.** accord. To Design Description 9024  
**Insulation, Elbow DN 800, 30 - 45°, exhaust extraction**  
Complete delivery and installation
- 9.3.110.** accord. To Design Description 9024  
**Insulation, T-piece rated width 800 x 800 x 800, exhaust extraction**  
Complete delivery and installation
- 9.3.120.** accord. To Design Description 9024  
**Insulation, Transition piece, L= 1750 mm**
- rated width ventilator flange: 1258 mm  
dimension sound  
absorber chamber flange: 1258 mm  
length: 1750 mm  
- 1 connection flange to the sound absorber chamber  
- 1 connection flange to the ventilator  
- 2 elbow
- Complete delivery and installation

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- 9.3.130.** accord. To Design Description 9024  
**Insulation, Transition pipe, L= 500 mm**  
rated width ventilator flange: 1258 mm  
dimension sound  
absorber chamber flange: 1258 mm  
length: 500 mm
- 1 connection flange to the sound absorber chamber
  - 1 connection flange to the ventilator
  - 1 pipeline
- Complete delivery and installation
- 9.3.140.** accord. To Design Description 9024  
**Insulation, Welding saddle rated width 200 for pipe rated width 700, exhaust extraction**  
Complete delivery and installation
- 9.3.150.** accord. To Design Description 9024  
**Insulation, Welding saddle rated width 300 for pipe rated width 700, exhaust extraction**  
Complete delivery and installation
- 9.3.160.** accord. To Design Description 9024  
**Insulation, Welding saddle rated width 200 for pipe rated width 800, exhaust extraction**  
Complete delivery and installation
- 9.3.170.** accord. To Design Description 9024  
**Insulation, Welding saddle rated width 300 for pipe rated width 800, exhaust extraction**  
Complete delivery and installation
- 9.3.180.** accord. To Design Description 9024  
**Insulation, Blind flange DN 700, exhaust extraction**  
Complete delivery and installation
- 9.3.190.** accord. To Design Description 9024  
**Insulation, Reduction piece rated width 800 - width 700, exhaust extraction**  
Complete delivery and installation
- 9.3.200.** accord. To Design Description 9024  
**Insulation, Transition piece square to round, exhaust extraction**  
for the connection of ventilators to pipeline system,
- Rated width: 800 mm



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Dimension ventilator  
connection piece: 802 x 1002 mm  
Length: 500 mm

Complete delivery and installation.

**9.3.210.** accord. To Design Description 9024  
**Insulation, Compensator 20/DN 200**  
Expansion absorption +/- 20 mm  
installation length: 150 mm

Complete delivery and installation

**9.3.220.** accord. To Design Description 9024  
**Insulation, Compensator 20/DN 300**  
Expansion absorption +/- 20 mm  
installation length: 150 mm

Complete delivery and installation

**9.3.230.** accord. To Design Description 9024  
**Insulation, Compensator 20/DN 700**  
Expansion absorption +/- 20 mm  
installation length: 150 mm

Complete delivery and installation

**9.3.240.** accord. To Design Description 9024  
**Insulation, Compensator 20/DN 800**  
Expansion absorption +/- 20 mm  
installation length: 150 mm

Complete delivery and installation

**9.3.250.** accord. To Design Description 9024  
**Insulation, Compensator 60/DN 800**  
expansion absorption +/- 60 mm  
installation length: 300 mm

Complete delivery and installation

**9.3.260.** accord. To Design Description 9024  
**Insulation, Pipeline sound absorber DN 300, L = 2265 mm**  
Dyno 1 -15

connections: DN 300

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construction length: 2265 mm  
diameter: 730 mm

Complete delivery and installation.

**9.3.270.** accord. To Design Description 9024  
**Insulation, Pipeline sound absorber DN 200, L = 1720 mm**  
CVS 1 - 5

connections: DN 200  
construction length: 1720 mm  
diameter: 580 mm

Complete delivery and installation.

**9.3.280.** accord. To Design Description 9024  
**Insulation, Pipeline sound absorber DN 300, L = 2350 mm**  
Dyno 21, chassis Dyno

connections: DN 300  
construction length: 2350 mm  
diameter: 730 mm

Complete delivery and installation.

**9.3.290.** accord. To Design Description 9024  
**Insulation, Crank sound absorber, exhaust extraction, left and right wing**  
width: 1300 mm  
height: 2000 mm  
length: 1700 mm

Complete delivery and installation.

**9.3.300.** accord. To Design Description 9024  
**Insulation, Sound absorber connection chamber**  
for the connection to crank sound absorber,  
as duct piece with end bottom.

Dimensions:  
width: 1300 mm  
height: 2000 mm  
length: 1500 mm

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1 pipe connection: DN 800

Complete delivery and installation.

**9.3.310.** accord. To Design Description 9024  
**Insulation, Sound absorber connection chamber, chassis dyno**  
for the connection to crank sound absorber,  
as duct piece with end bottom

Dimensions:

width:	1300 mm
height:	2000 mm
length:	1500 mm
1 pipe connection:	DN 300
1 pipe connection:	DN 800

Complete delivery and installation.

\*\*\* Design-Description 9025  
**Insulation of exhaust gas line outside**

Installation on roof,  
as thermal insulation made of temperature resistant mineral wool  
on wire fabric, insulation thickness 100 mm, in weather resistant make  
and coating made of stainless steel 1.0 mm, material no. 1.4571 with  
all required connection and fastening material, support constructions,  
metal ridges as well as thermally and acoustically decoupled pipe  
holding devices. The material compatibility of entire insulation shall be  
guaranteed.

Media temperature: up to 200°C

Surrounding (air) temperature/Humidity:  
max. + 60 °C / 20 - 100 %  
min. - 8 °C / 10 - 100 %

Incl. connection of insulation to  
- welding sleeve  
- measuring pipe  
- pipe sleeve  
- fixed and sliding bearing construction

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**9.3.320.** accord. To Design Description 9025  
**Insulation, Pipe rated width 800, exhaust extraction, outside**  
Complete delivery and installation

**9.3.330.** accord. To Design Description 9025  
**Insulation, Elbow DN 800, 90°, exhaust extraction, outside**  
Complete delivery and installation

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**9.4. Signboards and direction arrows**

**9.4.10. Signboards 200 x 200 mm**

made of colored formica acc. to direction of Contracting Agency, incl. holding angles, signs supports and/or hooks and fastening material. Lettering acc. to approved sign list.

Complete delivery and installation.

**9.4.20. Signboards 120 x 60 mm**

otherwise same as above

Complete delivery and installation.

**9.4.30. Signboards 74 x 52 mm**

otherwise same as above

Complete delivery and installation.

**9.4.40. Direction arrows**

for gluing to the exhaust gas line, in permanent make. Color, lettering and accomplishment acc. to directions of the Contracting Agency.

Complete delivery and installation

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### 9.5. Special rating

#### 9.5.10. Revision Documentation

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass.

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

#### 9.5.20. Starting UP and Test Operation

Test procedures and measuring methods for handing over installed ventilation and air conditionig systems acc. to DIN E 12599.

After finishing installation, the systems have to be started up.

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The systems and the components must be adjusted, so that the functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the testl operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

### **9.5.30. Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

### **9.5.40. Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate

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files.

The customer has to supply these inspections by sending his commissioning personal so much as it is necessary.



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### General remark

The whole planning of the technical construction and installation was made of the basis that there are no explosion risks, caused by the Fuels and Materials in the building. There is no need for electrical classified equipment, because storage, handling and dispensing of Diesel don't cause EX-Zones, that is classified location.

This is also corresponding to the GM Standards, the NFPA (US National Fire Protection Agency) Codes and European ATEX Rules. Diesel Fuel is classified as Class II liquid and area are no more classified as hazardous.

According to the special utilities layouts, the Building Automation Control System (BACS) and the special installed devices (sensor, ventilation, alarm system, monitoring system, relief venting walls and explosion-proof-doors) there are no areas with explosion residual risk.

### **10. electrical supply**

Ref. Normative for the electrical supply:

CEI EN 60079-10 (31-30) Classificazione dei luoghi pericolosi

CEI EN 60079-14 (31-33) Impianti elettrici nei luoghi con pericolo di esplosione per la presenza di gas

CEI EN 60079-17 (31-34) Verifica e manutenzione degli impianti elettrici nei luoghi con pericolo di esplosione per la presenza di gas

CEI 31-35 Guida all'applicazione della norma CEI EN 60070-10 (31-30) Classificazione dei luoghi pericolosi

CEI 31-35; V1 Guida all'applicazione della norma CEI EN 60070-10 (31-30)

CEI 31-35; V3 Guida all'applicazione della norma CEI EN 60070-10 (31-30)

CEI 31-35/A Guida all'applicazione della norma CEI EN 60070-10 (31-30) - Esempi di applicazione

CEI 31-35/A;V1 Guida all'applicazione della norma CEI EN 60070-10 (31-30) Esempi di applicazione

CEI EN 50281-1-2 (31-36) - Costruzioni elettriche protette da custodie - Scelta, installazione e manutenzione

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CEI EN 50073 (31-42) - guida per la scelta, installazione, uso e manutenzione delle apparecchiature per la rilevazione e misura dei gas combustibili o di ossigeno

CEI CLC/TR 50404 (31-55) Elettrostatica - Guida e raccomandazioni per evitare i pericoli dovuti all'elettricità statica

CEI 64-8 Impianti elettrici utilizzatori a tensione nominale non superiore a 1000 V in corrente alternata e 1500 V in corrente continua

### 10.1. mains-calculation

#### 10.1.10. dimensioning of compensation mains-calculation (mains-analysis)

Because of the consumption of reactive-power in relation to several drives and different conditions of the whole plant, it will be necessary to measure all mains conditions over a duration of 2-4 weeks.

It must be done by a method to determine the dimension of capacitors and inductors (di/dt).

The determination of the content of the harmonics must be realized at site. The results of the measuring should be given by a printed document (5-times).

Following quantities should be collect:

- active power,
- reactive power
- load current (broken down into the harmonics)

especially the following harmonics:

- 3. harmonic = 150 Hz,
- 5. harmonic = 250 Hz,
- 7. harmonic = 350 Hz,
- 11. harmonic = 550 Hz,
- 13. harmonic = 650 Hz,

The purpose of the measuring is to customize the mounted compensation concerning harmonics and it's content. (3., 5., 7., 11., 13....).

Further on it should be done a calculation for all relevant filter-circuits in relation to the considered frequencies of the harmonics.

The determination of the content of the harmonics must be documented 5-times.

After finishing the measuring and documentation at all, a possible solution-suggestion must be given by the supplier if it's

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necessary to guarantee full function.  
The solution-suggestion and its costs has to be considered by the supplier.  
All necessary data has to be managed by the supplier.

**10.1.20. short-cut current calculation**

4 weeks before commissioning, the supplier has to show his short-circuit current calculation for different cases of load (max. 5).  
(documentation is required) IEC 60909

Further on the mains conditions has to be determined and the right dimension of the whole plant (e.g. cabinets, cable-sizes etc. ...) has to be confirmed.

The short-circuit current calculation, the conditions of the mains and confirmation of right dimensioning of the plant as well has to be documented (5-times)

(like written before)

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### 10.2. Distributions LVMD

Low-voltage switchgear

ready for connection, sheet-steel case, cabinet form, free-standing version as

"Type-approved switchgear combination" TSK as per  
EN 60 439 - 1. Suitable for indoor areas  
Guideline CEI 64-8,

Cabinet system of individual add-on sections of the same type, welded in a torsionally rigid manner from electrolytically galvanized 2-mm sheet-steel with 25-mm inner hole matrix texture powder-coated in RAL 7032 (pebble-gray), open at the side and add-on, detachable outer facings of electrolytically galvanized 1.5-mm sheet-steel, texture powder-coated in RAL 7032 (pebble-gray).

All construction parts for interior work galvanized and perforated in 25 mm .

Equipment configuration in function assemblies, that can be separated vertically and/or horizontally into individual areas. powder- coated in RAL 7016 (anthracite gray) with detachable, side, front and rear panels. The base must be suitable for direct transportation of the cabinet field with suitable aids. Cabinets accessible from the front through a surface-mounted door locked by rod closure. Actuation by pivoted lever with semi-cylinder safety lock.

The cabinets are provided with an identification strip over the whole width of the installation. The mechanical connection at the separation points is carried out outside the cabinet fields with integrated centering elements for the alignment of the individual fields.

For the avoidance of stray currents via conductive structural parts in the building, the bus bar system is to be arranged as an electromagnetically compatible TN-S system as specified in IEC 60364-5-54.

The conductors of the bus bar system are to be marked with L1 L2 L3 N PE.

The emc-shielding requirements must be fulfilled inside and outside of the cabinet.

The supplier has to take care for to make the grade of emc considering the construction cabinet at all.

Measuring and testing-technique must be guided separately in different wiring systems

The emc-shielding requirements must be fulfilled

The N-conductor of the switchgear is to be arranged with the

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same current load capacity as the outdoor conductors.

The N-conductor is to be laid in the area of the outdoor conductors and over its whole length is to be isolated from all conductive parts. In the connection area of each field, an N-connection strip is to be provided for the cables and is to be tapped in every field from the N-strip in the bus bar system. When laid, it is to be isolated from all conductive parts.

The installation of the lightning conductor, Category B/C, including any preliminary fuse, has to be executed in an approved arrangement in accordance with 534. Proof is to be given that the protective level has been observed.

System of protection: IP 54 as per EN 60 529  
Protective measure: with grounded conductor  
Protection Class I)  
Design insulation voltage: AC 1000V  
Overvoltage category: III  
Contamination level: 3  
Design operating voltage: AC 400V  
Frequency: 50Hz  
Control voltage: DC 24V  
Bus bar design current: 2500A  
Max. prospective short-circuit AC at the installation point of the switchgear  $I_{k\text{ eff}}$ :  
77kA or 60kA  
Bus bars (number) Conductor identification:  
1 L2 L3 N PE  
Max. permissible transport units:  
width 850mm..height 2270 mm depth 500 mm

Switchgear installation described above, completely assembled and wired ready for connection, part-tested at the factory as per EN 60 439 Part 1. The test protocol is an integral part of the documentation.

For the preparation of the installation site and before the start of manufacture of the switchgear installation, dimensioned drawings for the consolidation of the ground must be provided.

For the switchgear > 250 A listed below, a connection system is to be provided with a separate terminal point for every conductor of the outgoing and incoming cables. Equipment configuration of the switchgear installations with fields and equipment described below:

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The supplier has to consider that all cable connections of the cabinet (in,-outgoing cables) must be included in the offered price-calculation

Included ratings:

Isolation measuring (incl. documentation)

Fixing the ingoing and outgoing cables

Connecting all cables to the terminal blocks (incl. accessories)

Labelling all cables

The colour of the cabinets must be clarified with the client.

The supplier has to take care about the way of delivering the cabinets into the building and it's installation.

The supplier must be certified by the italian authority

active parts must be covered by plexiglass.

Internal wiring is required in cableducts (max. 60% filling)

The colour of internal wiring is according. to the additional technical contract conditions.

Crossing connections between the cabinetfields must be guided via terminal blocks.

the space reserve is required with 20%

the reserve of mounted devices in the cabinet(s) is required with 20%.

The supplier has to take care about a sufficient air-conditioning of the cabinets.

Each cabinet must be outfitted with illumination controlled by doorswitches.

Lowvoltage main distribution designed like specified before, with the following devices and components.

All components and devices are placed, fixed and already connected with all it's necessary accessories. Delivering on site, mounting and ready connected to run.

total dimension:

LVMD 1

h = 4250 mm including base

w = 850 mm

d = 500 mm

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LVMD 2

h = 4250 mm including base

w = 850 mm

d = 500 mm

LVMD 3

h = 7150 mm including base

w = 850 mm

d = 500 mm

**10.2.10.**

**feeder field**

W= : 850 mm,

H= 2270mm

D= 500mm

incl. bus bar system 2500A  
delivery and assembly

delivery and assembly

**10.2.20.**

**cable connection sections**

W= : 850 mm,

H= 2270mm

D= 500mm

Outgoing cables upward,  
incl. bus bar system 2500A,  
vertical PE-bars,

delivery and assembly

**10.2.30.**

**outgoing sections**

W= : 850 mm,

H= 2270mm

D= 500mm

incl. bus bar system 2500A,  
Distribution bar system 2000A, 4-pole  
for outgoing cables with power switch  
plug technology, plugged incoming and  
outgoing sides,  
outgoing power cables can be replaced  
or retrofitted

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without interruption of operation, protected-type  
bus-bar systems.

delivery and assembly

**10.2.40. MCB mini circuit breaker B6A 2-pole**  
with aux. contacts

Delivery, assembly, wiring on terminal-blocks

**10.2.50. 4-pol. switch disconnecter 2500 A :**  
feeder field

Feeder from above, by bus bar system  
incl. bus bar system 2500A

main switch / switch disconnecter  
2500A 4--pole  
Design operating voltage  $U_e = AC\ 690V$ ,  
Design current  $I_n = 2500A$ ,  
Design insulation voltage  $U_i = 1000V$ ,  
Design short-circuit making capacity  
 $I_{cm} = 135kA$ .  
As per IEC 60947-2, IEC 60664-1.  
with 4 auxiliary switches OF (W),  
undervoltage release  
door seal frame.  
all aux. contacts must be guided  
to terminal-blocks.

**10.2.60. Surge protector /class B**  
feeder field

Surge protector -  
4-pole. Type 1  $I_{sn} = 100kA$

consisting of:  
1 only breaker switch 4-pole, 160A,  
690V NH00,  
4x low-voltage power fuse NH00, 160A gl/gG,

1 only surge protector 4-pole Cl.=B/C  
 $I_{mp} = 100kA$  TN-S with aux.contacts for  
status message.

Delivery, assembly, wiring on terminal-blocks



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**10.2.70. Multifunction measuring unit**  
feeder field

panel mounted in frontdoor (fixed well in sight)  
Multifunction measuring unit  
with illuminated LCD display, display of current,  
voltage, active, reactive and apparent power  
per phase and total.  
Frequency, power factor, working hours,  
secondary transformer connection../1A o. ../5A.  
Dimensions: HxWxD: 96x96x80mm,  
Optional: 3 modules can be retrofitted.  
incl. Module 6 (Profibus),  
instrument transformer and motor protection switch

Delivery, assembly, wiring on terminal-blocks

**10.2.80. 24VDC-power supply**  
Feeder field

24VDC-power supply  
type 10A  
(for supplying all undervoltage releases in the scope  
Lowvoltage main distribution)

Input Single and two-phase AC

rated voltage 24VDC

(IEC 898)

Degree of protection (EN 60529) IP20  
Total tolerance  $\pm 3\%$   
Recommended motor protection device (IEC 898)  
in mains supply line

Delivery, assembly, wiring on terminal-blocks

**10.2.90. Motor-protection switch**  
feeder field

Motor-protection switch

(as transformer-protection)

for prefusing and protecting the 24VDC power supply.  
located in the feeder-field.

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(with all necessary accessories like aux. contacts.  
terminals etc..)

Delivery, assembly, wiring on terminal-blocks

**10.2.100.** **circuit breaker (RCC) 1000A 4pol.+Vigi 30mA**  
outgoing sections

circuit breaker 1000A 4-pole

residual current circuit breaker (30mA)

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 400\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (1000A),  $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W), undervoltage  
release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.2.110.** **circuit breaker (RCC) 630A 4pol.+Vigi 30mA**  
outgoing sections

circuit breaker 630A 4-pole

residual current circuit breaker (30mA)

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 400\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (630A),  $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W), undervoltage  
release 24VDC

Delivery, assembly, wiring on terminal-blocks

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**10.2.120.** **circuit breaker (RCC) 400A 4pol.+Vigi 30mA**  
outgoing sections

circuit breaker 400A 4-pole

residual current circuit breaker (30mA)

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 400\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (400A),  $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W), undervoltage  
release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.2.130.** **circuit breaker (RCC) 250A 4pol.+Vigi 30mA**  
outgoing sections

circuit breaker 250A 4-pole

residual current circuit breaker (30mA)

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 250\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (250A)  $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W), undervoltage  
release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.2.140.** **circuit breaker (RCC) 160A 4pol.+Vigi 30mA**  
outgoing sections

circuit breaker 160A 4-pole  
residual current circuit breaker (30mA)

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,

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design operating voltage  $U_e = AC\ 690V$ ,  
design current  $I_n = 160A$ ,  
design insulation voltage  $U_i = 750V$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (160A),  $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling  
switch (1W),  
fault signaling switch (1W), undervoltage  
release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.2.150.** **circuit breaker (RCC) 100A 4pol.+Vigi 30mA**  
outgoing sections

circuit breaker 100A 4-pole

residual current circuit breaker (30mA)

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70kA / AC\ 415V$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = AC\ 690V$ ,  
design current  $I_n = 100A$ ,  
design insulation voltage  $U_i = 750V$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (100A or 40A) STR22SE,  
 $I_r = 0,4-1 \times I_n$ , auxiliary switch (1W), triggered  
signaling switch (1W), fault signaling switch  
1W), undervoltage release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.2.160.** **circuit breaker 400A 3pol.**  
outgoing sections

circuit breaker 400A 3pol.

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70kA / AC\ 415V$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = AC\ 690V$ ,  
design current  $I_n = 400A$ ,  
design insulation voltage  $U_i = 750V$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (400A) STR22SE,  
 $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W), undervoltage

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release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.2.170.** **circuit breaker 250A 3pol.**  
outgoing sections

circuit breaker 250A 3pol.

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 250\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (250A) STR22SE,  
 $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W), undervoltage  
release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.2.180.** **Illumination cabinets**  
Illumination cabinet with lamps and door-switches.  
Mounting in each cabinet field.

Wiring in front of the main switch must be done short-cut  
proofed.

Delivery, assembly, wiring on terminal-blocks

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### 10.3. compensation-cabinet

#### compensation description

compensation

The compensation in the scope of the Lowvoltage main distribution should be realized by the following requirements:

The compensation should be already wired for connection, the cabinets of compensation will be installed on the 2nd floor. The supplier has to take care about the way of delivering the cabinets into the building and it's installation.

The compensation-cabinets are already constructed with fuse links, contactors, discharge inductors and discharge-resistances connected to the terminal blocks of the capacitors and all accessories which are needed for the full function.

The supplier has to take care that the fixing and positioning of the fuses is done in a safety way, so there will be no risk for switching the number of several capacitors

Further on it is expected an apparent power controller (which is well in sight ) mounted in cabinet-door.

All components are enclosed in cabinets. The cabinets for the compensation must be performed in the same quality as the lowvoltage main distribution cabinets. It must be possible to array both kind of cabinets. The assembling of the cabinets shall be realized in a modular way, so that it is possible to extent the compensation all the time. (-concerning enough space for additional capacitors, fuses, terminal blocks etc.)

The supplier has to make sure that all the compensation cabinets are sufficiently cooled with air inlet filters and the temperature should be monitored as well.

The supplier has to show his calculation and investigation about dimensioning of the cabinets and it's components, before the client release the construction.

The whole compensation cabinets has to be constructed EMC-compatible

For the right dimensioning of the compensation and it's blocking filters, the supplier has to execute mains-measuring in the uncompensated current state of the mains. The supplier has to complete the mains-measuring and the duration in trade-off the client and it's authority.

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Further on the supplier has to take care about the harmonics and requirements about the valid current regulation of the amount of the powerfactor by the client.

The compensation-cabinets will be supplied by the lowvoltage main distribution.(it must be possible to array the compensation-cabinets with the LVMD-cabinets)

dimension total (considered in LVMD 3)

h = 2270 mm including base  
w = 1200 mm (600mm each)  
d= 500 mm

**10.3.10.** **compensation unit incl cabinet**  
compensation unit

Total Cable connection sections

Compensating fields  
Width 600 mm,  
Form of inner sectioning: Form 1,  
incl. bus bar system 2500A,  
Preliminary fuse NH2, control assembly, fans and  
reactive power compensator 12-stage.

Compensation BGR  
50 kVar 400V 13,5%  
capacitor and fixed installation  
technology, with attenuators 13.5%,  
ambient temperature 55 degrees centigrade,  
assembly protection with breaker switch,  
total output/stages: 50 kVar / 1 stage,  
design operating voltage Ue= 50Hz 400V.  
Capacitors: LKT technology, capacitor  
50Hz 440V, low-loss, self-sealing

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### 10.4. subdistribution

#### **Sub distribution** (in accordance to titel 2 Distribution)

(valid for:

SD-engine dyno

SD-controlroom

SD-on several floor and Room-SD)

Construction:

#### **SD engine dyno 1-4 u. 5-8:**

1x feeder-field (w=600mm)

4x test-section scopes (with seperated illumination  
and socket fields)(W=600mm)

total dimension l=5400mm,h=2200mm incl.base,d=600mm

#### **SD engine dyno 9-10:**

1x feeder-field (w=600mm)

2x test-section scopes (with seperated illumination  
and socket fields)(W=600mm)

total dimension l=3000mm,h=2200mm incl.base,d=600mm

#### **SD engine dyno 11-15:**

1x feeder-field (w=600mm)

5x test-section scopes (with seperated illumination  
and socket fields)(w=600mm)

total dimension l=6600mm,h=2200mm incl.base,d=600mm

#### **SD chassis-dyno:**

1x feeder-field (w=600mm)

1x field illumination(w=600mm)

1x field sockets(w=600mm)

#### **SD controllroom left wing**

1x feeder-field (w=600mm)

1x field illumination (w=800mm)

1x field sockets (w=800mm)

total dimension l=2200mm,h=2200mm incl.base,d=600mm

#### **SD controllroom right wing**

1x feeder-field (W=600mm)

1x field illumination (w=800mm)

1x field sockets (w=800mm)

total dimension l=2200mm,h=2200mm incl.base,d=600mm

#### **SD 2 left wing (2nd floor)**

1x feeder-field (W=600mm)

1x field illumination (w=600mm)

1x field sockets (w=600mm)

total dimension l=1800mm,h=2200mm incl.base,d=600mm



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### **SD 3 right wing (2nd floor)**

- 1x feeder-field (W=600mm)
- 1x field illumination (w=600mm)
- 1x field sockets (w=600mm)

total dimension l=1800mm,h=2200mm incl.base,d=600mm

### **SD GF**

- 1x feeder-field (W=600mm)
- 2x field illumination (w=600mm)
- 2x field sockets (w=600mm)

total dimension l=3000mm,h=2200mm incl.base,d=600mm

### **RSD hydraulic lab**

- 1x feeder-field (W=600mm)

total dimension l=600mm,h=2200mm incl.base,d=600mm

### **RSD machine tools**

- 1x feeder-field (W=600mm)

total dimension l=600mm,h=2200mm incl.base,d=600mm

Steel metal sheet cabinet

Each field must equipped with a separated cabinet door Door lockers must be performed in accordance to the client

Protection code: IP54

The cabinets must constructed under consideration of EMC (acc. to the EN-Norms and guidelines).

All in- and outgoing cables and all aux. contacts must be guided via terminal blocks.

The main-switch can only be tripped when the cabinet door is closed.

The location of the main switch should be done in accordance with client (front door or sidewall-mounted)

The colour of internal wiring is according. to the additional technical contract conditions.

The supplier has to take care for a sufficient air-conditioning of the cabinets at all.

One cabinet field should have a fixed plan cover inside (for all necessary docs).

All devices and device-locations must be labelled in a permanent way.

Further on the doors of the cabinet must be labelled as well. All labelling, concerning the size and kind of, has to be done in

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accordance to client.  
Handcrafted or handwritten labels are not permitted.

The supplier has to consider that all cable connections of the cabinet (in,-outgoing cables) must be included in the offered price-calculation

Included ratings:  
Isolation measuring (incl. documentation) of each circuit  
Fixing the ingoing and outgoing cables  
Connecting all cables to the terminal blocks (incl. accessories)  
Labelling all cables

Drawings:  
Disposition-drawings (front-, back.- and side views)  
Electrical circuit drawings  
Plans of terminal blocks  
Cable list with label numbers  
List circuit allocation at all  
List of spare parts

**10.4.10. subdistribution 600mm**  
described like before

**(valid for the construction of all combinations of subdistributions)**

Sub-distribution designed like specified before, with the following devices and components.  
All components and devices are placed, fixed and already connected with all it's necessary accessories.(e.g. terminals,labeling etc.)  
Delivering on site, mounting and ready connected to run.

**used as feeder field or arraying cabinet 600mm**

total dimension: **h = 2200 mm including base**

**w = 600 mm**

d = \_\_\_\_\_ mm

**10.4.20. subdistribution 800mm**  
described like before

**(valid for the construction of all combinations of subdistributions)**

Sub-distribution designed like specified before, with the

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following devices and components.  
All components and devices are placed, fixed and already  
connected with all it's necessary accessories.  
Delivering on site, mounting and ready connected to run.

**used as arraying cabinet 600mm**

total dimension: **h =2200 mm including base**

**w = 800 mm**

d = \_\_\_\_\_ mm

**10.4.30. 4-pol. switch disconnecter 630 A**  
main switch as switch disconnecter, current 630A - 4-pole

switch disconnecter 630A 4-pole

Design limit short-circuit switch-off capacity  
Icu= 70kA / AC 415V, Ics = Icu,  
design operating voltage Ue= AC 690V,  
design current In= 630A,  
design insulation voltage Ui= 750V,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
undervoltage release 24VDC

**10.4.40. 4-pol. switch disconnecter 400 A**  
main switch as switch disconnecter, current 400A - 4-pole

switch disconnecter 400A 4-pole

Design limit short-circuit switch-off capacity  
Icu= 70kA / AC 415V, Ics = Icu,  
design operating voltage Ue= AC 690V,  
design current In= 400A,  
design insulation voltage Ui= 750V,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
undervoltage release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.4.50. 4-pol. switch disconnecter 250A**  
main switch as switch disconnecter, current 250A - 4-pole

switch disconnecter 250A 4-pole

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Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 250\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
undervoltage release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.4.60.** **4-pol. switch disconnecter 200A**  
main switch as switch disconnecter, current 200A - 4-pole

switch disconnecter 200A 4-pole

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 200\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
undervoltage release 24VDC

Delivery, assembly, wiring on terminal-blocks

**10.4.80.** **4-pol. switch disconnecter 125A**  
main switch as switch disconnecter, current 250A - 4-pole

switch disconnecter 250A 4-pole

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 250\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
undervoltage release 24VDC

Delivery, assembly, wiring on terminal-blocks

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**10.4.90. 4-pol. switch disconnecter 100A**  
main switch as switch disconnecter, current 100A - 4-pole

switch disconnecter 100A 4-pole

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 100\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),

Delivery, assembly, wiring on terminal-blocks

**10.4.100. 4-pol. switch disconnecter 63A**  
main switch as switch disconnecter, current 63A - 4-pole

switch disconnecter 63A 4-pole

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 63\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),

Delivery, assembly, wiring on terminal-blocks

**10.4.110. 4-pol. switch disconnecter 50A**  
main switch as switch disconnecter, current 50A - 4-pole

switch disconnecter 50A 4-pole

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 50\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),

Delivery, assembly, wiring on terminal-blocks

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**10.4.120. 4-pol. switch disconnecter 32A**  
main switch as switch disconnecter, current 32A - 4-pole

switch disconnecter 32A 4-pole

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 32\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),

Delivery, assembly, wiring on terminal-blocks

**10.4.130. undervoltage release for circuitbreaker (24VDC)**  
undervoltage release for the following circuitbreaker  
mounting and integrating in circuitbreaker-enclosure

24VDC

**10.4.140. 4-pol. circuit breaker 40A, 30 mA**  
4-pol. circuit breaker 40A, 30mA

Design limit short-circuit switch-off capacity  
 $I_{cu} = 50\text{ kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 40\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (50A)  $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
vigi 30 mA

Delivery, assembly, wiring on terminal-blocks

**10.4.145. 4-pol. circuit breaker 32 A**  
4-pol. circuit breaker 32A

Design limit short-circuit switch-off capacity  
 $I_{cu} = 50\text{ kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 32\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (50A)  $I_r = 0,4-1 \times I_n$ ,

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auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),

Delivery, assembly, wiring on terminal-blocks

**10.4.150. 4-pol. circuit breaker 50A, 30 mA**  
4-pol. circuit breaker 50A, 30mA

Design limit short-circuit switch-off capacity  
 $I_{cu}=50 \text{ kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e= \text{AC } 690\text{V}$ ,  
design current  $I_n= 50\text{A}$ ,  
design insulation voltage  $U_i= 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (50A)  $I_r=0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
vigi 30 mA

Delivery, assembly, wiring on terminal-blocks

**10.4.160. 4-pol. circuit breaker 63A, 30mA**  
4-pol. circuit breaker 63A, 30 mA

Design limit short-circuit switch-off capacity  
 $I_{cu}=50 \text{ kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e= \text{AC } 690\text{V}$ ,  
design current  $I_n= 63\text{A}$ ,  
design insulation voltage  $U_i= 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (63A)  $I_r=0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),  
vigi 30 mA

Delivery, assembly, wiring on terminal-blocks

**10.4.180. 4-pol. circuit breaker 200A**  
4-pol. circuit breaker 200A

Design limit short-circuit switch-off capacity  
 $I_{cu}=50 \text{ kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e= \text{AC } 690\text{V}$ ,  
design current  $I_n= 200\text{A}$ ,  
design insulation voltage  $U_i= 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (200A)  $I_r=0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),

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fault signaling switch (1W),

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**10.4.190.** **4-pol. circuit breaker (RCC) 100A**  
circuit breaker 100A 4-pole

residual current circuit breaker (30mA)

Design limit short-circuit switch-off capacity  
 $I_{cu} = 70\text{kA} / \text{AC } 415\text{V}$ ,  $I_{cs} = I_{cu}$ ,  
design operating voltage  $U_e = \text{AC } 690\text{V}$ ,  
design current  $I_n = 100\text{A}$ ,  
design insulation voltage  $U_i = 750\text{V}$ ,  
as per IEC 947-2, EN 60947-2,  
with overcurrent release (100A),  $I_r = 0,4-1 \times I_n$ ,  
auxiliary switch (1W), triggered signaling switch (1W),  
fault signaling switch (1W),

Delivery, assembly, wiring on terminal-blocks

**10.4.210.** **fuse-disconnector NH00 160A-base**  
fuse disconnector, incl. fuse links NH00, 4 pole

Delivery, assembly, wiring on terminal-blocks

**10.4.220.** **mini-circuit breaker 4-pole C 16 A**  
MCB, 10kA, 4pole, C, 16A, AC 230/400V,  
aux contacts  
specifications: EN 60 898, IEC 60 898, Characteristic C

Delivery, assembly, wiring on terminal-blocks

**10.4.240.** **mini-circuit breaker 4-pole B10 A**  
MCB, 10kA, 4pole, B, 10A, AC 230/400V,  
aux contacts  
specifications: EN 60 898, IEC 60 898, Characteristic B

Delivery, assembly, wiring on terminal-blocks

**10.4.250.** **mini-circuit breaker 2-pole B10 A**  
MCB, 10kA, 2pole, B, 10A, AC 230/400V,  
aux contacts  
specifications: EN 60 898, IEC 60 898, Characteristic B

Delivery, assembly, wiring on terminal-blocks



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**10.4.260. mini-circuit breaker 2-pole C16 A**  
MCB, 10kA, 2pole, C, 16A, AC 230/400V,  
aux contacts  
specifications: EN 60 898, IEC 60 898, Characteristic C

Delivery, assembly, wiring on terminal-blocks

**10.4.270. mini-circuit breaker 2-pole B6 A**  
MCB, 10kA, 2pole, B, 6A, AC 230/400V,  
aux contacts  
specifications: EN 60 898, IEC 60 898, Characteristic B

Delivery, assembly, wiring on terminal-blocks

**10.4.280. mini-circuit breaker 2-pole C25A**  
MCB, 10kA, 2pole, C, 25A, AC 230/400V,  
aux contacts  
specifications: EN 60 898, IEC 60 898, Characteristic C

Delivery, assembly, wiring on terminal-blocks

**10.4.290. motor protection switch 4,0-6,0 A**  
motor protection switch as transformer-protection  
(control-rectifier)  
with aux.contacts

delivery, assembly, wiring on terminal blocks

**10.4.300. RCD, 63/0,03 A 4pole**  
4-pole RCD 63A/30mA (fixed in cabinet)  
fixing,delivering and wiring

Delivery, assembly, wiring on terminal-blocks

**10.4.310. RCD, 40/0,03 A 4pole**  
4-pole RCD 40A/30mA (fixed in cabinet)  
fixing,delivering and wiring

Delivery, assembly, wiring on terminal-blocks

**10.4.320. power contactor 4 kW, AC 3, 24VDC**  
power contactor 4 kW, AC 3, 4 Pole

inductor volltage 24VDC

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and aux.contacts

Delivery, assembly, wiring on terminal-blocks

**10.4.330. impulse switch relay 1NC, 1NO 24VDC**

impulse switch relay  
voltage 24VDC  
1x NC  
1 xNO  
load current 10A

Delivery, assembly, wiring on terminal-blocks

**10.4.340. power contactor 4 kW, AC 3, 230VAC, insta**  
power contactor 4 kW, AC 3,insta, 4 Pole

inductor volltage 230VAC  
for installation in circuit-breaker boxes  
and aux.contacts

Delivery, assembly, wiring on terminal-blocks

**10.4.350. impulse switch relay 1NC, 1NO 230VAC insta**

impulse switch relay  
voltage 230VAC  
1x NC  
1 xNO  
load current 10A

Delivery, assembly, wiring on terminal-blocks

**10.4.360. power contactor 100A , AC 3, 24VDC**  
power contactor 100A, AC 3,insta, 4 pole

inductor volltage 24VDC

and aux.contacts

Delivery, assembly, wiring on terminal-blocks

**10.4.370. 400V/24VDC power supply**

primary: 400VAC, 50Hz  
secondary: 24VDC  
incl. internal fusing

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S=500kVA

Delivery, assembly, wiring on terminal-blocksLieferung,

**10.4.380. Surge protector /class C**

Surge protector -  
4-pole. Type 1 isn= 100kA

consisting of:

1 only breaker switch 4-pole, 160A,  
690V NH00,  
4x low-voltage power fuse NH00, 50A gl/gG,

1 only surge protector 4-pole Cl.=C  
Imp=100kA TN-S with aux.contacts for  
status message.

Delivery, assembly, wiring on terminal-blocks

Delivery, assembly, wiring on terminal-blocks

**10.4.390. push button in cabinet door**

push button / panel mounted  
fixed cabinet front door  
"illumination false floor"-control-room  
1pole switch (I-0)

Delivery, assembly, wiring on terminal-blocks

**10.4.400. indicator lamp (cabinet door) green**

indicator lamp as LED green  
fixed cabinet front door  
"illumination false floor"-control-room

Delivery, assembly, wiring on terminal-blocks

**10.4.410. illumination cabinets /each field**

incl. door-switch for each cabinet-field and all connections via  
terminals (short-circuit proofed wiring in front of the main switch  
is required)  
230V-socket included.

Delivery, assembly, wiring on terminal-blocks

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**10.4.420.** **termial blocks upto 2,5 mm<sup>2</sup>**  
to connect 5-wired cables to the cabinet incl. connection  
protection-earth (PE) to termial bus bar  
fixing, wiring and delivering'  
.....'

**10.4.430.** **termial blocks 4 to 10 mm<sup>2</sup>**  
to connect 5-wired cables to the cabinet incl. connection  
protection-earth (PE) to termial bus bar  
fixing, wiring and delivering'  
.....'

**10.4.440.** **termial blocks 16 mm<sup>2</sup>**  
to connect 5-wired cables to the cabinet incl. connection  
protection-earth (PE) to termial bus bar  
fixing, wiring and delivering'  
.....'

**10.4.450.** **termial blocks 25 to 35 mm<sup>2</sup>**  
to connect 5-wired cables to the cabinet incl. connection  
protection-earth (PE) to termial bus bar  
fixing, wiring and delivering'  
.....'

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### 10.5. room sub distributions

#### **Switch cabinet wall mounted,1100x300x218**

Wall mounted cabinet  
Acc. To IEC 439-1 / EN 60439/  
For lowvoltage distribution upto 630 A,  
3AC 690 V /50Hz. Protectionclass IP54  
DIN VDE 0110/1-2.  
Steel metal sheet (profiled)  
1.5mm thick  
Plastic coated inside  
Universal insertings for cable up-and down with ISO flanges  
8 rows( for 12 devices each).

IP: 54  
Protection class: II  
width: 300 mm  
height: 1100 mm  
depth: 218 mm  
doors: 1  
montage: surface  
colour: white

#### **Switch cabinet in-wall mounted, 3 rows (for 12 devices each)**

colour white  
width 285 mm  
height 495 mm  
door 1

material steel

Protection class IP 00  
depth 15 mm

### 10.5.10. **Switch cabinet in-wall mounted,**

Room subdistribution  
(coffe break)  
like described before

mountaing rails 3-row

Delivery and assembly

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**10.5.20.** **Switch cabinet wall mounted,1100x300x218**  
Room subdistribution

like described before

incl. PE and N-rails, terminal- blocks

Delivery and assembly

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### 10.6. equipotential system

remarks of grounding foundation and equipotential bonding system

The grounding foundation and the equipotential bondage system must be realized in accordance to IEC 64/1134 CEI 64-

the equipotential bondage system has to be connect to:

- all equipotential bus bars
- grounding foundation
- all protection earth wires/cables
- all metal-pipes
- the central heating system
- air conditioning (by-pass modes)
- the earthing for telecommunication
- the lightning protection system
- all cabletrays,-ladders,-rails for elevators, etc...
- all auxiliary metal constructions

The following positions are containing all the necessary parts for equipotential bonding systems and the earthing itself.

All connections, equipotential bus bars and metal-parts must be fixed and assembled well in sight. All connection must be done in a removable way

The whole grounding foundation and equipotential bonding system must be connected to the main earthing point on the 2nd floor.

**10.6.10. equipotential bus bar L = 0,8 m**  
made of copper 80 x 10 mm, L = 0,8 m mit 18 drillings, accessories etc. and engraved labels for each conductor/wire

delivering and assembling

**10.6.20. equipotential bus bar L = 0,4 m**  
made of copper 80 x 10 mm, L = 0,4 m with 8 drillings, accessories etc. and engraved labels for each conductor/wire

delivering and assembling

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**10.6.30. equipotential bus bar L = 0,3 m**  
made of copper 80 x 10 mm, L = 0,3 m mit 6 drillings,  
accessories etc. and engraved labels for each conductor/wire

delivering and assembling

**10.6.40. equipotential bus bar 200 x 65 x 56**  
size 200 x 65 x 56,  
7 single conductors upto -16mm<sup>2</sup>  
4 single conductors 16 upto 95mm<sup>2</sup>  
and engraved label

delivering and assembling

**10.6.50. earthing pipe clamp DN 65 bis DN 100**  
earthing pipes with diamter range DN 65 upto DN 100

delivering and assembling

**10.6.60. earthing pipe clamp DN 125 bis DN 200**  
earthing pipes with diamter range DN 125 upto DN 200

delivering and assembling

**10.6.70. by-pass earthing for compensators, 50 mm<sup>2</sup>**  
assembly-devices etc. HO5V-F 1 G 50 mm<sup>2</sup>  
length 30 cm, incl. cable-shoes

delivering and assembling

**10.6.80. by-pass earthing 10 mm<sup>2</sup>**  
cable trays etc. .  
HO 5 V - F 1 G 10 mm<sup>2</sup>  
length upto 1m incl. cable shoes

delivering and assembling

**10.6.90. by-pass earthing 6 mm<sup>2</sup>**  
cable trays etc. .  
HO 5 V - F 1 G 6 mm<sup>2</sup>  
length upto 1m incl. cable shoes

delivering and assembling



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- 10.6.100.** **by-pass earthing-strip**  
connecting metal-parts or -sheets as expansion-strip  
copper - strip (tin-plated) 40 mm<sup>2</sup>  
  
delivering and assembling  
  
\*\*\* Design-Description 1001  
**cable for equipotential and grounding foundation**  
  
assembling and shifting:  
partly in conduits, cabletrays, ducts  
including all necessary accessories  
  
delivering, assembling and connecting
- 10.6.110.** accord. To Design Description 1001  
**NY-Y-J 1 x 240 mm<sup>2</sup>**  
connection Lowvoltage main distribution to main earthing point  
(MEP)  
  
as partial length  
  
delivering and assembling.
- 10.6.120.** accord. To Design Description 1001  
**NY-Y-J 1 x 120 mm<sup>2</sup>**  
connection to cabinets testing technique (equipotential)  
  
as partial length  
  
delivering and assembling.
- 10.6.130.** accord. To Design Description 1001  
**NY-Y-J 1 x 95 mm<sup>2</sup>**  
connection to cabinets (equipotential)  
  
as partial length  
  
delivering and assembling.
- 10.6.140.** accord. To Design Description 1001  
**NY-Y-J 1 x 70 mm<sup>2</sup>**  
connection to cabinets (equipotential)

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as partial length

delivering and assembling.

**10.6.150.** accord. To Design Description 1001  
**NYJ-J 1 x 50 mm<sup>2</sup>**  
equipotential bonding terminal

as partial length

delivering and assembling.

**10.6.160.** accord. To Design Description 1001  
**NYJ-J 1 x 25 mm<sup>2</sup>**  
equipotential bonding terminal

as partial length

delivering and assembling.

**10.6.170.** accord. To Design Description 1001  
**NYJ-J 1 x 16 mm<sup>2</sup>**  
equipotential bonding terminal

as partial length

delivering and assembling.

**10.6.180.** accord. To Design Description 1001  
**NYM-J 1 x 10 mm<sup>2</sup>**  
field devices and aux.constructions

as partial length

delivering and assembling.

**10.6.190.** accord. To Design Description 1001  
**NYM-J 1 x 6 mm<sup>2</sup>**  
field devices and aux.constructions

as partial length

delivering and assembling.

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**10.6.200.** accord. To Design Description 1001  
**check of complete equipotential system**  
measuring documents with relevant measuring-points and datas  
protocols and docs are required 4-times  
signed by the supplier / company

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### 10.7. cable installation systems

#### remarks cable installation systems

cabletray systems and cable ladder systems

The trays and ladders consists of steel, strip galvanized acc. to EN 10147, steel, hot-dip galvanized acc. to EN ISO 1461

All cable trays and ladders must be mounted only original accessories like e.g. connectors, barrier strips, clamps etc. Additional drillings of separated holes is not permitted

Cable trays and ladders for weak-power must be marked with yellow colour over the running length in accordance to the client. This rating must considered in the calculation.

The material and accessories for auxiliary constructions must be considered in the price calculation and has to be delivered and assembled. .

Sharp edges and cuts must be prevented with edge-protection. All connections must be performed that tight bending rates and damages of the cables or wires are prevented.

The cable trays and ladders must be connected to the equipotential bus bar system. Cable ladders, end of trays and supports must be equipped with end caps and edge-protections.

cable ladders in the height of 0.00m upto 2.50m must be performed with covers for mechanical protection.

All the covers must be removable.

For separation of several powercables it is provided to guide the cables with additional barrier strips.  
All cabletrays must be devided by barrier strips or executed with an additional cabletray-system.  
The final guiding of the cabletrays requires the agreement of the site management.

The mounting and assembling of the cabletrays has to be done in accurate way.

In the case of roughness of the walls, the difference must be equalized by wall brackets.

The supports and the brackets must be fixed with clamping brackets.

It is a space reserve of 25% permitted for all cable-systems

If the client does not requires any special drawings in relation to

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the cable installation systems, the dimensioning of the accessories, the mounting-materials and the cabletrays has to be done that a space reserve of 25% is possible to get. Otherwise it must take place an agreement with the site management.

The prices contain the complete delivering and assembling, incl. all necessary

Accessories:

mounting material

supports from 100 upto 1500 mm

wall brackets, clamp brackets, tees, bends, joint-connections etc.

Only installed parts are ready for to calculate. The cut-off will be left unpaid, so it must be considered in the price of the offer.

Assembly categorie:

1. from the ceiling 1.50m ( aprox. 75%)
2. wall fixed ( aprox. 25%)

All systems with conductive materials must be connected to equipotential bus bar systems.(even raceways and conduits or ducts).

It must be realized with all accessories like screwed cable glands etc..

End caps and edge-protections has to be used on each sharp and dangerous part of the cable installation systems

If there will be a need to cut the supports ,decided by the site management, the supplier has to consider this effort and it's calculation in his offer.

### conduits

Assembling in concrete (e.g. stair cases)

conduits should be located early, before the brickwork or concrete-works starts. Each conduit has to be labeled on the end and where does it starts.

After the assembling each conduits must get an taut-wire inside. Each circuit needs a separated conduit and the circuits for e-lighting systems must be done in the same way.

### assembling in walls

It always has to be chosen the shortest way. All slots must be

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done by milling cutters (it is not allowed to stem).  
The whole run of the conduits (e.g to socket, switches or muffs)  
must be sealed.

The bending rates of the conduits must be considered (tight  
bending rate must be done by ready made 90°bends

conduits/pipes surface mounted  
All conduits must be made of aluminium and must be fixed with  
the required accessories for running on ceilings/floors and walls.  
bends for the aluminium conduits are not required, only the  
cables are describing the bends.

### Installationducts and raceways.

Raceways or cable ducts should be performed with barriers.  
Especially in the scope of the test-section and controlroom  
landing beneath the windows or inside the cell.

Further on, when the raceways are crossing several rooms the  
supplier has to take care about acoustic transmissions.  
It is not permitted to transmit some noise via raceways from  
room to room.

For mounting on concrete or brickwork, the requirements of  
manufacturer has to be considered.

In the case of cable -installation with functionality (e.g.E30  
halogen-free) the special requirements about the assembling  
and fixing or mouting of the cable must abide with accuracy.  
This requirement is specially valid in the scope of emegency  
lighting systems

The cabling for the e-lighting system must be guided separatly  
and always close to the ceiling or on the highest level which is  
possible.

### \*\*\* Design-Description 1002 **cable trays**

cabletrays in accordance to the remarks

additional ratings like cutting, manufacturing of tees, cross-over,  
90°bends, etc..  
must considered in all the concerning postions  
Further on wall supports for different sizes

distance between the supports 1.50m  
(normal cabletray)

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distance between the supports upto 6.0m  
(wide span cabletray)  
side height 60mm and 100mm

delivering and assembling

**10.7.10.** accord. To Design Description 1002  
**cable trays 100 x 60 mm**  
delivering and assembling

**10.7.20.** accord. To Design Description 1002  
**cable trays 200 x 60 mm**  
delivering and assembling

**10.7.30.** accord. To Design Description 1002  
**cable trays 300 x 60 mm**  
delivering and assembling

**10.7.40.** accord. To Design Description 1002  
**cable trays 400 x 60 mm**  
delivering and assembling

**10.7.45.** accord. To Design Description 1002  
**cable trays 600 x 60 mm**  
delivering and assembling

**10.7.50.** accord. To Design Description 1002  
**cable trays 600 x 100 mm**  
delivering and assembling

**10.7.60.** **aux. construction with c-profiles-rails (3m)**  
complete construction for mounting the cable trays in the false  
floor  
3m each  
cutting included  
delivering and assembling

**10.7.70.** **support upto 2.500 mm**  
Support with H-profile, hot-dip galvanized steel  
incl.support brackets and end caps

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supports with length upto 2500mm

delivering and assembling

\*\*\* Design-Description 1004  
**cable ladder**

hot-dip galvanized performance  
wall and ceiling-montage with c-profiled supportst

delivering, assembling and connecting

**10.7.80.** accord. To Design Description 1004  
**cable ladder, 600mm**  
delivering and assembling

**10.7.90.** accord. To Design Description 1004  
**cable ladder, 400mm**  
delivering and assembling

**10.7.100.** accord. To Design Description 1004  
**cable ladder, 300mm**  
delivering and assembling

**10.7.110.** accord. To Design Description 1004  
**cable ladder, 200mm**  
delivering and assembling

**10.7.120.** accord. To Design Description 1004  
**cable ladder, 100mm**  
delivering and assembling

\*\*\* Design-Description 1005  
**cable ladder covering**

hot-dip galvanized steel 1.5mm thick  
with all necessary accessories for fixing  
all covers must be always removeable  
Montage in accordance to the site management

delivering and assembling



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**10.7.130.** accord. To Design Description 1005  
**cable ladder cover 600mm (2m length)**  
delivering and assembling

**10.7.140.** accord. To Design Description 1005  
**cable ladder cover 400mm (2m length)**  
delivering and assembling

**10.7.150.** accord. To Design Description 1005  
**cable ladder cover 300mm (2m length)**  
delivering and assembling

**10.7.160.** accord. To Design Description 1005  
**cable ladder cover 200mm (2m length)**  
delivering and assembling

**10.7.180.** **marking and labelling of cabletrays**  
labelling of several cabletrays with engraved nameplates  
fixing with screws  
(delivering with necessary accessories)  
  
delivering and assembling

**10.7.190.** **hot-dip galvanized flat-steel, angle-steel**  
several aux. steel constructions and special constructions  
as support for tray-assembling  
  
delivering and assembling

**10.7.200.** **-rails (c-profiled) 50 x 30 x 3,0 mm (3m)**  
3m each  
cutting included  
delivering and assembling

\*\*\* Design-Description 1007  
**Aluminium conduits**

For applications where an excellent corrosion resistance, a high mechanical protection and low weight are required. For surface mounted cable-installations on brickwork and concrete. Including all necessary accessories like clamps couplings and end plugs.

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**10.7.210.** accord. To Design Description 1007  
**Aluminium conduits, type 20**  
delivering and assembling

**10.7.220.** accord. To Design Description 1007  
**Aluminium conduits, type 25**  
delivering and assembling

**10.7.230.** accord. To Design Description 1007  
**Aluminium conduits, type 32**  
delivering and assembling

**10.7.240.** accord. To Design Description 1007  
**Aluminium conduits, type 40**  
delivering and assembling

**10.7.250.** accord. To Design Description 1007  
**Aluminium conduits type 50**  
delivering and assembling

**10.7.260.** accord. To Design Description 1007  
**Aluminium conduits, type 63**  
delivering and assembling

\*\*\* Design-Description 1008  
**surface raceways**

for running lines on walls or/and, ceilings incl. all necessary  
accessories like endplates, tees, etc..

delivering and assembling

**10.7.280.** accord. To Design Description 1008  
**installationsducts (solid wall) H/B = 40/60 mm**  
material: PVC  
color: withe  
height : 40mm  
width: 60mm

delivering and assembling

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- 10.7.290.** accord. To Design Description 1008  
**installationsducts (solid wall) H/B = 40/110 mm**  
material: PVC  
color: withe  
height : 40mm  
width: 110mm  
  
delivering and assembling
- 10.7.300.** accord. To Design Description 1008  
**installationsducts (solid wall) H/B = 60/150 mm**  
material: PVC  
color: withe  
height :60mm  
width: 150mm  
  
delivering and assembling
- 10.7.310.** **Raceway 170mm x 68mm PVC**  
used in the scope of controlrooms (beneath windows), lab's and storages, (in accordance to the drawings)  
  
equipped with barrier inside, size: 68 x 170 mm  
  
incl. all necessary accessories like bends, couplingparts, clamps, bends, endplates etc...  
color: white (in accordance to the client)  
  
upper part/cover of raceway included  
  
material: PVC  
,  
delivering and assembling'
- 10.7.320.** **connector-socket for raceway montage**  
connector socket for raceway-montage  
  
delivering and assembling
- 10.7.330.** **connector-socket for raceway with CEE-socket 32A**  
connector socket for raceway-montage  
incl 32A socket  
delivering and assembling

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- 10.7.340. connector-socket for raceway with CEE-socket 16A**  
connector socket for raceway-montage  
incl 32A socket  
delivering and assembling
- 10.7.350. collective cable-holder (PVC)**  
for mounting of several cables in space between the ceilings,  
  
provided distance between 1.00 m  
  
delivering and assembling
- 10.7.360. support cabletrays (with functionality 30min.)**  
all necessary parts and accessories concerning the carrying  
systems must be performed as functionality- standard 30/90min.  
(containing e.g. supports, clamps etc...)  
  
provided distance 1.50m  
montage: always on top, close as possible to the ceiling  
  
delivering, assembling with all necessary accessories
- 10.7.370. collective cable-holder (functionality 30/90 min.) for wall or ceiling mounting**  
made of galvanized steel  
  
for assembling and shifting of cables with functionality 30/90  
min.  
  
distance : 800 mm  
  
delivering, assembling with all necessary accessories

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### 10.8. cable and wires

#### All required cables

The cabling and wiring must be realized in accordance to the guidelines CEI-64-8

The labeling of the cables and the wires must be done in a permanent way. (labeling always on both sides).

The used labeling should be done in accordance to the cable-lists.

The effort must be considered in position

The cablelist gives all necessary datas about the cabletype, cablesource and destination, number of wires

The cable- installation at all is realized with protective earth conductor in the color green-yellow. The circuits for sockets and illumination has to be done separatly.

The exact cable-ways has to be managed with the site engineer  
It must always the shortest cableway considered or else is the agreement of the site management required

The fixing of the cables on auxiliary construction like ladders or c-profiled bars must be done with cable-clips and PVC-protection underneath.

Bei Verlegung von Einleiter-Kabeln ist neben der thermischen Beeinflussung auch die dynamische Beanspruchung unbedingt zu beachten. Deshalb müssen solche Kabel mit entsprechenden Hilfsmitteln in den notwendigen Abständen verlegt werden.

The problems of temperature has to be considered in relation to the number of the cables.

The requirements and recommends of the manufacturer must be considered.

It is not allowed to use cable-muffs for to connect.

All cable length have to be shift as one.

The bending-rates of the manufacturer must be considered

The supplier has to take care for the safety of the cables in the duration of assembly

In case of damage the whole length of the cable must be shifted again.

All connections on cabinets must be done via cable-shoes

Isolation and resistance-measuring must be done before the acceptance and commisioning takes place.

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All circuits must be checked separately.  
All measurements must be documented.

In case of shifting cables in concrete it is wished that the installation of the required conduits did happen early enough.  
The supplier has to take care about a correct conduit shifting in the concrete.

The manufacturing of slots in concrete or brickwork needs clarification with the site engineer.

Following cables are required:

Sockets one-phase wiring  
- 3 x 2,5 mm<sup>2</sup>  
illumination one-phase wiring  
- 3 x 2,5 mm<sup>2</sup>  
illumination three-phase wiring  
5 x 2,5 mm<sup>2</sup>

The connection to equipotential bus bars must be done via cablesheoes as a fixed connection.

Cabling through fire-walls or floors:  
The recent italian guidelines must be accurately required.  
Each cable must be fixed in a distance of 1m in front and behind of each fire compartment .

In the case of high stress or mechanical loads the cable must be leaded via steel or aluminium conduits.

In the case of expansion joints of the , all special arrangements or conditions has to be considered.

### **cabling and wiring**

The cabling and wiring will be realized with 75% on cabletrays/ladders and with 25%in conduits/ducts or raceways in surface mounted modes.

The valid CEI-Norm must be considered:

The wiring-connection to the devices should be done, with enough reserve in relation to the cable-length.

Incoming cables should be sealed by well dimensioned screwed cable glands..

The supplier has to take care for temperature ranges in relation to cabling and wiring.

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It must be prevented, that cables/wires are in touch with plant-parts which are able to reach more than +40°C.

Flexible cables/wires must be connected by crimped wire ends and wire-shoes.

Soldering of wire ends and shoes is not permitted.

All wires and shields must be guided via terminal-blocks. In the case of functionality of the cable all requirements in relation to installationsystems must be considered.

All cables with functionality (e.g. emergency lighting systems) must be installed on the ceiling (close as possible).  
The time and effort must be considered by the supplier

All cables must lead separated wires for N- and PE-conductors.

The requirements of EMC must be fulfilled at all.

The cost/price of the cabling/wiring contains delivering and assembling.

**10.8.10.** **NY-Y-J 24 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.20.** **NY-Y-J 40 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.30.** **NY-CW-Y 3 x 240/120 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.40.** **NY-CW-Y 3 x 150/120 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

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**10.8.50.** **NYCWY 4 x 240/120 mm2**  
as partial length

delivering and assembling.

**10.8.60.** **NYCWY 4 x 185/95 mm2**  
as partial length

delivering and assembling.

**10.8.70.** **NYCWY 4 x 150/70 mm2**  
as partial length

delivering and assembling.

**10.8.80.** **NYCWY 4 x 120/70 mm2**  
as partial length

delivering and assembling.

**10.8.85.** **NYCWY 4 x 95/50 mm2**  
as partial length

delivering and assembling.

**10.8.90.** **NYCWY 4 x 70/35 mm2**  
as partial length

delivering and assembling.

**10.8.100.** **NYCWY 4 x 50/25 mm2**  
as partial length

delivering and assembling.

**10.8.110.** **NYCWY 4 x 35/16 mm2**  
as partial length

delivering and assembling.



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installation cables

**10.8.145.** **NYJ-J 3 x 2,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.150.** **NYM-J 3 x 2,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.220.** **NYM-J 5 x 16 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.230.** **NYM-J 5 x 10 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.240.** **NYM-J 5 x 6 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.245.** **NYJ-J 5 x 6 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.260.** **NYM-J 5 x 2,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.270.** **NYM-J 5 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

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### control-cables

- 10.8.300.** **Ölflex-110 3 x 2,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.305.** **Ölflex-110 CY 3 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.310.** **Ölflex-110 3 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.330.** **Ölflex-110 4 x 10 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.360.** **Ölflex-110 4 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.370.** **Ölflex-110 7 x 2,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.375.** **Ölflex-110 CY 7 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.377.** **Ölflex-110 7 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

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**10.8.378.** **Ölflex-110 7 x 6 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.379.** **Ölflex-110 7 x 10 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.380.** **Ölflex-110 5 x 16 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.385.** **Ölflex-110 5 x 25 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.390.** **Ölflex-110 5 x 10 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.400.** **Ölflex-110 5 x 6 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.410.** **Ölflex-110 5 x 4 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

**10.8.420.** **Ölflex-110 5 x 2,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.

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- 10.8.430.** **Ölflex-110 5 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.435.** **Ölflex-110 CY 5 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.505.** **Ölflex-110 CY 10 x 1,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.510.** **unitronic EB JE-LiCY...BD 2x2x0,5 mm<sup>2</sup>**  
intrinsically safe -cable blue  
  
as partial length  
  
delivering and assembling.
- 10.8.520.** **unitronic EB JE-LiCY...BD 4x2x0,5mm<sup>2</sup>**  
intrinsically safe -cable blue  
  
as partial length  
  
delivering and assembling.
- 10.8.530.** **NHXH E 30 3 x 2,5 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.540.** **NHXH E 30 3 x 4 mm<sup>2</sup>**  
as partial length  
  
delivering and assembling.
- 10.8.550.** **IE-Y(St)Y 2 x 2 x 0,8 Lg**  
as partial length  
  
delivering and assembling.

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- 10.8.560.** **IE-Y(St)Y 4 x 2 x 0,8 Lg**  
as partial length  
  
delivering and assembling.
- 10.8.570.** **IE-Y(St)Y 8 x 2 x 0,8 Lg**  
as partial length  
  
delivering and assembling.
- 10.8.580.** **IE-Y(St)Y 12 x 2 x 0,8 Lg**  
as partial length  
  
delivering and assembling.
- 10.8.590.** **IE-Y(St)Y 20 x 2 x 0,8 Lg**  
as partial length  
  
delivering and assembling.
- 10.8.600.** **communication-cable 800 MHz cat. 7**  
for applications upto 800MHz  
(max.100m length)  
  
with 4 shielded pairs as one common shield  
  
Guidelines ISO/IEC 11801, EN 50173  
  
as partial length  
  
delivering and assembling.
- 10.8.605.** **unitronic bus FD PLP2/FIP**  
Profibus DP cable  
highflexible (4-cores)  
  
as partial length  
  
delivering and assembling.
- 10.8.610.** **cable - fire detection system (red-coloured)**  
as partial length  
  
delivering and assembling.

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**10.9.** **cable and wires - connections**

**remarks:**

arming, inserting into the cabinets, including cable glands for e.g. motors , fixing or arming the cables on c-profiled rails.

Measuring all the cables and wires including test-documentation

Including wire-ends, shoes and fixing materials

Labeling of the cables is required, is has to be done in accordance to the cablelist.

All additional ratings needs the permission of the site management.

**10.9.10.** **cabel NYY- J 1 x 240 mm<sup>2</sup>**  
cabel NYY- J 1 x 240 mm<sup>2</sup>

**10.9.20.** **cabel NYY- J 1 x 120 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>

**10.9.25.** **cabel NYY- J 1 x 95 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>

**10.9.27.** **cabel NYY- J 1 x 70 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>

**10.9.28.** **cabel NYY- J 1 x 50 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>

**10.9.29.** **cabel NYY- J 1 x 25 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>

**10.9.29.0** **cabel NYY- J 1 x 16 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>

**10.9.29.1** **cabel NYY- J 1 x 10 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>

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- 10.9.29.2** **cabel NYY- J 1 x 6 mm<sup>2</sup>**  
cabel NYY- J 1 x 120 mm<sup>2</sup>
- 10.9.30.** **cabel NYCWY 3 x 240/120 mm<sup>2</sup>**  
cabel NYCWY 3 x 150/70 mm<sup>2</sup>
- 10.9.35.** **cabel NYCWY 3 x 150/95 mm<sup>2</sup>**  
cabel NYCWY 3 x 150/70 mm<sup>2</sup>
- 10.9.40.** **cabel NYCWY 4 x 240/120 mm<sup>2</sup>**  
cabel NYCWY 3 x 150/70 mm<sup>2</sup>
- 10.9.50.** **cabel NYCWY 4 x 150/70 mm<sup>2</sup>**  
cabel NYCWY 3 x 120/70 mm<sup>2</sup>
- 10.9.60.** **cabel NYCWY 4 x 185/95 mm<sup>2</sup>**  
cabel NYCWY 3 x 120/70 mm<sup>2</sup>
- 10.9.90.** **cabel NYCWY 4 x 70/35 mm<sup>2</sup>**  
cabel NYCWY 4 x 70/35 mm<sup>2</sup>
- 10.9.95.** **cabel NYCWY 4 x 50/25 mm<sup>2</sup>**  
cabel NYCWY 4 x 25/16 mm<sup>2</sup>
- 10.9.100.** **cabel NYCWY 4 x 35/16 mm<sup>2</sup>**  
cabel NYCWY 4 x 35/16 mm<sup>2</sup>
- 10.9.110.** **cabel NYCWY 4 x 25/16 mm<sup>2</sup>**  
cabel NYCWY 4 x 25/16 mm<sup>2</sup>
- 10.9.120.** **cabel NYCWY 4 x 16/16 mm<sup>2</sup>**  
cabel NYCWY 4 x 16/16 mm<sup>2</sup>
- 10.9.130.** **cabel NYCWY 4 x 10/10 mm<sup>2</sup>**  
cabel NYCWY 4 x 10/10 mm<sup>2</sup>

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**10.9.147. cabel upto 5x 2,5 mm<sup>2</sup> (massive)**  
cabel upto NYM-I 5x 2,5 mm<sup>2</sup> (massive)

**10.9.148. cabel upto 7x 2,5 mm<sup>2</sup> (massive)**  
cabel upto NYM-I 7x 2,5 mm<sup>2</sup> (massive)

**10.9.150. cabel upto 5x 16 mm<sup>2</sup> (massive)**  
cabel upto NYM-I 5x 16 mm<sup>2</sup> (massive)

**10.9.160. cabel upto 5x 2,5mm<sup>2</sup> (flexible)**  
cabel upto 5x 2,5mm<sup>2</sup> (flexible)

**10.9.170. cabel upto 5x 16mm<sup>2</sup> (flexible)**  
cabel upto 5x 16mm<sup>2</sup> (flexible)

**10.9.180. cabel upto 5x 2,5mm<sup>2</sup> shielded (flexible)**  
cabel upto 5x 2,5mm<sup>2</sup> shielded (flexible)

**10.9.190. cabel upto 5x 16mm<sup>2</sup> shielded (flexible)**  
cabel upto 5x 16mm<sup>2</sup> shielded (flexible)

**10.9.200. NHXH E30 upto 3x4mm<sup>2</sup>**  
NHXH E30 upto 3x4mm<sup>2</sup>

**10.9.210. communication cable 800MHz cat.7**  
communication cable 800MHz cat.7

**10.9.215. unitronic bus FD PLP2/FIP**  
unitronic bus FD PLP2/FIP

**10.9.220. weak-power cable 40 x 2 x 0,8**  
weak-power cable 40 x 2 x 0,8

**10.9.230. weak-power cable 16 x 2 x 0,8**  
weak-power cable 16 x 2 x 0,8



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**10.9.240.** **weak-power cable 8 x 2 x 0,8**  
weak-power cable 8 x 2 x 0,8

**10.9.250.** **weak-power cable 2 x 2 x 0,8**  
weak-power cable 2 x 2 x 0,8

**10.9.260.** **weak-power cable 20 x 2 x 0,8**  
weak-power cable 20 x 2 x 0,8

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### 10.10. bus-bar systems

#### techn. description

bus bar 2500A

approx.90% of total length is running horizontally including all necessary accessories for connection and montage.

Distance between supports 1.50m

(5-pole TN-S netform)

All poles must be performed in the same dimension

The system "Type-approved switchgear combination" TSK as per

EN 60 439 - 1. Suitable for indoor areas

Guideline CEI 64-8,

The bus bar system must be delivered as one system. It should include all necessary accessories like e.g direction-changes and cabinet-connections for feed-in.

Straight bus bar parts must be delivered in several lengths and special-length as well.

The supplier has to take care about a low number of connections of the bus bar system and sufficient expansion-parts for length-equalisation over the total length of the system

Further on the supplier has to consider for his calculation

The system considers the possibilities for length expansions in case of temperatur and force-influences. The expansion must be integrated in the straigh-lengtht-parts. Additional expansion-boxes are not permitted.

Each conection must be overlaped and double-screwed. Each connection must be mechanical safe and no need for any maintenance.

The construction must be realized in protection class (IP2X),

The feed-in units for the Q-TRASF (cabinet of RPA) and the Lowvoltage main distribution (LVMD) must be considered by the aforesaid cabinets and it's suppliers.

The necessary fixing devices and accessories must be considered over the length of the bus bar system and calculation

2500A without outgoings

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in part length of 5.00m, 3.00m, 2.00m, special -length  
incl. mounting and fixing-accessories  
fixing height 3.00m  
delivering and assembling

\*\*\* Design-Description 1009  
**techn. data (2500A)**

- 10.10.10.** accord. To Design Description 1009  
**run components 2500A straight length,**  
run components 2500A straight length, 5000 mm  
for feeding  
  
delivering and assembling
- 10.10.20.** accord. To Design Description 1009  
**run components 2500A flexible component**  
run components 2500A flexible component  
for equalisation of different heights  
for feeding  
  
delivering and assembling
- 10.10.30.** accord. To Design Description 1009  
**component for changing direction 2500A (flat / edgewise elbows)**  
component for changing direction 2500A (flat / edgewise  
elbows)  
  
for feeding  
to shift the trunking path axis upwards, downwards, to the right  
or left  
  
delivering and assembling
- 10.10.40.** accord. To Design Description 1009  
**End feed unit - LVMD-ingoing feeder field (2500A)-5pole**  
End feed unit for Lowvoltage main distribution from top, (flat  
elbow) incl. all necessary accessories  
  
delivering and assembling

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- 10.10.50.** accord. To Design Description 1009  
**Feed in connection for main switch LVMD (2500A)-5pole**  
Flexible connection for aforesaid feeder unit for main switch  
connection via braids incl. all accessories  
required for all poles  
  
delivering and assembling
- 10.10.60.** accord. To Design Description 1009  
**End feed unit - QTRASF-outgoing feeder field (2500A)-5pole**  
End feed unit for Lowvoltage main distribution from top, (flat  
elbow) incl. all necessary accessories  
  
delivering and assembling
- 10.10.70.** accord. To Design Description 1009  
**Feed in connection for main switch QTRASF (2500A)-5pole**  
Flexible connection for aforesaid feeder uni LVMD  
for main switch connection via braids incl. all accessories  
  
delivering and assembling
- 10.10.80.** accord. To Design Description 1009  
**Firewall grommet for bus bar 2500A / Rei 120**  
Firewall grommet for bus bar 2500A / Rei 120  
  
by manufacturer and supplier.  
  
delivering and assembling

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### 10.11. installation equipments

#### remarks

All installation devices has to be shown as pattern to the site management for consideration.

Switches, sockets and several devices which are provided in a flush mode must be fixed flushed to the wall.

For all surface mounted devices the installation has to be done with covered screws, for the inlet of the cables it must be guided via glands.

All flush mounted switches and sockets must be delivered with additional screws to the usually used claws.

The possibility for inserting controllamps must given all the time. (even after the installation).

Branch or junction boxes must be performed with a flame retardant material.

In the case of fixing several switches or sockets in row, the frames has to be performed as a adequate combination.

The fixing height is provided with 1.05m FFL (Finished floor level)

Socketes are provided with 0.35m FFL

All switches and sockets in the same installation mode has to be offered in the same performance.

Except 400V-sockets, (CEE-form is required)

400V-sockets:

CEE-performance

all 400V sockets must show the same phase-sequence

The load of all installed switches is not less than 10A

The load of all installed sockets is not less than 16A

In the scopes flammable liquids or gases, an explosion-proofed installation for all devices has to be required.

All the necessary zones must be considered in accordance to the Euro-Norm EN 50014 bis 50028, with ATEX-admittance

All devices must carry the CE-conformation sign

All devices like lamps must be labeled in a permanet way.

Provided in PVC or aluminum, different sizes and different colors - in accordance with is client and the site management

The effort has to be required in the calculation

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The labeling must be done in accordance to the cablelist.

The montage of the switches has to be done in relation and consideration to the door wings and it's opening angle or direction.

For all devices must calculated:  
the delivering, assembling, labeling, inserting and connecting  
the cable, (each single wire is connected)

All devices must fulfill the EMC-guidelines  
A documentation about fulfilling the guidelines is required.

**10.11.10. cable junction boxes 85/85 IP 54**  
cable junction boxes 85/85 IP 54

400 V, surface mounted

incl cable entries  
and cable glands

dimension : 85 x 85 mm

delivering, assembling and connecting

**10.11.20. cable junction boxes 120 x 120 IP54**  
cable junction boxes 120/120 IP 54

400 V, surface mounted

incl cable entries  
and cable glands

dimension: 120 x 120 mm

delivering, assembling and connecting

**10.11.30. cable junction boxes 240 x 160 IP54**  
cable junction boxes 240/160 IP 54

400 V, surface mounted

incl cable entries  
and cable glands

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dimension: 240 x 160 mm

delivering, assembling and connecting

**10.11.40. one gang box for hollow wall 68mm**  
one gang box for hollow wall 68mm

cutting hole Ø 68 mm  
for plate thickness 7 - 28 mm  
4 wiring entries 3 x 1.5<sup>2</sup>  
conduit entries made by means of punch pliers or  
Universal opening cutter  
mounting screws distance 60 mm

delivering and assembling

**10.11.50. push-button (illuminated) flush-mounted , 250 V, white**  
push-button (illuminated) flush-mounted , 250 V, white  
incl. frame  
1-pole 10 A, incl rocker

delivering and assembling

**10.11.60. push-button (illuminated) surface-mounted, 250V,**  
push-button (illuminated) flush-mounted , 250 V, white

1-pole 10 A, incl rocker

delivering and assembling

**10.11.70. socket 230V. (single) flush mounted., white, 16 A,**  
socket 230V. (single) flush mounted., white, 16 A,  
incl. frame  
for raceway montage  
delivering, assembling and connecting

**10.11.80. socket 230V. (single) surface mounted., white, 16 A,**  
socket 230V. (single) surface mounted., white, 16 A,

delivering, assembling and connecting

**10.11.90. socket 230V. (double) flush mounted., white, 16 A,**  
socket 230V. (double) flush mounted., white, 16 A,

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incl. frame  
for raceway montage  
delivering, assembling and connecting

**10.11.100. socket 230V. (double) surface mounted., white, 16 A,**  
socket 230V. (double) surface mounted., white, 16 A,  
  
delivering, assembling and connecting

**10.11.110. socket 230V. (triple) flush mounted., white, 16 A,**  
socket 230V. (double) flush mounted., white, 16 A,  
incl. frame  
for raceway montage  
delivering, assembling and connecting

**10.11.120. fixed connection box , white, 5-pole**  
fixed connection, white, 5-pole  
  
delivering, assembling and connecting

**10.11.130. CEE-socket 16 A, 400 V, 5 P, (surface mounted)**  
CEE-socket 16 A, 400 V, 5 P, (surface mounted)  
  
CEEtyp socket  
  
delivering, assembling and connecting

**10.11.140. CEE-socket 400V, 16 A, raceway-montage, 5-pole**  
CEE-socket 400V, 16 A, raceway-montage, 5-pole  
  
CEEtyp 16A in raceway mounted  
  
delivering, assembling and connecting

**10.11.150. CEE-socket 400V, 32 A, raceway-montage, 5-pole**  
CEE-socket 400V, 32 A, raceway-montage, 5-pole  
  
CEEtyp 32A in raceway mounted  
  
delivering, assembling and connecting

**10.11.160. Socket-distributer 1xCEE 16 A, 2xsocket 230V**  
Socket-distributer 1xCEE 16 A, 2xsocket 230V  
  
Combination unit:



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IEC/EN 60 309-1,2  
IP44.  
enclosure:  
contains:  
1 CEEtyp panel socket 16A, 400 V, 5 P  
2 Schuko-sockets 16 A, 230 V

fuse:  
1 Mini circuit breaker 16 A, 4 P, C  
2 Mini circuit breaker 16 A, 1 P, C'  
terminal block sets'  
delivering, assembling and connecting

**10.11.170. Socket-distributer 1xCEE 16 A,,1xCEE 32A , 2xsocket 230V**  
Socket-distributer 1xCEE 16 A 1xCEE32A, 2xsocket 230V

Combination unit:  
IEC/EN 60 309-1,2  
IP44.  
enclosure:  
contains:  
1 CEEtyp panel socket 16A, 400 V, 5 P  
2 Schuko-sockets 16 A, 230 V

fuse:  
1 Mini circuit breaker 16 A, 4 P, C  
2 Mini circuit breaker 16 A, 1 P, C  
1 Mini circuit breaker 32A, 4 P ,C'  
terminal block sets'  
delivering, assembling and connecting

**10.11.180. power cube 1x CEE 16 A,, 3x socket 230V**  
Socket-distributer 1xCEE 32A, 1xCEE 16 A, 2xsocket 230V

Combination unit:  
IEC/EN 60 309-1,2  
IP44.  
enclosure:  
contains:  
1 CEEtyp panel socket 32A, 400V, 5P  
1 CEEtyp panel socket 16A, 400 V, 5 P  
2 Schuko-sockets 16 A, 230 V

fuse:  
  
1 Mini circuit breaker 32A, 4P, C  
1 Mini circuit breaker 16 A, 4 P, C  
2 Mini circuit breaker 16 A, 1 P, C'

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terminal block sets

delivering, assembling and connecting

**10.11.190. main switch crane (raceway - montage)**

main switch crane (raceway - montage),  
4-pole, 25 A.

delivering, assembling and connected.

**10.11.200. e-stop (flush mounted) raceway montage**

e-stop (flush mounted) raceway montage,  
incl. frame  
for raceway-system  
PVC  
IP 54 with red mushroom and yellow faceplate compatible to  
raceway system

1 NC-contact

1 NO-contact

delivering, assembling and connecting

**10.11.210. e-stop (surface mounted) switch-off e-lighting**

power cube with all necessary accessories like chains, hooks  
etc...

location according to the site management/client

delivering, assembling and connecting

**10.11.220. cable junction boxes (functionality 30min.)**

incl. 10 terminal blocks for safety lights  
terminal size upto 6mm<sup>2</sup>

delivering, assembling and connecting

**10.11.230. data socket 2xRJ45**

data socket 2xRJ45

Cat.7, with accessories

800MHz

incl. measuring of the socket / cable

delivering, assembling and connecting

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### 10.12. illumination

#### remarks

The illumination of each room should be done in accordance to the guideline EN 12464 5035 .

All lamps must carry the CE-confirmation sign  
consider: specification for lighting fittings for service voltages below 1000V.

The number of lamps belongs to the illumination-calculation. (in accordance to specification).

The lamps must be specified for an ambient temperature of 35°C. Further on the protection class I , class II (lamps with PVC-body) must be confirmed.

All lamps must be according to each enviromental condition and carrying the required protection-signs.

Safetylights like pictograms must be performed with all the essential prints

The stand-by safetylights will be integrated into the normal-illumination with several lamp-types or e-light elements in lightband performance.

Further on all lamps which are belonging to the emergency lighting system must be labeled in accordance to the e-lighting scheme.

The offered price must contain all accessories and aux. constructions. Further on it should contain the internal wiring for one or three phase wiring mode of the lightband-performance.

Following conditions should be considered:

All lamps must be outfitted with fluorescent lamps /fluorescent tubes TL-D-type

Lightcolor code 830 warm-white (in acc. to the client)

Lightcolor code 840 cool-white (in acc. to the client)

In case of pendular montage, the supplier has to be consider the effort (with necessary details)

The fixing can be done on brickwork or concrete, walls, ceilings or several steel-constructions.

Before the order of the lamps is done, each montage-location needs clarification with the site management.

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All lamps should be outfitted with electronic balasts or/and lowlost-balast

Including all illuminants

In case of fixing the lamps in a flush mode, the supplier has to manage the location together with the manufacturer of the ceiling on his own.

Lightband performance with mounting-rails

(illumination mounting rail)  
the rail system on the 2nd floor  
guiding and leading cables/wires for the illumination via the rail  
and montage of the lamps [type: surface mounted lamps]

(mounting rail sheet-steel)  
the rail system in the ground floor and mezzanine  
guiding integrated three-phase wiring system inside of the  
profile  
The gaps between the mounted lamps must be closed by blind  
plates.  
[type: T 1,2,3,4,8,12]

In the case of mounting e-light elements (type 12), the different  
size of the plates must be considered because of closing the  
gaps between with different lengths.

all necessary accessories has to be considered into the  
calculation

**10.12.10. suspension (illumination mounting rail)**  
all necessary accessories  
like knod-chain, screws ,clamps, hooks etc.

for different fixing heights  
delivering and assembling.

**10.12.20. suspension (mounting rail sheet-steel)**  
all necessary accessories  
like knod-chain, screws ,clamps, hooks etc.

for different fixing heights  
delivering and assembling.

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**10.12.30. Type 1 Lightband-lamp 1x58W (IP20)**

Type 1 Lightband-lamp 1x58W (IP20)

lightbandlamp with reflector (trapeze),

protection class I

pendular montage on lightband-rail  
parallel compensation

balast (low-loss)

white (RAL 9016)

L=1530mm

d=167mm

h=140mm

1xTL-D58W

delivering, assembling and connecting

**10.12.40. Type 2 Lightband-lamp 2x58W (IP20)**

Type 2 Lightband-lamp 2x58W (IP20)

lightbandlamp with reflector (trapeze),

protection class I

pendular montage on lightband-rail  
parallel compensation

balast (low-loss)

white (RAL 9016)

L=1530mm

d=226mm

h=140mm

2xTL-D58W

delivering, assembling and connecting

**10.12.50. Type 3 Lightband-lamp 1x58W (IP20)**

Type 3 Lightband-lamp 1x58W (IP20)

lightbandlamp with reflector (trapeze),

protection class I

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pendular montage on lightband-rail  
parallel compensation

balast (low-loss)

white (RAL 9016)  
L=1530mm  
d=226mm  
h=140mm

1xTL-D58W

delivering, assembling and connecting

**10.12.60. Type 4 Lightband-lamp 2x58W reflector (IP20)**  
Type 4 Lightband-lamp 2x58W reflector (IP20)

lightbandlamp with reflector facette-grider

protection class I

pendular montage on lightband-rail  
parallel compensation

balast (low-loss)

white (RAL 9016)  
L=1530mm  
d=189mm  
h=171mm

2xTL-D58W

delivering, assembling and connecting

**10.12.70. Type 6 Lightband-lamp 2x49W reflector (IP20)**  
Type 6 Lightband-lamp 2x49W reflector (IP20)

lightbandlamp with reflector facette-grider

protection class I

surface mounted

balast (electronic)  
pendular montage on lightband-rail  
parallel compensation

balast (low-loss)

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white (RAL 9016)  
L=1300mm  
d=318mm  
h=55mm

2xTL5-49W

delivering, assembling and connecting

**10.12.80. Type 8 Lightband-lamp 2x58W (IP20)**  
Type 8 Lightband-lamp 2x58W (IP20)

lightbandlamp with reflector facette-grider

protection class I

pendular ,montage

balast (electronic)

white (RAL 9016)  
L=1530mm  
d=189mm  
h=171mm

2xTL-D58W

delivering, assembling and connecting

**10.12.90. Type 9 1x58W damp location (IP66)**  
Type 9 1x58W damp location (IP66)

damp location lamp

protection class I

pendular or surface montage

balast (electronic)

L=1600mm  
d=100mm  
h=92mm

1xTL-D58W

delivering, assembling and connecting

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**10.12.100. Type 10 2x58W damp location (IP66)**

Type 10 2x58W damp location (IP66)

damp location lamp

protection class I

pendular or surface montage

balast (electronic)

L=1600mm

d=140mm

h=92mm

2xTL-D58W

delivering, assembling and connecting

**10.12.105. Type 11 2x58W ex-lamp**

Type 11 2x58W

ex-lampe

valid for ATEX 1,2,21 and 22

pendular or surface montage

L=1632mm

d=188mm

h=130mm

2xTL-D58W

delivering, assembling and connecting

**10.12.110. Type 12 e-light element E27-base**

Type 12 e-light element E27-base

incl. coverplate for intergration as lightband-performance  
and incandescent lamp

fixed in mounting-rail

delivering, assembling and connecting



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**10.12.120. Type 14 wall-lamp 2x26W surface mounted (IP44)**  
Type 14 wall-lamp 2x26W surface mounted (IP44)

wall mounted

IP 44  
protection class I

2x TC-DEL/26W

base G24q-3

delivering, assembling and connecting

diameter: 390mm  
height: 110mm

(electronic balast)

delivering, assembling and connecting

**10.12.130. illumination mounting rail (hot-dip galvanized)**  
illumination mounting rail (hot-dip galvanized)

(2nd. floor scope utilities)

for fixing lamps in pendular or surface montage  
1.5mm thick

50mm x 45mm

6.00m delivering length  
(including cutting)

for type 9+10  
(damp location)

delivering and assembling( in parts or complete)

**10.12.140. mounting rail sheet-steel (1 lamp-unit)**  
mounting rail sheet-steel (for 1 lamp-unit)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

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compatibel for Type 1,2,3,4,8,12

delivering, assembling and connecting

**10.12.150. mounting rail sheet-steel (3 lamp-unit)**  
mounting rail sheet-steel (for 3 lamp-unit)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

delivering, assembling and connecting

**10.12.160. mounting rail sheet-steel (3 lamp-unit / 1 blind plate)**  
mounting rail sheet-steel (for 5 lamp-unit / 2 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

delivering, assembling and connecting

**10.12.170. mounting rail sheet-steel (5 lamp-unit / 2 blind plate)**  
mounting rail sheet-steel (for 5 lamp-unit / 2 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

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compatibel for Type 1,2,3,4,8,12

delivering, assembling and connecting

**10.12.180. mounting rail sheet-steel (5 lamp-unit / 3 blind plate)**  
mounting rail sheet-steel (for 5 lamp-unit / 3 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

delivering, assembling and connecting

**10.12.190. mounting rail sheet-steel (49 lamp-unit / 32 blind plate)**  
mounting rail sheet-steel (49 lamp-unit / 32 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 32

delivering, assembling and connecting

**10.12.200. mounting rail sheet-steel (39 lamp-unit / 27 blind plate)**  
mounting rail sheet-steel (39 lamp-unit / 27 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

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number of blind plates: 32

delivering, assembling and connecting

**10.12.210. mounting rail sheet-steel (7 lamp-unit / 3 blind plate)**  
mounting rail sheet-steel (7 lamp-unit / 3 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 3

delivering, assembling and connecting

**10.12.220. mounting rail sheet-steel (16 lamp-unit / 12 blind plate)**  
mounting rail sheet-steel (16 lamp-unit / 12 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 12

delivering, assembling and connecting

**10.12.230. mounting rail sheet-steel (9 lamp-unit / 4 blind plate)**  
mounting rail sheet-steel (16 lamp-unit / 4 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

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compatibel for Type 1,2,3,4,8,12

number of blind plates: 4

delivering, assembling and connecting

**10.12.240. mounting rail sheet-steel (2 lamp-unit)**  
mounting rail sheet-steel (2 lamp-unit)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 0

delivering, assembling and connecting

**10.12.250. mounting rail sheet-steel (4 lamp-unit / 2 blind plate)**  
mounting rail sheet-steel (4 lamp-unit / 2 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 2

delivering, assembling and connecting

**10.12.260. mounting rail sheet-steel (33 lamp-unit / 16 blind plate)**  
mounting rail sheet-steel (33 lamp-unit / 16 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel

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colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 16

delivering, assembling and connecting

**10.12.270. mounting rail sheet-steel (10 lamp-unit / 6 blind plate)**  
mounting rail sheet-steel (10 lamp-unit / 6 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 6

delivering, assembling and connecting

**10.12.280. mounting rail sheet-steel (15 lamp-unit / 7 blind plate)**  
mounting rail sheet-steel (15 lamp-unit / 7 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 7

delivering, assembling and connecting

**10.12.290. mounting rail sheet-steel (16 lamp-unit / 10 blind plate)**  
mounting rail sheet-steel (16 lamp-unit / 10 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

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made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 10

delivering, assembling and connecting

**10.12.300. mounting rail sheet-steel (30 lamp-unit / 15 blind plate)**  
mounting rail sheet-steel (30 lamp-unit / 15 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates:15

delivering, assembling and connecting

**10.12.310. mounting rail sheet-steel (27 lamp-unit / 13 blind plate)**  
mounting rail sheet-steel (27 lamp-unit / 13 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 13

delivering, assembling and connecting

**10.12.320. mounting rail sheet-steel (13 lamp-unit / 8 blind plate)**  
mounting rail sheet-steel (13 lamp-unit / 8 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

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IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 8

delivering, assembling and connecting

**10.12.330. mounting rail sheet-steel (4 lamp-unit)**  
mounting rail sheet-steel (7 lamp-unit / 5 blind plate)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 2

delivering, assembling and connecting

**10.12.340. mounting rail sheet-steel (7 lamp-unit / 4 blind plate)**  
mounting rail sheet-steel (7 lamp-unit / 4 blind plates )

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 2

delivering, assembling and connecting



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**10.12.350.** **mounting rail sheet-steel (17 lamp-unit / 11 blind plate)**  
mounting rail sheet-steel (for 17 lamp-unit / 11 blind plates)

for wiring inside three-phase mode  
(5x2,5mm<sup>2</sup>)

IP20

made of sheet-steel  
colour: white

compatibel for Type 1,2,3,4,8,12

number of blind plates: 2

delivering, assembling and connecting

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### 10.13. emergency lighting system

#### emergency lighting system

The cost of the emergency lighting system contains all required power-ratings like wiring and connecting of all ingoing/outgoing cables. The connection will be done via terminal-blocks in the cabinet.

Further on it is required that all connections to the lamps and it's installation (mounting and fixing) will be done by the supplier. The supplier has to take care for labeling/marketing of all in-and outgoing cables on the cabinet-side and on the lamps as well. The labeling/marketing of the cables must be done in a permanent- way.

The labeling of the cabinet itself will be done after consulting the client.

The power ratings of the emergency lighting system is also containing the comissioning and the montage at all.

#### Central Battery System

Central battery system CB-S to supply power to 230V/216V AC/DC safety and exit luminaires, complies with EN 50171, EN 50272, with automatic test device and individual luminaire monitoring in conjunction with system-dependent electronic ballasts including monitoring module, without additional data cable.

The switching mode of each of the safety and exit luminaires with system-dependent electronic ballasts or monitoring modules can be programmed as required in the control module of the central battery system. An additional data cable to the luminaires is not required.

It should possible to combine operation of maintained light, switched maintained light and non-maintained light in a single common circuit.

All operating modes can be assigned retrospectively without modifying the luminaire installation. A choice of the operation modes maintained light and non-maintained light with contingently slide switch, coding switch or a respectively jumper on the monitoring module or EVG is not allowed.

Electronic units in service-friendly modular design, wired up ready for connection on 3-level isolating neutral terminals 4 sqmm (AWG 11) with PE connection. The modules have quick-release locks that make them easy to fit and replace. Simple

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connection method with plug-on terminals on the modules.

Connections are made from above or below onto shock-proof terminals. With optional built-in terminal block for battery and mains supplies to the substations, including fusing. Modular plug-on design.

Bus technologies

The 2-pole, bi-directional CB-S data bus in series integrated in the control module is used for data communication between the Central Battery System and connected substations or monitoring devices like CG-Controller (or visualisation software). With an optional available interface-box each Building Management technology can communicate with the systems via the CB-S bus.

Alternative each Building Management System which is OPC compatible can be connected to the CG-S bus via an optional available OPC Server and interface-box.

So the CG-S Bus has the possibility to call off voluminous status messages and control commands without additional modules.

The following data can be communicated in this way:

- Output data, e.g., system blocked, deep discharge protection, battery open circuit, battery voltage, current and temperature, insulation fault, charger / booster malfunction, bus communication error, mains failure, circuit malfunctions etc.
  - Input commands, e.g., start function test, start and cancel operating time test, manual reset, block and release device
- 16 virtual input switches enable via external LONsensors to switch independently circuits or even separate luminaires.

Status and error messages of individual luminaires of each circuit are recallable due to send the circuit number to the system via the CG-S bus.

External units such as the 3-phase bus module, are connected with the RS485 bus.

Only the power supply cable is required for communication with the system-dependent luminaires.

The central system uses a search function to automatically find the system-dependent luminaires and modules that were addressed when the system was installed.

Control module

A user-programmable control module with non-volatile program memory and 4-line alphanumeric display monitors and controls the central battery system. All functions such as charging,

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mains/emergency lighting selection and deep discharge protection of the devices and the emergency luminaires are tested automatically. Any faults that occur are signalled immediately.

An interface enables a central monitoring facility to be connected.

In the event of a short circuit or open circuit in current loops, differential monitors immediately power on the system (maintained light) or put the system in readiness.

Display:

4 x 20 characters, backlit, program adjustable contrast and brightness

Readouts:

Battery voltage, battery charge current (+), battery discharge current during test or in case of fault (-), charging malfunction, luminaire fault indicating the location in plain text, deep discharge protection, manual reset, time-delayed emergency light (remaining time in minutes), test operation, date/time, insulation fault indicating the faulty circuit, UV-AV failure (indicating the location in plain text), fault information, programming information, logbook.

LED indicators:

Run, mains operation, battery operation, group fault

Sealed keypad:

- separate keys for system test, function test, operating duration test

- 3 programmable function keys for e.g.: system disable/enable, manual reset, maintained light On/Off, show fault list, through lighting On/Off, mains failure simulation UV

- 7 control keys for user-friendly navigation in polling and programming mode.

Each module also has its own service button which can be used to view directly the current module status in the display.

Programming possibilities:

individual luminaire monitoring, current value monitoring, individual name per device, circuit, luminaire and bus-module, device address, selective manual reset, delay on mains return (1-15 min.), selective emergency light, LON switch, timer function, automatically function and battery duration test, selection of menu language.

Connection for disable switch:

Control loop for disabling the installation during factory shutdowns with differential loop monitoring for short-circuit and open circuit detection.

Differential monitoring: Short-circuit or open circuit result in readiness for operation of the system.

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Connection for phase monitor:

24 V current loop for requesting emergency lighting using differential loop monitoring for the detection of short and open circuits.

Differential monitoring: Short-circuit or open circuit result in the immediate power on (maintained light) of the system.

Connection for floating signalling contacts and buzzer:

3 floating relays, each 1 x UM, 24 V 0.5 A; buzzer

One or more of 11 different signals can be assigned to each floating contact or to the buzzer. Freely programmable, DIN VDE 0108 requirement can be called at any time as a preset.

Connection for 24V inputs:

4 off user-assignable 24V inputs, can be programmed negated or non-negated for, e.g.

Function test start/cancel, operating duration test start/cancel, system disable/enable, manual reset, maintained light On/Off, power on safety lighting as through lighting.

Smart media card:

Storage card for archiving the device configuration and mandatory test log information for at least 2 years.

Provides storage for:

- 300,000 test log entries
- Location texts for the luminaires (20 characters per luminaire)
- Location texts of external modules such as phase monitor, (20 characters per module)
- Names of the circuits (20 characters per circuit)
- System name (20 characters)

Can be programmed offline on a PC

Charging technology

The completely sealed, low-maintenance lead batteries are carefully charged using a microprocessor-controlled I/U charging characteristic with temperature control. Depending on the charge state of the batteries, boost charging is activated to allow the batteries to be charged without exceeding the gassing voltage. The patented charge monitoring process continuously checks the charge and immediately signals faults such as battery open circuit, a faulty charging module or a high-resistance cell.

- With insulation tester
- Depending on battery size, with additional boost charger with electrical isolation
- LED indicators for charging module on, boost charging on, battery capacity > 10%, > 50%, 100%, insulation fault, charging malfunction, mains present
- Floating contacts for charging malfunction, boost charging, insulation fault

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- Temperature sensor built into battery cabinet

### Circuit modules

The circuit changer supplies and monitors emergency luminaires with electronic ballasts for DC operation and incandescent lamps. The intrnal monitor checks the function of the luminaires that are connected to the system.

- Up to 20 luminaires can be monitored per circuit with individual status display
- Combined operation of maintained light, switched maintained light and non-maintained light within one circuit is possible. An additional data cable to the luminaires is not required.
- Output voltage in battery mode: 216V DC
- Individual circuit changing (mains / battery) for each emergency lighting circuit (typical switchover time: 200ms),
- User programming for maintained light, switched maintained light or non-maintained light,
- Separate fusing for mains and battery operation (two-pole),
- Fuses easily accessible on the front of module,
- When there is one phase-to-ground fault in AC operation, fault-free DC operation can continue,
- permanent monitoring of the AC - fuse
- LED indicates fault and Run/ON for each circuit
- service button, used to view directly the current module status in the display
- at 3phase feeding selective mains- / battery switchover per phase / module carrier
- automatically luminaire search function

### External 3Ph Bus Module (as three phase monitor)

The external 3PH bus module for installation in sub-distribution boards for the general lighting can be used as a phase monitor and for light switch polling (DLS) for the common switching of safety and general lighting systems.

8 inputs (2.5 sqmm) with LED indicators or 5 inputs combined with 3 phase monitor inputs can be activated by a selector switch.

Monitoring thresholds comply with DIN EN 60598-2-22: 60-85% UNOM.

Connection of RS485 bus and 24 V module supply.

Addressable by decode switch, LEDs for Fault, ON status and Run.

Enclosure for DIN rail mounting.

User-programmable assignment of independent DLS inputs for each emergency light circuit or luminaire as well as individual name per bus-module in the control module.

When using as a 3 phase monitor the detailed phase failure information with location of the mains distribution board will be displayed in the control module.

Event printer

For logging and storage of operating states on a CB-S

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installation or US-S substation  
With built in 4-needle-printmechanism.

Relay module  
Relay module for signalling the following operating states using potential-free contacts:  
Emergency/mains operation, emergency lighting/charging failure, deep discharge protection, function test on/off, operating time test on/off.  
8 pcs. LED indicators for indications given above

**blocking function: (incl. in the central batterie system)**

the central batterie system must be outfitted with an blocking function which gives the possibility to switch off all outgoing lines. The blocking function is cutting off the batterie from the system,  
The cut-off must be released by a seperated switch as an e-stop function

**10.13.10. central battery system 63Ah**

Central Battery System CB-S with automatic test device and individual luminaire monitoring with individual status- and names-display per luminaire in the control module in conjunction with system-dependent electronic ballasts including monitoring module. An additional data cable to the luminaires is not required.

The switching mode of each of the safety and exit luminaires with system-dependent electronic ballasts or monitoring modules can be programmed as required in the control module of the central battery system without an additional data cable to the luminaires. Combined operation of maintained light, switched maintained light and non-maintained light within one circuit is possible.

**Rated operating time: 2 h**  
**Recharging time: 12 h**

Comprising of:

Microprocessor control module with a transportable logbook and configuration memory (smart media card) and a bi-directional CG-S - bus interface

Charging system with microprocessor controlled and temperature guided charging and the number of charging modules and boost chargers required for battery charging in conformity with standards

1 pcs. off steel sheet stand-alone cabinet with partial viewing door,

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Dimensions: h = 2050 mm, w = 800 mm, d = 400 mm,  
Enclosure class: Electronics cabinet IP 21, Safety class I,  
Cable entry from above or below,  
Right-hinged door, two-way lock  
Exterior paint finish: Textured powder paint (epoxy polyester),  
Colour: RAL 7035 light grey.  
..... off cabinet plinth, 100 mm high, finished in RAL 7035 light grey  
..... off cabinet plinth, 200 mm high, finished in RAL 7035 light grey

Wired ready to connect on 3-level isolating neutral terminals 4 mm<sup>2</sup> with PE connection,  
accepts max. 26 variable modules and terminal block for up to 6 fused battery and mains feeders to substations. L.v.h.b.c. load disconnecter for mains and battery supply, conductor size 50 mm<sup>2</sup>

Fitted with:

**50** off user-programmable final circuits 3 A nominal current / fusing 5 A,  
individual circuit changing (mains / battery) for each circuit (typical switchover time: 200ms), separate fusing AC / DC, permanent monitoring of the AC - fuse, service button, up to 20 luminaires can be monitored, fault-free DC operation during one phase-to-ground fault

**1 off OGiV block battery 63 Ah / 216V built-in:**  
1 off battery cabinet, h x w x d 2050 x 800 x 400 mm

..... off cabinet plinth battery cabinet, 100 mm high, finished in RAL 7035 light grey  
..... off cabinet plinth battery cabinet , 200 mm high, finished in RAL 7035 light grey  
(incl. 25% ageing reserve acc. to EN 50171)

delivering, assembling at site  
connecting all ingoing and outgoing cables

**10.13.20. monitoring module incandescent lamps**  
**monitoring module incandescent lamps**  
(for e-light element acc. to Pos.:10.12.120)

monitoring module with address-switches for 20 addresses in flame retardant polycarbonate enclosure to UL 94-VO. To be installed in protection class I and II luminaires. For function monitoring of loads between 4 - 150 W (fluorescent lamps with high frequency electronic ballast, tungsten halogen lamps with electronic transformer and incandescent lamps).



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Switching modes (maintained/non-maintained and switched emergency luminaries) freely programmable with suitable emergency lighting system. Mixed operation possible in a single circuit. Without additional data line. The module is available for installation inside a luminaire or, with special fixing plate, for external installation. Max. distance luminaire 500 m

Permissible temperature range:

-10°C up to +50°C

Lamp:

- for 4-150 W

Voltage: 230 V 50/60 Hz, 220 V DC +25/-20 %

Loop terminals: 2.5 mm<sup>2</sup>

Dimensions (mm): H = 27.5; L = 140; W = 39

Degree of protection: IP 20

Accessories:

- Mounting plate with pull-relief

Dimensions (mm): L = 350, W = 57, H = 41

### 10.13.30. e-luminaire wall mounted

Emergency Luminaire acc. EN 60598-1, EN 60598-2-22 and EN 1838. Luminaire with single sided, smoothed light emission surface, made of: quick mounting set, body of luminaire with EVG (automatic cut-off for failures within the lamp circuit), clear cover with three self-adhesive legend foils. Luminaire enclosure made of 850°C glow wire resistant, halogen-free polycarbonate. Mounting without tools onto the quick mounting set.

EVG with ENEC-test mark, certified from an independent testing lab, with integrated monitoring facility. Allows single luminaire monitoring with address-switches for 20 addresses.

Switching modes (maintained/non-maintained and switched emergency luminaries) freely programmable with suitable emergency lighting systems. Mixed operation possible in a single circuit.

Marking: single-sided with legend foil

Viewing distance: 32 m

As Emergency Luminaire without legend foil:

Max. spacing between luminaire/luminaire and clear cover= 14 m

(mounting high = 5 m, C0 level, Emin = 1.25 lx, (luminous flux at the end of the rated duration)

Voltage range: 230 V 50/60 Hz, 220 V DC +25/-20%

Current drawn (battery operation): 30 mA

Power consumption: 16 VA

Permissible temperature range: -10°C up to +40°C

Loop terminals: 3 x 2.5 mm<sup>2</sup>

Insulation class: II, Degree of protection: IP 41

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Colour of enclosure: RAL 7032  
Inclusive lamp: 8 W T16, 450 lm  
Dimensions (mm): L = 340, H = 197, D = 60

Accessories:

- Wall bracket with quick mounting set
- Chain fastening clip incl. quick mounting set
- Pendulum set with wall bracket/termination box and quick mounting set and 90° angle
- Pendulum set IP 54 with quick mounting set
- IP 54 Set
- Wire guard
- Opaque cover
- Clear cover, silk screened structure

**10.13.40. e-luminaire two-sided ceiling mounted**

Exit Luminaire acc. EN 60598-1, EN 60598-2-22 and EN 1838.  
Luminaire with single sided, smoothed light emission surface,  
made of: quick mounting set, body of luminaire with EVG  
(automatic cut-off for failures within the lamp circuit), clear cover  
with three self-adhesive legend foils. Luminaire enclosure made  
of 850°C glow wire resistant, halogen-free polycarbonate.  
Mounting without tools onto the quick mounting set.  
EVG with ENEC-test mark, certified from an independent testing  
lab, with integrated monitoring facility. Allows single luminaire  
monitoring with address-switches for 20 addresses.  
Switching modes (maintained/non-maintained and switched  
emergency luminaires) freely programmable with suitable  
emergency lighting systems. Mixed operation possible in a  
single circuit.

Marking: double-sided with self-adhesive legend foils  
Viewing distance: 32 m  
Voltage range: 230 V 50/60 Hz, 220 V DC +25/-20%  
Current drawn (battery operation): 30 mA  
Power consumption: 16 VA  
Permissible temperature range: -10°C up to +40°C

Loop terminals: 3 x 2.5 mm<sup>2</sup>  
Insulation class: II, Degree of protection: IP 41  
Colour of enclosure: RAL 7032  
Inclusive lamp: 8 W T16, 450 lm  
Dimensions (mm): L = 340, H = 200, D = 60

Accessories:

- Wall bracket with quick mounting set
- Chain fastening clip incl. quick mounting set
- Pendulum set with wall bracket/termination box and quick mounting set
- Pendulum set IP 54 with quick mounting set

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- IP 54 Set

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**10.13.50. three phase monitoring module**

three phase monitoring module  
mounted in each cabinet

External 3phase bus module

The external bus module for installation in sub-distribution boards for the general lighting can be used as a phase monitor and for light switch polling for the common switching of safety and general lighting systems.

8 inputs (2.5 sqmm) with LED indicators or 5 DLS inputs combined with 3 phase monitor inputs can be activated by a selector switch.

Monitoring thresholds comply with DIN EN 60598-2-22: 60-85% UNOM.

Connection of RS485 bus and 24 V module supply.

Addressable by decode switch, LEDs for Fault, ON status and Run.

delivering, assembling and connecting

**10.13.60. Type 15 safety light with clear screen IP41, 8W-T16**

safety light with clear screen

8W T16

2nd. floor scope of utility

protection class I

IP 41

surface montage

delivering, assembling and connecting

**10.13.70. programming and instruction**

Programming of all basics of the centralbattery-system.

Introduction for the staff by a certified engineer of the supplying company.

**10.13.80. scheme of emergency lighting system**

Scheme and drawings with terminalblock-plan

Each line must be drawn in a common scheme.

All datas like cable dimension, -type, -lamp-type, location of the

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lamps, etc..., must be given in the scheme

The drawing is in acc. to revision docs (3-times)

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**10.14. special ratings**

\*\*\* Design-Description 1010  
**openings floor and wall**

**The measure for all drillings requires the accordance of the site management.**

(all additional efforts for the ratings has to be considered in the calculation)

manufacturing the wall- and ceiling-breakthroughs upto diameter 250mm .

**10.14.10. opening size 25 x 50 cm in concrete**  
opening size 25 x 50 cm in concrete

manufactured

**10.14.20. drillings D = 50 mm in concrete**  
drillings D = 50 mm in concrete

manufactured

**10.14.30. drillings D = 100 mm in concrete**  
drillings D = 100 mm in concrete

manufactured

**10.14.40. drillings D = 200 mm in concrete**  
drillings D = 200 mm in concrete

manufactured

**10.14.50. opening size 10 x 10 cm in brickwork**  
opening size 10 x 10 cm in brickwork

manufactured

**10.14.60. opening size 25 x 50 cm in brickwork**  
opening size 25 x 50 cm in brickwork

manufactured

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**10.14.70. manufacturing slots in brickwork**  
in brickwork dimension = 100 x 30 mm, incl. tools and machines.

manufactured

**remarks cable installation systems**

**10.14.80. isolation- rubber mat for cabinets and s-gears**  
rubber mat per meter  
required for electrical service rooms  
dielectric strength/voltage <50kV  
shifting over the length of the switchgears and cabinets in all scopes

delivering and assembling

**10.14.90. safety equipment and tools**  
safety helmet with visor  
and NH-safety-handhold  
several revision-shields and markers for each cabinet or switchgear  
sufficiently equipped for all cabinets and switchgear

delivering and assembling

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**10.15. documents**

**10.15.10. Starting UP and Test Operation**

Starting UP and Test Operation

After finishing installation, the systems have to be started up.

The systems and the components must be adjusted, so that the functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the testl operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

**10.15.20. Instruction of Operation Personal**

Instruction of Operation Personal

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.



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The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

**10.15.30. Revision Documentation**  
Revision Documentation

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

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**10.15.40. Acceptance by Legal Experts**

Acceptance by Legal Experts

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate files.

The customer has to supply these inspections by sending his commissioning personal so much as it is necessary.

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**11.** **BAC - Building automation and control**

**11.1.** **User software and process graphics**

**11.1.10.** **MAC AHU left wing 1 + 2**

Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

shared:  
DO/AO/DI/DIC/AI

**11.1.20.** **MAC AHU right wing 1 + 2 + parking area**

Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

shared:  
DO/AO/DI/DIC/AI

**11.1.30.** **MAC water supply**

Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

shared:  
DO/AO/DI/DIC/AI

**11.1.40.** **MAC chassis dyno**

Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

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shared:  
DO/AO/DI/DIC/AI

**11.1.50. MAC ED 1 - 4**  
Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

shared:  
DO/AO/DI/DIC/AI

**11.1.60. MAC ED 5 - 8**  
Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

shared:  
DO/AO/DI/DIC/AI

**11.1.70. MAC ED 9 + 10**  
Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

shared:  
DO/AO/DI/DIC/AI

**11.1.80. MAC ED 11 - 15**  
Provision of user software and process graphic for all systems and functions acc. to description for the listed switch cabinets.

datapoints see the data sheets

physical:  
DO/AO/DI/DIC/AI

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shared:  
DO/AO/DI/DIC/AI

**11.1.90. Change of user software and process graphic**  
Costs per data point (DE/DA/AA/AE/controller/rated value) incl. all change work from user program up to visualization, incl. change of all documentation documents as described at "Provision of user software".

A change exists at:  
- additional hardware equipment or  
- additional programming of controllers, rated values  
- program changes after inspection of system

**11.1.100. Notification matrix failure case (SMS; fax, email)**  
Coordination, generation and equipment of a notification matrix sending a short message in SMS or in fax shape to a determined person subgroup in case of a failure (SMS; fax, email). (See also specification of management system)

These notifications will be sent by the management system.

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### 11.2. Hardware

The following prices are including delivery, installation in switch cabinet, complete wiring and cabling, wiring of all inputs/outputs to clamps, all accessories and small parts required for operation, initial operation, system manuals (in German language) etc. System software shall be installed ready to operate to the systems.

The system shall have a reserve at existing inputs and outputs as well as CPU capacity (command set etc.), memory capacity of 30% (after planning of construction level 2).

The same applies for the plug-in area reserves in assembly group supports.

All assembly groups shall have the CE-identification.

Ethernet with TCP/IP will be used for the communication in entire system.

Measurement transformers required for the connection of e.g. passive signal transmitters shall be included in the unit prices of related assembly groups.

Temperature sensors e.g. PT 100 in 2, 3, 4-conductor technology will be connected directly to the AI\_assembly group.

Analog input assembly groups shall only be selected acc. to attached approval list for assembly groups.

Each automation station shall have the possibility for complete operation and inquiry via a mobile OS-station for maintenance and inspection purposes.

#### 11.2.10. Automation station; 1MByte MC, 2x DP

Selection acc. to function capacity and consideration of attached approval list for hardware components.

cycle time max. 300 ms

2 x ProfibusDP interfaces Master/Slave  
(integrated or extending the controller with max. 2 ProfibusDP-assembly groups)

Incl. Memory Card RAM 1MByte  
(at least 2\*CPU-memory and 30 % reserve at the inspection)

Incl. interface for connection to a local operation panel (BUS offered same as panel)

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- 11.2.20. Power supply assembly group - 10A**  
Supply voltage: 120/230VAC  
Exit voltage: 5/10V  
  
Current: max. 10A  
  
matching controller
- 11.2.30. Power supply assembly group - 20A**  
Supply voltage: 120/230VAC  
Exit voltage: 5/10V  
  
Current: max. 20A  
  
matching controller
- 11.2.40. Communication - Ethernet**  
Communication assembly group for connection to Industrial Ethernet
- 11.2.50. Communication - ProfibusDP - 256 participants**  
Communication assembly group for connection of an additional ProfibusDB riser (256 participants)
- 11.2.60. Communication - ProfibusDP - 64 participants**  
Communication assembly group for connection of an additional ProfibusDB riser (64 participants)
- 11.2.70. Assembly group support for 18 plug-in stations**  
Number of plug-in stations: at least 18 (units)  
  
matching controller
- 11.2.80. Assembly group support for 9 plug-in stations**  
Number of plug-in stations: at least 9 (units)  
  
matching controller
- 11.2.90. Bus connection - offset assembly groups ProfibusDP**  
Bus connection - assembly group for connection of decentral I/O

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assembly groups to the controller

Protocol: ProfibusDP

**11.2.100. Digital inputs - 4 DI**  
Plug-in module on terminal base with 4 inputs

spring clamp (also for cord)

Short-circuit protection, diagnosis function per input  
status display per channel  
status display module  
potential separation to system bus  
wire break proof function is possible

**11.2.110. Digital outputs - 4 DO**  
Plug-in module on terminal base with 4 outputs

spring clamp (also for cord)

switch capacity 24VDC 0.5 A

Short-circuit protection, diagnosis function per input  
status display per channel  
status display module  
potential separation to system bus  
wire break proof function is possible

**11.2.120. Analog inputs - 2 AI**  
Plug-in module on terminal base with 2 inputs

spring clamp (also for cord)

Short-circuit protection, diagnosis function per input  
status display per channel  
status display module  
potential separation to system bus  
wire break proof function is possible

potential separation: per channel

definition: 15 bit

0(4)-20mA, 0(2)-10V, thermal elements, PT100/1000,  
Ni100/1000

characteristic linearization



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cycle time per input: < 5 ms

**11.2.130. Analog outputs - 2 AO**  
Plug-in module on terminal base with 2 inputs

spring clamp (also for cord)

Short-circuit protection, diagnosis function per input  
status display per channel  
status display module  
potential separation to system bus  
wire break proof function is possible

potential separation: per channel

definition: 13 bit or more

0(4)-20mA, 0(2)-10V

integration time: < 30 ms

converter time per channel: < 100 ms

smoothing input signal is possible

**11.2.140. Operation panel - planning software**  
Software for planning of operation panel  
license: single license

incl. manual (English)

matching operation panel

**11.2.150. Operation panel**  
Display: 4x20 symbols (alphanumeric)  
Lighting: yes  
Keyboard: 22 system keys (cursor, numbers)  
and at least 8 function keys  
License: single station

incl. manual (English), connection kit, BUS plug with final resistance

Connection to system bus (e.g. ProfibusDP etc.) matching controller

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**11.3. Switch cabinet**

**11.3.10. Switch cabinet field**

Modular switch cabinet with galvanized installation panel, potential equalization and shielding rail with connection elements to modular switch cabinet as well as PVC ducts for the internal wiring, cable propping bar at least 15 cm above base, in feeding panel also higher, each acc. to bending radius of cable.

Delivery with a lateral wall or EMV partition, if required.

All switch cabinet components are highly effectively grounded (electrically connected with each other)

Larger 600 mm equipped with two-wing doors.  
Division then in 1200 mm width double-wing panels

Doors have 180 degrees opening angle and at least a 3-fold locking as well as a swiveling handle.

A locking with locking cylinder shall be provided, this shall be determined in coordination with the Contracting Agency.

Each door is grounded on top and bottom via high-flexible copper band 16 mm<sup>2</sup>.

The protective degree is IP 54

Switch cabinet lighting with door contact and integrated service receptacle, completely with fluorescent tube 20 W

Energized cables, conductors and components in front of main switch shall be marked yellow.

Energized components in front of main switch shall be additionally lettered acc. to EN-standard.

Planned size (wxhwx d): 2200 x 600 x 600 mm  
incl. 200 mm base

**11.3.20. Overvoltage protection conductor**

4-fold overvoltage protective unit SPD with pre-fuse

incl. wiring and clamps

connection will be accomplished in front of main switch, on shortest way to potential equalization rail

Dimension shall be reviewed

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SPD type: 4-pole (TN-S)  
Class: 2

### 11.3.30. Main switch 25 A, 4-pole

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

### 11.3.40. Main switch 40A, 4-pole

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

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The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

### 11.3.50. **Main switch 63A, 4-pole**

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

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The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

**11.3.60. Main switch 100A, 4-pole**

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

**11.3.70. Main switch 125A, 4-pole**

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The

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undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

### 11.3.80. **Main switch 315A, 4-pole**

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

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The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

### 11.3.90. Main switch 400A, 4-pole

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

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**11.3.100. Main switch 500A, 4-pole**

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.

The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

**11.3.110. Main switch 630A, 4-pole**

The main switch is accomplished as load disconnecting switch and as safety switch (red-yellow).

The switch is equipped with an undervoltage release. The undervoltage release is wired to clamp for an external cut-off.

The auxiliary contact is wired to clamp.

The installation of switch will be accomplished each acc. to size to the installation panel with extension and handle panel in switch cabinet door or directly in door.

The switch can be also operated at opened door.



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The switch cabinet door shall be recessed and sealed at installation to installation panel. The protective degree of switch cabinet shall be observed. The recess is in the scope of service of contractor.

The switch shall be accomplished acc. to IEC 60947 for AC-23 operation.

The switch is connected to the busbar system via single conductors of sufficient dimension.

The dimension shall be reviewed.

Network type:	400VAC TN-S network
Switchable pole number:	4-pole (L1, L2, L3, N)
Color code handle and trim:	red-yellow (e-stop)
Lettering:	ON-OFF
Switchable:	undervoltage release
Locking:	1-fold lockable
Auxiliary contact:	1 opener/closer

**11.3.120. Phase failure relay**  
3-pole monitoring of voltage on busbar

incl. required pre-fuse, wiring (short circuit resistant), clamps and small material

**11.3.130. Control voltage 24V AC**  
Connection of control transformer (with potential separation primary/secondary) at exit one-sided with earth separation clamp voltage 230V AC to potential equalization.

Voltage primary:	400VAC
Fuse primary:	motor protection device with auxiliary contact NC
Fuse secondary:	fuse circuit breaker with auxiliary contact NC
Capacity:	500 VA
Capacity load:	max. 70 %

incl. wiring and clamps

dimension shall be reviewed.

**11.3.140. Control voltage 24V DC**  
Switch network part with short-circuit resistant output (potential separation primary/secondary) at exit one-sided with earth separation clamp voltage 230V AC to potential equalization.

Voltage primary:	3 x 400VAC
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Fuse primary: motor protection device with  
auxiliary contact NC  
Fuse secondary: fuse circuit breaker with  
auxiliary contact NC  
Capacity: 1000 VA  
max. current: 40 A  
Capacity load: max. 70 %

incl. wiring and clamps

dimension shall be reviewed.

**11.3.150. Busbar system 600 mm - 250 A**

Busbar system made of Cu with busbar bracket fastening and connection loops for connection of a further series modular cabinet with touch-proof covering (at least IP 20) also for the connection elements to add-on switch cabinet.

Installed in top switch cabinet part

Dimension shall be reviewed

Panel size: 600 mm  
Dimension: 250 A  
Distance of rails: 40 mm  
Number of rails: 3 (L1, L2, L3 and/or RST)

**11.3.160. Busbar system 600 mm - 390 A**

Busbar system made of Cu with busbar bracket fastening and connection loops for connection of a further series modular cabinet with touch-proof covering (at least IP 20) also for the connection elements to add-on switch cabinet.

Installed in top switch cabinet part

Dimension shall be reviewed

Panel size: 600 mm  
Dimension: 390 A  
Distance of rails: 40 mm  
Number of rails: 3 (L1, L2, L3 and/or RST)

**11.3.170. Busbar system 600 mm - 630 A**

Busbar system made of Cu with busbar bracket fastening and connection loops for connection of a further series modular cabinet with touch-proof covering (at least IP 20) also for the connection elements to add-on switch cabinet.

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Installed in top switch cabinet part

Dimension shall be reviewed

Panel size: 600 mm  
Dimension: 630 A  
Distance of rails: 40 mm  
Number of rails: 3 (L1, L2, L3 and/or RST)

**11.3.180. Securing case in panel**

Collective failure message via illuminated detector (LED) for defective fuses and motor protective of this switch cabinet panel as hardware switching.

incl. required wiring, clamps and small material.

**11.3.190. Fuse protection switch cabinet lighting**

Short-circuit resistant cabling to automatic cutout

- automatic cutout B16A with auxiliary contact NC  
incl. clamps and small material

**11.3.200. Switch cabinet cooling with cooling unit**

Wall add-on cooling unit

Utilization cooling capacity \_\_\_\_\_ W  
Operation voltage 400 V, 50 Hz 3~ or 230VAC, 50 Hz  
Rated capacity  $P_{el}$  \_\_\_\_\_ W  
Cooling agent R 134a  
Temperature range 20°C up to 55°C  
Temperature control and monitoring via comfort controller  
with two potential-free failure alarm outputs and  
door end switch connection  
Factory adjustment 35°C  
Connection via plug-in connection clamp strip  
Protective type exterior circuit IP 34/interior circuit IP 54  
Weight \_\_\_\_\_ kg  
Color RAL 7035

with door end switch and connection to automation station

Dimensioning of heat discharge shall be proven!

Incl. functional installation and recess in switch cabinet door, door and hinge reinforcement where required

Dimensioning for 4x frequency converter a 5.5 kW installed in switch cabinet plus internal loads

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- 11.3.210. RFC residual current protective device 2-pole 25A, 30mA**  
consisting of:
- RFC residual current circuit breaker 2-pole 25A, 30mA with auxiliary contact NC
  - clamps and small material
  - all other required components
- as protective device in front of power outputs
- 11.3.220. Power output 1-pole, B6A**  
consisting of:
- automatic cutout B6A with auxiliary contact NC
  - clamps and small material
  - all other required components
- 11.3.230. Power output 3-pole , NH00**  
consisting of:
- NH00-L load-break switch disconnecter
  - with corresponding fuses according to the consumer with auxiliary contact NC
  - clamps and small material
  - all other required components
- 11.3.240. Installation evaluation units, signal amplifier, barriers**  
consisting of:
- installation of switch cabinet built-in parts
  - clamps and small material
  - all other required components
- 11.3.250. Control V-belt guard**  
consisting of:
- coupling relay
  - all required auxiliary/contactors
  - clamps and small material
  - all other required components
  - with the corresponding evaluation unit installed, configured and ready for operation

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**11.3.260.** **Frost sensor**  
consisting of:

- coupling relay with locking
- connection to controller
- clamps and small material
- all other required components

Conversion of function anti-freeze protection - pump "ON", valve "OPEN" and ventilators "OFF", flaps "CLOSE" per hardware switching.

**11.3.270.** **Cut-off by duct smoke detector**  
consisting of:

- coupling relay with locking
- connection to controller
- clamps and small material
- all other required components

Conversion of function system "OFF".

**11.3.280.** **Control fire cut-off main alarm**  
Control via local fire alarm center and/or via safety switch unit

Connection will be accomplished via safety switch units

- consisting of:
- safety switch unit
  - all required contactors and relays
  - clamps and small material
  - all other required components

**11.3.290.** **Control emergency stop**  
local alarmControl via wire and/or via contactor and safety switch units

Connection will be accomplished via contactor and safety switch units

- consisting of:
- all required contactors and relays
  - clamps and small material
  - all other required components

**11.3.300.** **Control "gas monitoring system" main alarm CO and HeH2**  
Control via local gas monitoring system and/or via safety switch unit

Connection will be accomplished via safety switch units

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consisting of:  
- safety switch unit  
- all required contactors and relays  
- clamps and small material  
- all other required components

**11.3.310. Control "gas monitoring system" main pre-alarm CO and HeH2**  
Control via local gas monitoring system and/or via contactor

Connection will be accomplished via contactors

consisting of:  
- all required contactors and relays  
- clamps and small material  
- all other required components

**11.3.320. Control fire detection zone**  
Control via fire detection system and/or via contactor

Connection will be accomplished via contactors

consisting of:  
- all required contactors and relays  
- clamps and small material  
- all other required components

**11.3.330. Input 2-pole to controller**  
consisting of:

- clamps and small material  
- all other required components

Connection of 2 conductors e.g. for potential-free contacts (DI) and analog signals (AI) 4-20mA, PT1000 etc.

**11.3.340. Input 2-pole to controller + feeding 24 V**  
consisting of:

- clamps and small material  
- 24V supply  
- all other required components

Connection of 2 conductors e.g. for potential-free contacts (DI) and analog signals (AI) 4-20mA, PT1000 etc.

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**11.3.350. Input 4-pole to controller**  
consisting of:

- clamps and small material
- all other required components

Connection of analog signals (AI) with 4 conductors e.g. 0-10V and PT100 (4-conductor connection).

**11.3.360. Output 2-pole + coupling relay**  
consisting of:

- coupling relay
- clamps and small material
- all other required components

Provision of potential-free contact (DO) - for local controls

**11.3.370. Output 2-pole**  
consisting of:

- clamps and small material
- all other required components

Provision of 2 contactors for analog signals (AO) 4-20mA without feeding

**11.3.380. Air flow Control - 1 AO + feeding 24 V**

- consisting of:
- coupling relay
  - 1 analogue output to the flow controller
  - connection controller
  - 24 V supply
  - clamps and small material
  - all other required components

**11.3.390. Valve Control - 1 AO + feeding 24 V**

- consisting of:
- coupling relay
  - 1 analogue output to the valve controller
  - connection controller
  - 24 V supply
  - clamps and small material
  - all other required components

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**11.3.400.      Valve Control - 1 AO+1 AI + feeding 24 V**  
for 2 way control valves with position feedback

consisting of:

- coupling relay
- 1 analogue output to the valve controller
- 1 analogue input from the valve controller
- connection controller
- 24 V supply
- clamps and small material
- all other required components

**11.3.410.      Valve Control - 1 AO + feeding 230 VAC**  
for pneumatic controlvalve with EX-Protection code

consisting of:

- coupling relay
- 1 analogue output to the valve controller
- connection controller
- 230 VAC supply
- clamps and small material
- all other required components

**11.3.420.      Control flap - 1 DO - 2-pole 24 V**  
consisting of:

- coupling relay (change-over switch)
- 1 output to flap
- connection 2 limit switches
  
- clamps and small material
- all other required components

**11.3.430.      Control flap or valve - 1 DO - 1-pole 24 V**  
consisting of:

- coupling relay
- 1 output to flap
- connection 2 limit switches
  
- clamps and small material
- all other required components

**11.3.440.      Control volume flow - 1 DO - 1-pole + feeding 24 V**  
consisting of:

- feeding 24V



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- contactor (further OPEN + further CLOSE) with 1 output to the flow controller  
- connection 2 limit switches

- clamps and small material  
- all other required components

**11.3.450. Control flap - 1 DO - 2-pole - 2-torque 230VAC**  
consisting of:

- automatic cutout B6A with auxiliary contact NC  
- feeding flap  
- contactor (change-over switch) with 1 output to flap  
- connection 2 limit switches

- clamps and small material  
- all other required components

**11.3.460. Control flap - 1 DO - 2-pole - 230VAC ATEX "ATmosphere EXplosible"**  
consisting of:

- automatic cutout B6A with auxiliary contact NC  
- feeding flap  
- contactor (change-over switch) with 1 output to flap  
- connection 2 limit switches

- clamps and small material  
- all other required components

**11.3.470. Motor assembly group 2-ea, up to 5.5 kW**  
for electrical motors with two speeds, consisting of:

- 2 motor protective switches 3-pole with auxiliary contact NC or motor full protective device with auxiliary contact NC  
- contactor  
- coupling relay  
- all required clamps and/or plugs, identifications and related installation material

**11.3.480. Motor assembly group 2-ea, up to 2 kW**  
for electrical motors with two speeds, consisting of:

- 2 motor protective switches 3-pole with auxiliary contact NC or motor full protective device with auxiliary contact NC  
- contactor  
- coupling relay  
- all required clamps and/or plugs, identifications and related

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installation material

the speed-Transformator will be supplied.

**11.3.490. Motor assembly group 1-ea, up to 5.5 kW**  
for electrical motors with one speed, consisting of:

- motor protective switch 3-pole with auxiliary contact NC
- contactor
- coupling relay
- all required clamps and/or plugs, identifications and related installation material

**11.3.500. Motor assembly group 1-ea, up to 5.5 kW, external motor protection**  
for electrical motors with one speed, motor full protection is integrated in drive

consisting of:

- automatic cutout 3-pole B/C char., auxiliary contact NC
- contactor
- coupling relay
- all required clamps and/or plugs, identifications and related installation material

**11.3.510. Motor assembly group 1-ea, up to 1 kW blocking current resistant**  
for electrical motors with one speed, consisting of:

- automatic cutout B10A 1/3-pole, auxiliary contact NC
- contactor
- coupling relay
- all required clamps and/or plugs, identifications and related installation material

**11.3.520. Motor assembly group 1-ea, larger 5.5 kW until 15 kW - S/D**  
for electrical motors with one speed with star/triangle connection, consisting of:

- motor protective switch 3-pole with auxiliary contact NC
- contactor, timing elements
- coupling relay
- all required clamps and/or plugs, identifications and related installation material

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- 11.3.530. Motor assembly group 1-ea, until 5,5 kW - S/D**  
for electrical motors with one speed with star/triangle connection,  
consisting of:
- motor protective switch 3-pole with auxiliary contact NC
  - contactor, timing elements
  - coupling relay
  - all required clamps and/or plugs, identifications and related installation material
- 11.3.540. Motor assembly group 1-ea, larger 15 kW until 22 kW - S/D**  
for electrical motors with one speed with star/triangle connection,  
consisting of:
- motor protective switch 3-pole with auxiliary contact NC
  - contactor, timing elements
  - coupling relay
  - all required clamps and/or plugs, identifications and related installation material
- 11.3.550. Motor assembly group 2-ea, larger 5.5 kW until 15 kW**  
for electrical motors with two speeds
- consisting of:
- 2 motor protective switches 3-pole with auxiliary contact NC
  - contactor, timing elements
  - coupling relay
  - all required clamps and/or plugs, identifications and related installation material
- 11.3.560. Motor assembly group with motor full protection DS, up to 1 kW**  
for electrical motors with thermistor or coiling protective contact, three-  
phase current
- consisting of:
- automatic cutout 3-pole with C char., auxiliary contact NC
  - motor full protective device for monitoring of thermal protective circuit(s) of motor with auxiliary contact NC
  - contactors
  - coupling relay
  - all required clamps and/or plugs, identifications and related installation material

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**11.3.570.** **Motor assembly group with motor full protection DS, up to 5,5 kW**  
for electrical motors with thermistor or coiling protective contact, three-  
phase current

consisting of:

- automatic cutout 3-pole with C char., auxiliary contact NC
- motor full protective device for monitoring of thermal protective circuit(s) of motor with auxiliary contact NC
- contactors
- coupling relay
- all required clamps and/or plugs, identifications and related installation material

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**11.4. Field units**

**11.4.10. exhaust temperature sensor, PT1000, 400°C**

with submersible rod for temperature measurement in air ducts or pipes.

Measuring range: - 20 .... + 400 °C  
sensor: PT1000, class B  
Protective type: with cable set

**11.4.20. Average temperature sensor, 6m**

for average measurement in air ducts and/or at heat exchangers.  
The entire sensor length has to be distributed regularly over the entire cross section.

Sensor type NI1000  
Capillary pipe length: 6 m  
Measuring range: - 50 .... + 80 °C  
time constant: 30 Sek. by 2 m/s  
Protective type: IP 42

Complete with all accessory, capillary pipe brackets etc.

**11.4.30. Average temperature sensor, 2m**

for average measurement in air ducts and/or at heat exchangers.  
The entire sensor length has to be distributed regularly over the entire cross section.

Sensor type NI1000  
Capillary pipe length: 2 m  
Measuring range: - 50 .... + 80 °C  
time constant: 30 Sek. by 2 m/s  
Protective type: IP 42

Complete with all accessory, capillary pipe brackets etc.

**11.4.40. Average temperature sensor, 0,4m**

for average measurement in air ducts and/or at heat exchangers.  
The entire sensor length has to be distributed regularly over the entire cross section.

Sensor type NI1000  
Capillary pipe length: 0,4 m  
Measuring range: - 50 .... + 80 °C  
time constant: 30 Sek. by 2 m/s

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Protective type: IP 42

Complete with all accessory, capillary pipe brackets etc.

**11.4.50. Submersible temperature sensor with sleeve 100mm**  
for installation in steel pipeline. Sensor length acc. to pipe cross sections and socket length. Measuring socket placing acc. to information of the Contracting Agency.

Sensor type NI1000  
mounting length: 100mm  
Measuring range: - 30 ..... + 130 °C  
Protective type: IP 54  
Liquid: water

Incl. submersible sleeve.

**11.4.60. Submersible temperature sensor with sleeve 150mm**  
for installation in steel pipeline. Sensor length acc. to pipe cross sections and socket length. Measuring socket placing acc. to information of the Contracting Agency.

Sensor type NI1000  
mounting length: 150mm  
Measuring range: - 30 ..... + 130 °C  
Protective type: IP 54  
Liquid: water

Incl. submersible sleeve.

**11.4.70. Room temperature sensor, IP 65, time constant 20 Sek.**  
in plastic case for surface-mounting.

Measuring range: - 20 .... + 60 °C  
Protective type: IP 65  
time constant: 20 Sek.

Incl.fitting materials

**11.4.80. Frost sensor (air) with switch contact; 0..10 V; 6m**  
for unit and duct installation, with manual or automatic resetting. With permanent controller for starting sequence and limit value contact for system control

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Capillary pipe length: 6 m  
Adjustment range: 1 .. 10 °C  
messuring ranche: 0 .. 15 °C  
Protective type: IP 65  
Output signal: 0 .. 10 V standardized signal  
Change-over contact: AC 230 V, 6 (4) A

Complete with all accessory, capillary pipe brackets (at least 12 each)  
etc.

**11.4.90. Frost sensor (air) with switch contact ; 0.10 V; 2m**  
for unit and duct installation, with manual or automatic  
resetting. With permanent controller for starting sequence  
and limit value contact for system control

Capillary pipe length: 2 m  
Adjustment range: 1 .. 10 °C  
messuring ranche: 0 .. 15 °C  
Protective type: IP 65  
Output signal: 0 .. 10 V standardized signal  
Change-over contact: AC 230 V, 6 (4) A

Complete with all accessory, capillary pipe brackets (at least 6 each)  
etc.

**11.4.100. Duct sensor temperature/humidity**  
with submersible rod for combined temperature / humidity  
measurement in air ducts.  
Submersible rod length acc. to the duct cross sections

Measuring range: -20 ... + 50 °C  
1 - 100% rel. humidity  
Protective type: IP 42  
Temperature signal output: 0..10V  
Humidity signal output: 0..10V  
dew point signal output: 0..10V

Incl. duct drilling

**11.4.110. Room sensor temperature / humidity**  
in plastic case for surface-mounting.

As room or outdoor sensor

Measuring range: - 20 .... + 50 °C  
0 - 100 % rel. humidity  
Protective type: IP 54

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Temperature signal output: 4..20mA  
Humidity signal output: 4..20mA

Incl.fitting materials

**11.4.120. Duct pressure sensor 1500/3000 Pa**  
for control of the duct pressure

Measuring range: 0...1500 Pa  
0...3000 Pa  
Signal output: 0-10 V

Complete with all accessory, measuring hose etc.

**11.4.130. Pressure differential controller (air flow)**  
for attachment to the filter units completely with all accessory, unit holders, measuring lines etc.

Adjustment range: up to 300 Pa  
Switch difference: 20 Pa  
Protective type: IP 54  
with switch function 24 VAC or DC

Complete with all accessory, unit holder for installation without vibrations, measuring lines, possibly capillary pipe etc.

**11.4.140. Pressure sensor for liquids 10 bar**  
for control or for indication of the network printer

Measuring range: 10 bar  
max. pressure: 50 bar  
Liquid: water  
Protective type: IP 54

Complete with all accessory, unit holder for installation without vibrations, measuring lines, possibly capillary pipe etc.

**11.4.150. Pressure sensor for gas/air 10 bar**  
for control or for indication of the network printer

Measuring range: 10 bar  
max. pressure: 50 bar  
Medium: gas/air  
Protective type: IP 54

Complete with all accessory, unit holder for installation without vibrations, measuring lines, possibly capillary pipe etc.



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**11.4.160. Pressure sensor differential for liquids 10 bar**  
for control or for indication of the network printer

Measuring range: 10 bar  
max. pressure: 50 bar  
Liquid: water  
Protective type: IP 54

two pressure sensors and the differenz calculation value or a differential pressure sensor

Complete with all accessory, unit holder for installation without vibrations, measuring lines, possibly capillary pipe etc.

**11.4.170. V-belt controller**

for speed-controlled and multi-level drives with contactless pulse transmitter for monitoring of ventilator shaft and pertinent evaluation unit for switch cabinet installation.

- transmitter at the shaft and appropriately installed sensor with holding angle

- evaluation unit with adjustable start-up bridging, optical operation indication, adjustable disconnecting speed, installed unlocking push button, possibility for central locking, wire and sensor break monitoring, operating and failure reporting.

Start-up bridging: approx. 30 s  
Working range: 50 to 7000 1/min  
Disconnecting range: 100 to 600 1/min

Complete with all accessory

### Frequency transformer

Static frequency transformer for infinitely variable speed control pump and ventilator drives with speed-depending load moment , performed as voltage link converter, without power reduction at the transformer outlet. Operating and programming unit with clear text indication, programmable in two levels.

Integrated PID-controller, suitable for flow rate, pressure or level control. Indication of the control variable in pertinent dimension unit as e.g. flow rate (m<sup>3</sup>/h), pressure (bar) or temperature (C).

Optionally indication possibility in display of: Control target value (%), motor frequency (Hz), actual value (%), motor current (A), motor load moment (%), motor power (kW), electrical power (kWh), motor voltage (V), intermediate circuit voltage (V),

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thermal motor load (%), thermal frequency transformer load (%).

Indication possibility of simultaneously two data values as well as status and turning direction indication.

Radio screening filter: Class A

Mains overvoltage and mains transient protection acc. to VDE 0160.

Mains protective throttle in intermediate circuit for reduction of the mains harmonics acc. to VDE 0160.

Control connections galvanically separate from the power part acc. to VDE 0106/0160

Standard equipment:

Automatic power optimization for optimal motor efficiency in partial load range, switching at the outlet, operation hours meter, minimum and maximum speed limitation, ramp functions, motor restart on the fly, direct current brake, variable frequency, PID-controller, multi-motor operation possible, same motor power as in case of direct operation at the network, V-belt monitoring, motor posistor monitoring.

Protective functions:

Motor protection (thermal image), installed motor coils (output throttle / filter) for long motor lines and reduction of the voltage rising speed du/dt, short-circuit and ground-circuit resistant, overcurrent protection, thermal frequency transformer, under- and overvoltage monitoring, phase outage monitoring

Analog inputs:

0 - 10 V, 0(4) - 20 mA and inverted signal,

4 digital inputs:

Start/stop, reversing, motor posistor, quick stop/motor freewheel/direct current brake, acknowledgement, fixed speed, electronic motor potentiometer, MANUAL - 0 - AUTOMATIC

2 analog / digital outlets: 0(4) - 20 mA or + 24 V DC/40 mA

2 pot.-free outlet relays: 250 V AC or 24 V DC, 2 A

Serial interface RS 232/485

The handbook/system book (immediately) as well as the programming and parameter list (after performed initial operation) shall be submitted to the Contracting Agency for each frequency transformer.

**11.4.180. Frequency transformer 22 kW, IP 54**

Increased price for above described frequency transformer, however, design protective type IP 54 for installation at the place of erection.

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The calculated space requirement shall be included in the ACS-switch cabinet as decrease.

Chosen make/type: Danfoss, ABB, Siemens or equivalent

**11.4.190. Frequency transformer 30 kW, IP 54**

Increased price for above described frequency transformer, however, design protective type IP 54 for installation at the place of erection.

The calculated space requirement shall be included in the ACS-switch cabinet as decrease.

Chosen make/type: Danfoss, ABB, Siemens or equivalent

**11.4.200. Frequency transformer 37 kW, IP 54**

Increased price for above described frequency transformer, however, design protective type IP 54 for installation at the place of erection.

The calculated space requirement shall be included in the ACS-switch cabinet as decrease.

Chosen make/type: Danfoss, ABB, Siemens or equivalent

**11.4.210. Mounting rack for frequency transformer**  
for floor-mounting height approx. 1.60 m

**11.4.220. Repair switch 3-pole, 16 A**

for attachment to ventilation units complete with all accessory, for disconnection of the main power circuit, with the 2nd switch level as acknowledgement to the DDC.  
Surface-mounted case IP 54.

Contact stress 16 A,

with red handle and padlock for three locks

**11.4.230. Repair switch 3-pole , 100 A**

for attachment to ventilation units complete with all accessory, for disconnection of the main power circuit, with the 2nd switch level as acknowledgement to the DDC.  
Surface-mounted case IP 54.

Contact stress 100 A,

with red handle and padlock for three locks

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- 11.4.240. Repair switch 6-pole, 16 A**  
for attachment to ventilation units complete with all accessory, for disconnection of the main power circuit, with the 2nd switch level as acknowledgement to the DDC.  
Surface-mounted case IP 54.
- Contact stress 16 A,  
with red handle and padlock for three locks
- 11.4.250. Repair switch 6-pole, 63 A**  
for attachment to ventilation units complete with all accessory, for disconnection of the main power circuit, with the 2nd switch level as acknowledgement to the DDC.  
Surface-mounted case IP 54.
- Contact stress 63 A,  
with red handle and padlock for three locks
- 11.4.260. Repair switch 6-pole , 100 A**  
for attachment to ventilation units complete with all accessory, for disconnection of the main power circuit, with the 2nd switch level as acknowledgement to the DDC.  
Surface-mounted case IP 54.
- Contact stress 100 A,  
with red handle and padlock for three locks
- 11.4.270. Position Limit Switch**  
in enclosed make of flame-resistant,  
contacts with forced opening by activation lever. It has to be possible to subsequently exchange the drive heads against other variants and turn them by 90°. Position switch with drive head and activation angle.
- |                     |                                         |
|---------------------|-----------------------------------------|
| Switching members:  | 1 NC + 1 NO                             |
| Contact stress:     | 16A                                     |
| Cable feeding:      | 2 x PG 13                               |
| Housing material    | glass fiber reinforced molding material |
| protective type     | IP 65                                   |
| Roller material     | Plastic (HB)                            |
| Switching voltage   | 24 V DC                                 |
| Switching principle | Snap-action contact element             |
- Direct opening action contact according to IEC 60947-5-1

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Short-circuit protection according to IEC 60269-1  
(control circuit fuse)

The installation location shall be coordinated with the Contracting Agency.

**11.4.280. Ring balance (permanent-continuous) for air, -25 .. +25 Pa, 4-20mA**  
for pressure/differential pressure, with installed permanent controller,  
control behavior PID, actual value indication with pointer, target value  
indication via setting pointer

Measuring range:	- 25 .... + 25 Pa
Outlet:	0(4) .... 20 mA
Auxiliary power:	230 V/50 Hz
Measuring accuracy:	+/- 1%
Limit value contact:	min/max
indicating output status	LED 0% / 100%

Controller  
electronic continuous-output controller with PID characteristics

Control Settings  
P (proportional band), D (differential action), I (integral action),  
HAND/AUTO, INVERT.  
The response of the controller is tailored to the characteristics of the  
measuring system

Suitable for wall-mounting

Incl. approx. 10 m measuring line and fastening material.

**11.4.290. Pressure sensor differential for air, -50 .. +50 Pa, 0-10V**

for differential pressure, with actual value indication inside the  
room.(according to the Ring balance)

For air and not aggressive gases,  
For highest precision and quality-demands.  
With linear characteristic as well as digital display (read-out)  
With adjustable pressure range.

Supply voltage	AC 24 V ±15 % DC 13,5...33 V
Power input	0,5 VA
Output signal type	DC 0...10 V
Range	-50....+50 Pa
Sensor type:	Pressure membrane

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Reaction time <10 ms  
Type of connection electrical, : Screw terminal  
on the discharge side:  
pipe end Ø 6,2 mm  
Degree of protection IP 54  
Suitable for wall-mounting

Incl. approx. 10 m measuring line and fastening material.

**11.4.300. Switch operator On/Off**

Switch positions: 2 , "On, Off"  
Operation type: short turning handle,  
Color of the button black,  
Front form: round,  
Hole-diameter min. 22,5 mm  
protection type: IP54

with black plastic mounting ring and switch position label  
Waterproof

Complete delivery, installation and connection.

**11.4.310. Push button operator**

Switch positions: 1 , "0 or Off"  
Operation type: pushing mode,  
Color of the button black,  
Front form: round,  
Hole-diameter min. 22,5 mm  
protection type: IP54

with black plastic mounting ring and switch position label  
Waterproof

Complete delivery, installation and connection.

**11.4.320. flow monitor air**

Electrical design AC  
Output relay energised when flow is  
present  
Operating voltage 24 V AC  
Contact rating 3 A (30 V DC / 250 V AC)  
Power consumption ] 1.5 VA  
Max. temperature gradient of medium: 5 K/min  
Pressure rating [bar] 1  
Medium temperature [°C] -10...50  
Setting range [cm/s] 100...1000  
Greatest sensitivity [cm/s] 100...400

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Adjustment of the switch point with pot.  
Power-on delay time [s] 60  
Response time [s] 3...60  
Operating temperature [°C] -10...50  
Protection IP 65  
Housing material PBT (Pocan)  
Sensor material sensor surface: titanium  
  
Function display  
Function LED 1 x red / 1 x green  
Connection PUR cable / 2 m; 4 x 0.5 mm<sup>2</sup>

Complete delivery, installation and connection.

### 11.4.330. flow monitor air ATEX

Flow sensor for connection to evaluation units  
Threaded type: G½ Cable  
Operating temperature: -20...60 °C  
ATEX approval  
Group II, category 1/2G  
Zone 0 / Zone 1  
  
Application liquids and gases  
Internal capacitance [nF] 1.2  
Internal inductance [µH] 6  
Connection to control monitor VS2000 Exi (PTB 01 ATEX 2075)  
Max. temperature gradient of medium [K/min] 15  
Pressure rating [bar] 300  
  
Liquids  
Medium temperature [°C] -20...60  
Setting range [cm/s] 3...300  
Greatest sensitivity [cm/s] 3...60  
  
Gases  
Medium temperature [°C] -20...60  
Setting range [cm/s] 200...2000 \*)  
Greatest sensitivity [cm/s] 200...800 \*)  
Response time [s] 1...10  
Temperature class T4  
Protection IP 67  
Shock resistance [g] 40 (DIN / IEC 68-2-27, 11 ms)  
Vibration resistance [g] 10 (DIN / IEC 68-2-6, 55-2000 Hz)  
Approval DMT 03 ATEX E 090 X  
Marking of the unit II 1/2G EEx ia IIC T4  
Housing material stainless steel (316S12)  
Connection TPE-S cable / 6 m; 5 x 0.34 mm<sup>2</sup>  
Max. cable length [m] 100 (5 x 0.5mm<sup>2</sup>)

EVALUATION UNIT

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VS2000/24VDC/1G  
Control monitor for flow sensors  
Housing: for DIN rail mounting

Connection: 1 sensor(SF...A)  
ATEX approval  
Group II, category (1) G

Application flow monitoring and wire breaking monitoring  
Electrical design DC  
Output relay  
Operating voltage [V] 24 DC  
Voltage tolerance [%]  $\pm 10$   
Contact rating 4 A (250 V AC  $\cos \phi > 0.7$ ) ; 02 A (250 V DC); 4 A (24 V DC)  
Current consumption [mA] 125

Control circuit  
Voltage [V]  $U_0 = 15.8$   
Current [mA]  $I_0 = 84 / I_e = 38.5$   
Power [mW]  $P_0 = 680$

in protection rating intrinsic safety

EEx ia	IIC	IIB
External inductance	1 mH	1mH / 5 mH
External capacitance	205 nF	1.7 $\mu$ F / 935 nF

EEx ib	IIC	IIB
External inductance	1 mH	1mH / 5 mH
External capacitance	205 nF	1.7 $\mu$ F / 935 nF

Switching function  
Flow monitoring relay energised when flow is present  
Function display 11 LED  
Adjustment of the switch point with pot.  
Selection liquids / gases with slide switch

Switching function  
Wire break monitoring relay de-energised in case of wire break  
Output status indication LED red  
Power-on delay time [s] 30  
Operating temperature [°C] -20...60  
Protection housing / terminals IP 40 / IP 20  
Approval PTB 01 ATEX 2075  
Marking of the unit II (1) G [EEx ia] IIC  
Housing material plastics  
Connection 15 terminals...2.5 mm<sup>2</sup>



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Complete delivery (described Sensor and corresponding evaluation unit) and the necessary cables and fitting materials, installation and connection.

### 11.4.340. Signaling light LED

Housing: Aluminium  
Cap: Plastic  
Cap color: yellow  
Protection degree: IP 65  
Temperature range: -30°C up to + 50°C  
Operating voltage: 24 V DC  
Signaling type: flashing, blinking, permanent lightning

Complete delivery with the necessary fitting materials, installation and connection.

### 11.4.350. Field unit labeling 100x50 mm

All field-devices are to be labeled, in accordance to the names in the switch cabinet-plans, with durably labeling,

Material of label: Resopal / Colored plastic-layer-material  
Sign: engraved  
Ground: white,  
Character (font): black; oil-, wipe- and waterproof  
Text-height: 16 mm  
Text: two-lines  
Label dimension: 100 x 50 mm

inclusive label holder, fastening and plate carrier  
labeling approved plate list

Complete delivery with the necessary fitting materials and mounting,

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**11.5. cable and wires - connections**

**remarks:**

arming, inserting into the cabinets, including cable glands for e.g. motors , fixing or arming the cables on c-profiled rails.

Measuring all the cables and wires including test-documentation

Including wire-ends, shoes and fixing materials

Labeling of the cables is required, is has to be done in accordance to the cablelist.

All additional ratings needs the permission of the site management.

**11.5.10. cabel upto 5x 2,5mm<sup>2</sup> (flexible)**  
cabel upto 5x 2,5mm<sup>2</sup> (flexible)

**11.5.20. cabel upto 7x 2,5mm<sup>2</sup> (flexible)**  
cabel upto 7x 2,5mm<sup>2</sup> (flexible)

**11.5.30. cabel upto 5x 16mm<sup>2</sup> (flexible)**  
cabel upto 5x 16mm<sup>2</sup> (flexible)

**11.5.40. cabel upto 7x 16mm<sup>2</sup> (flexible)**  
cabel upto 7x 16mm<sup>2</sup> (flexible)

**11.5.50. cabel upto 5x 25mm<sup>2</sup> (flexible)**  
cabel upto 5x 25mm<sup>2</sup> (flexible)

**11.5.60. cabel upto 5x 2,5mm<sup>2</sup> shielded (flexible)**  
cabel upto 5x 2,5mm<sup>2</sup> shielded (flexible)

**11.5.70. cabel upto 7x 2,5mm<sup>2</sup> shielded (flexible)**  
cabel upto 7x 2,5mm<sup>2</sup> shielded (flexible)

**11.5.80. cabel upto 10x 2,5mm<sup>2</sup> shielded (flexible)**  
cabel upto 10x 2,5mm<sup>2</sup> shielded (flexible)

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**11.5.90.** **cabel upto 5x 16mm<sup>2</sup> shielded (flexible)**  
cabel upto 5x 16mm<sup>2</sup> shielded (flexible)

**11.5.100.** **cabel upto 5x 25mm<sup>2</sup> shielded (flexible)**  
cabel upto 5x 25mm<sup>2</sup> shielded (flexible)

**11.5.110.** **weak-power cable 8 x 2 x 0,8**  
weak-power cable 8 x 2 x 0,8

**11.5.120.** **profibus cable**  
profibus cable complete with D-SUB connector 90 GRAD for  
two cabel

**11.5.130.** **profibus connector D-SUB 90°**  
D-SUB connector 90 GRAD with entry for two profibus cabels  
and the switched terminating resistor

**11.5.140.** **weak-power cable 12 x 2 x 0,8**  
weak-power cable 12 x 2 x 0,8

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### Management System

The system shall be provided with trendsetting technology and completely in line with the offered DDC or SPS Controllers.

Despite its complex technology, the system used shall be controllable by the system operator and shall facilitate working considerably.

Optimum system reliability and availability as well as a comfortable graphic user interface are to be guaranteed as well.

Compatibility and upgrading as system-management system need to be possible.

It is planned to connect additionally available and future DDC systems to the this system.

For selection, it must be seen that also external makes need to be integrated.

Via commonly available communication ways, it must be possible that peripheral units can be connected independent of location and distance.

Basically, the system has to provide monitoring, controlling and optimization of the processes in the mechanical systems.

### **11.6. Management System**

#### **11.6.10. OS server, OS parameterization station**

19" rack server in industrial design for the offered management system

Can be upgraded for the redundant operation of 2 servers

Operating system Windows Server 2003 or higher,

communication connection of the installation and system bus via Ethernet without limitation of users,

connection to the terminal bus without limitation of users,

including software for the server (latest version) for operation of the offered guidance system

Installation in network cabinet

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**11.6.20. OS server, operation**  
- Change-over switch for keyboard, mouse and monitor for the two servers  
  
- keyboard  
- mouse  
- 17" TFT color monitor TOC'03

**11.6.30. OS server, redundancy package**  
Redundancy package for above server station  
  
including required hardware and software

**11.6.40. PC for OS clients and ES**  
PC with operating system Windows 2000 or XP Professional or Unix and all drivers  
  
with tower casing  
  
PENTIUM 4 551 (3.4 GHZ, HT) or equal  
display card with 256Mbyte graphic chache with DVI or more  
300 GByte (SATA) hard disk  
DVD double layer burner multi-format  
1.44 floppy disk drive  
1024 MBYTE DDR2 SDRAM  
512 MBYTE - LEVEL2-CACHE

Interfaces:

6x USB2.0 interface  
1x parallel interface (printer)  
2x serial interface (RS232)  
2x 1 GByte LAN  
1x VGA  
1x DVI  
2x PS/2 (keyboard and mouse)

Keyboard, mouse, 21" TFT color monitor TOC'03

Use for OS clients and engineering station (ES)

**11.6.50. Mobile PC as OS clients (laptop)**  
Laptop PC with operating system Windows 2000 or XP Professional or Unix and all drivers

PENTIUM 4 551 (3.4 GHZ, HT) or equal  
display card onboard with 256Mbyte graphic chache  
120 GByte hard disk  
DVD double layer burner multi-format

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1.44 floppy disk drive  
1024 MBYTE DDR2 SDRAM  
512 MBYTE - LEVEL2-CACHE

Interfaces:

2x USB2.0 interface  
1x parallel interface (printer)  
2x serial interface (RS232)  
2x 1 GByte LAN  
1x VGA  
2x PS/2 (keyboard and mouse)

Use as OS client

**11.6.60. Printer laser; color**  
Format: A4  
number of sheets cassette: 250

with necessary driver, cables,

with spare toner cartridge for all colors

configured ready for operation

**11.6.70. USV for ES + OS server1 + OS server2**  
As emergency supply for the described stations with necessary cables and accessories.

Rated capacity: 1440 VA  
rated capacity: 1000 W

Bridging period with full load: 5 minutes

**11.6.80. PC data backup + long-time memory**  
Software for clocked long-time memory of system data for the offered system

Long-time memory of 1000 addresses, storing on the hard disk and export to external data carrier like DVD-ROM

Export and compilation as well as presentation of stored and exported data in diagrams and table form as well as characteristic curves

Presentation of at least 10 characteristic curves on top of each other possible

Software for reflection of 2 hard disks

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PC in tower casing

PENTIUM 4 551 (3.4 GHZ, HT) or equal  
display card with 256Mbyte graphic cache with DVI or more

**2x** 300 GByte (SATA) hard disk

DVD double layer burner multi-format  
1.44 floppy disk drive  
1024 MBYTE DDR2 SDRAM  
512 MBYTE - LEVEL2-CACHE

Interfaces:

6x USB2.0 interface  
1x parallel interface (printer)  
2x serial interface (RS232)  
2x 1GByte LAN  
1x VGA  
1x DVI  
2x PS/2 (keyboard and mouse)

Communication via industrial Ethernet with OS server

with keyboard, mouse and 21" TFT color monitor

installed and configured ready for operation

**11.6.90. Monitors**  
21" TFT color monitor, additionally for the control system

1x multi VGA card with 2x DVI output for 2 screens

**11.6.100. OPC server**  
For connection of open interfaces.

With necessary basic software, configured ready for operation.

**11.6.110. Record/event printer A4**  
DIN A4 matrix b/w printer for document feed and continuous paper  
- fonts can be chosen via Control Panel  
- printer speed: at least 100 characters/sec.  
- connection cable PC-printer

Adjusted to building control system

Complete delivery and erection ready for operation.

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- 11.6.120. GSM modem - Italy**  
for transfer of SMS messages in case of failure to relevant persons acc. to the notification matrix via the Italian cellular network
- complete hardware with antenna and PCI card or via USB2.0 interface, with power supply unit if required, etc.
- including software
- The GSM card (cellular network card) will be furnished by the operator.
- Complete delivery and installation.
- 11.6.130. Network cabinet with fan system**  
Network cabinet with 42 height units
- for installation of the two servers as 19" rack PC with drawer for front operation
- Drawer for keyboard, mouse and monitor
- with fan system with filter for heat exhaust via thermostat
- with strip with 8 receptacles
- installation of 2 network switches 19"
- with cable carrying system for patch cable
- 2 passive port strips (patch field) with 16 ports each for rear connection of the building-side network cables Cat6
- 11.6.140. \*\*\* Item N/A**
- 11.6.150. Network switch 16 ports - Level2**  
Network switch 19" with 16 ports for automation network
- Installation in network cabinet
- 11.6.160. Patch cable Cat5+ 0.5m**  
Patch cable Cat5+



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2 m long

Delivery and installation

**11.6.170.** **Patch cable Cat5+ 1m**  
Patch cable Cat5+

0.5 m long

Delivery and installation

**11.6.180.** **Patch cable Cat5+ 2m**  
Patch cable Cat5+

2 m long

Delivery and installation

### Software of the Management System

The system software has to be so flexible that an optimum adjustment to the system requirements in regard to simultaneous accomplishment of any regulation tasks, control tasks and system monitoring will be given.

The software and program features listed in the following must be offered.

the system software needs to meet to following requirements:

a) Real-time signal processing of events, failure alarms and alarms by means of time stamp by the controller (the system time will be synchronized between all controllers every day, the server is the master)

b) The application parameters need to be accessible to the authorized user for entry, modification and deletion at any time. This requirement is very important as the system may not stand still.

c) Accessibility will be provided by limitations by means of access control. Protection shall be split up in at least 4 levels. The allocation of access authorization will be made by the system administrator. Access will be given by user ID and password only.

1st level: monitoring

- monitoring of all system images as well as all viewers without the possibility of parameter changes

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- navigation between the pages as well as printing is given unconditionally

2nd level: parameterization

- modification of application parameters like temperature, humidity, operating hours etc. as well as acknowledgement of notifications and failure alarms  
(any access will be recorded)

3rd level: operation

- modification of regulation characteristics like the proportional range etc.  
- operation of system components by HAND functions  
(any access will be recorded)

4th level: administrator

- provision of program components and system image -  
allocation of user permissions (release of levels)  
- deletion of program components and databases  
(any access will be recorded)

The application programming language shall serve for easy realization of any control tasks and shall allow reconditioning and processing of operation data and the accomplishment of individual logic functions and control programs.

Library files for symbols and system components of the HVAC will be made available to the user and the assembly contractor.

It must be possible for the management system to provide the following functions:

- software-like solution of the entire system control incl. locking with the standard functions
- spontaneous display of alarms with logging on the printer
- central limit value control of analog values
- time-dependent switching
- event-dependent switching
- manual selection/remote control (on/off)
- presentation of system and status images of the regulating diagrams listed in the specifications in the form of color graphics on the monitor. The given parameters and the actual values must be shown on the system image at the subject position. Also the status of the control and regulating unit.

For the air handling systems, images for the same system concept can be used several times. If there are only control and monitoring units available for other disciplines, these can be combined in table form acc. to disciplines.

All notifications, failure alarms and alarms are to be shown on the printer and the alarm viewer.

During the time of the initial operation, printing can be omitted

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until the operator took on system parts. Then, the operator will decide on the printer function. Signaling in the alarm viewer will be provided accordingly differently (e. g. alarms with red color)

Differentiation in:

1. maintenance signals and other kinds of information
2. failure
3. operational failure (alarms)

All acknowledged notifications will be maintained in the listing of the alarm viewer until the error has been eliminated. The history of all notifications will be saved with time synchronization in a separate file before it is deleted from the circulating memory of the alarm viewer (long-term storage of notifications, malfunctions and alarms).

All failure and status signals which have already been eliminated and/or disappeared will be maintained in the alarm viewer until acknowledgement.

All fault notifications can be provided with statement texts. The notifications and statement texts can be sent via connected interface devices (FAX, SMS etc.). In this way, the different notifications can be allocated to at least 3 groups of operators via matrix. Each group may contain different notifications.

The definition, documentation and input of programs, program modules and parameters will be provided by the contractor.

The building control system must comprise the following operation and indication functions:

- indication of all analog measured values
- indication of all analog actuating variables (controller output) in %
- spontaneous indication of all failure alarms and alarms
- indication of all operating states (status indication)
- change of parameters such as set points, time programs, marginal values etc.
- manual execution of switching commands
- manual actuator positioning (manual/automatic switch)

The mentioned software and program features must be provided by the management system at any rate.

If an UPS is used, the data must be saved before the computer is shut down.

The application parameters must be accessible to the authorized operator for the purpose of input, modification and deletion. This requirement is very important since a standstill of

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this system is not allowed.

The software of the control system shall serve for simple realization of any control tasks as well as for processing and workup of operating data and allow for the execution of individual logic functions and control programs.

All data points in the system (real and virtual) will be recorded by the management system and can be presented by means of mimic diagrams and viewers.

The prepared mimic diagrams have to be approved by the Contracting Agency in advance.

The calculation of the software also includes import, commissioning, adjustment and testing with potential changes/completions of the program in connection with all connected systems as well as the documentation of the functional package inspected by the Contracting Agency.

The standard programs acc. to system description belong to the hardware of the management system. The application must be set up in such a way that data can be entered by the operating staff without special programming knowledge.

In addition, a 30% reserve for further mimic diagrams and processing functions must be available in the software.

### 11.6.190. **System software management system**

The system software of the management system with:

- graphic editor with
- historical database (HDB)-editor
- automatic program control (PSTA)-editor
- runtime program
- alarm journal
- support of an external long-time archive system
- symbol libraries for heating, ventilation, air-condition and plumbing
- data backup
- watchdog function for all computers

The software must provide the following features:

Number of function addresses acc. to granted license

Presentation of any combinations of alarm messages, status messages, readings, metered measurands, control and actuating commands

Formation of any collective alarms for system overview displays

Support of at least 3 printers for event-related printouts (alarm printer,

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directions) and/or for printing of system data as tables or graphics

Modem activation for remote maintenance and notification services

Control via mouse and/or keyboard

Access protection by means of at least 4 password levels

1000 pages for system graphics / system lists for dynamic fade-in of current values and states

PopUp windows for parameterizing and control functions

System lists with graphic fade-ins

Bar graphs and trend graphs in the display

Multiple symbols with symbol and/or color change in case of state changes

Filling functions for any geometric figures

Output of event-related failure and operation notification protocols

Time programs (day, weeks, holidays) as tables for all individual systems

Special programs for one-time and compensating time functions

Time-dependent recording of existing failures, system states, historic data

Research operations

Processing of volumetric meters / operation hour counters

Central control of marginal values

Historic storage of 200 addresses and events in different, adjustable time frames (minutes to hours)

Support of long-time storage of 1000 addresses, storage on the hard disk and export to external data carriers such as CD-ROM or DVD-ROM

Support of export processes and assembly as well as presentation of exported times

- Data backup of intermediate states (at least once a month) and the final status by complete backup on a separate data carrier (DVD-ROM) for the documentation.

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- Another complete backup has to be done in the course of software adaptations after inspection (within the warranty period) which must be submitted to the Contracting Agency.

The described software must be installed onto server and clients, incl.

- provision and monitoring of data traffic to controllers and clients

- commissioning of standard software

**11.6.200. Engineering software and license 10000 addresses**

Engineering software of the management system for provision of the visualization (latest version) incl. all required licenses.

Submittal of the software and licenses for provision and modification of the application software of the management system to the Contracting Agency incl. the documentation.

License for generation of 10000 function addresses (real and virtual addresses)

License designation by contractor: \_\_\_\_\_

To be completely installed and generated.

**11.6.210. License extension by 10000 addresses**

The license for the producible function addresses

by 10000 function addresses

for the offered management system.

License designation by contractor: \_\_\_\_\_

To be completely installed and generated.

**11.6.220. License per OS-client**

License to use a computer as OS-clients on the OS-server.

To be completely installed and generated.

**11.6.230. patchboard ethernet 16 ports for network cabinet**

patchboard ethernet 16 ports for network cabinet

Installation in network cabinet

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**11.7. Services**

**11.7.10. Training of operator**

Efficient training of the operator for utilization of the management system.

Management system, application software, controller, data backup, etc.

Estimated duration: 3 days

**11.7.20. Starting UP and Test Operation**

After finishing installation, the systems have to be started up.

The systems and the components must be adjusted, so that the functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the testl operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

**The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.**

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

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**11.7.30. Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

**11.7.40. Revision Documentation**

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic



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tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

**11.7.50. Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate files.

The customer has to supply these inspections by sending his commissioning personal so much as it is necessary.

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**12. Cooling tower water system**

**12.1. Devices and Accessories**

### Guide Note

All pumps and fittings have to be calculated incl. pair of mating flanges as welding neck flanges incl. screws, nuts and sealing

Material: 1.4541 - stainless steel

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to length and connected by the trade "Measuring and control System"

\*\*\* Design-Description 1201

### Cooling Water Pump

Horizontal volute casing pump, single stage with power ratings and dimensions to EN 733 up to DN 200, with bearing bracket, in back pull-out design

Shaft with replaceable shaft sleeve/ shaft protecting sleeve in the shaft seal area.

Volute casing and impeller with replaceable wear rings.

Volute casing with integrally cast pump feet

Deep-groove ball bearings, grease-lubricated

Shaft seal as mechanical seal to EN 12756 or gland packing

incl.

Surface-cooled IEC 3-phase squirrel case motor

Current: 3 x 400 V, 50 Hz

Design: IMB 3

Enclosure: IP 55

Thermal class: F with temperature sensors 3 x PTC

Operation mode: continuous operation S1

Suitable for operation with frequency converter

The motor has to be dimensioned for the greatest pump power over the whole pump characteristic

incl. flexible coupling

coupling guard as per EN 294

base plate out of sectional steel/ folded steel plate, fabricated

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sectional steel for the complete unit (pump and motor), in  
torsion-resistant design

operation temperature range: - 30 up to+ 110 °C  
maximal operation pressure: 10 bar

incl. mating flanges, screws, nuts and sealing and mounting  
material

medium: water 27 / 36 °C

**12.1.10.** accord. To Design Description 1201  
**Pump G 150 - 250**  
System: chiller 1 + 2

technical data:

medium:	water 27 / 36 °C	
volume flow:	195,0	m <sup>3</sup> /h
pressure head	1,8	bar
rpm:	1450	1/min:
current:	3 x 400	V
el. Power:	22	kW
el. Current:	44	A

supply and mounting

**12.1.20.** accord. To Design Description 1201  
**Pump G 100 - 200**  
System: heat exchanger K 30 circuit

technical data:

medium:	water 27 / 36 °C	
volume flow:	100,0	m <sup>3</sup> /h
pressure head:	1,0	bar
rpm:	1450	1/min:
current:	3 x 400	V
el. Power:	5,5	kW
el. Current:	11	A

supply and mounting

\*\*\* Design-Description 1202  
**Butterfly Valve with Hand Lever**

Butterfly valve for mounting between flanges

temperature range: - 20°C up to +160°C  
operating pressure: PN 16

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tight closing up to pressure difference of 16 bar

body: grey cast iron GJL - 250  
seat: EPDM  
shafts: stainless steel  
disc: stainless steel

incl.  
**hand lever**  
insulation shaft  
vapour barrier

incl. mating flanges, screws, nuts and sealing

medium: water 27 / 36 °C

**12.1.30.** accord. To Design Description 1202

**butterfly-valve DN 300**

DN 300  
PN 16

torque value by operation pressure 10 bar: 280 Nm

supply and mounting

**12.1.40.** accord. To Design Description 1202

**butterfly-valve DN 200**

DN 200  
PN 16

torque value by operation pressure 10 bar: 140 Nm

supply and mounting

**12.1.50.** accord. To Design Description 1202

**butterfly-valve DN 125**

DN 125  
PN 16

torque value by operation pressure 10 bar: 45 Nm

supply and mounting

## Specification

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\*\*\* Design-Description 1203

### Electrical Acuator for Butterfly valve

surcharge to the above described butterfly valves

for electrical actuator completely mounted on the valve

operation current: 1 x 230 V

incl. internal wired and self operating  
limit switches for position open and shut

All cables will be installed by the trade "Electrical Supply", the  
cables will be feeded in, cutting to lenght and connected by the  
trade "Measuring and control System"

**12.1.60.** accord. To Design Description 1203  
**electric actuator 400 Nm**  
actuator for butterfly valve up to

torque: 400 Nm  
nominal current: 1,3 A  
starting current: 2 A  
el. power: 0,26 kW

**12.1.70.** accord. To Design Description 1203  
**electric actuator 100 Nm**  
actuator for butterfly valve up to

torque: 400 Nm  
nominal current: 0,7 A  
starting current: 1 A  
el. power: 0,16 kW

\*\*\* Design-Description 1204

### Strainer

Strainer consisting of a Y-style body  
with flanges and a wide - meshed Filter element  
to protect down streammed equipments,  
straining and collecting of dirt particles

material:

body: 1.4581 - stainless steel

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drain flange: 1.4571 - stainless steel  
filter: 1.4401 - stainless steel

with 2 holes for pressure gauge connection  
with tapped hole in the drain flange

incl. mating flanges, screws, nuts and sealing

medium: water 27 / 36 °C

**12.1.80.** accord. To Design Description 1204  
**strainer DN 200**  
DN 200  
PN 16

supply and mounting

**12.1.90.** accord. To Design Description 1204  
**strainer DN 125**  
DN 125  
PN 16

supply and mounting

\*\*\* Design-Description 1205  
**Balancing and Shut - Off Valve**

Maintenance-free soft seated shut-off globe valve  
With fluid rate and temperature sensor

For injusting and measuring the flow rate

Materials

Body: lamellar graphite cast iron EN-GJL 250

Design:

Sensor (IP 54 plug) for flow rate and temperature measurement as well as nominal diameter identification  
Straight-way globe valve with slanted seat and vertical bonnet  
Non-rotating stem with protected, external thread  
Non-rising handwheel, locking device, travel stop  
Compact throttling valve plug with EPDM coating as soft main and back seat  
Maintenance-free stem seal with EPDM profile  
Free from asbestos, CFC and PCB

## Specification

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Short face-to-face length to EN 558-1/14  
temperature-range: - 10 up to + 120 °C  
Medium: water 27 / 36 °C  
incl. mating flanges, screws, nuts and sealing

**12.1.100.** accord. To Design Description 1205  
**balancing valve DN 200**

DN 200  
PN 16

supply and mounting

**12.1.110.** accord. To Design Description 1205  
**balancing valve DN 125**

DN 125  
PN 16

supply and mounting

\*\*\* Design-Description 1206  
**Compensator**

for separation of the pipe system with the equipment

lateral compensator consisting of a rubber bellow with rotating flanges tie rods to absorb reaction force from internal pressure

rubber	EPDM
operation temperature	
range up to	+ 50 °C / 16 bar
	+ 80 °C / 10 bar
	+ 90 °C / 6 bar

flanges	
with drilling for through bolts	
material:	stainless steel 1.4541

PN 16

**12.1.120.** accord. To Design Description 1206  
**compensator DN 250**

DN 250

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PN            16

supply and mounting

**12.1.130.**      accord. To Design Description 1206  
**compensator DN 200**

DN            200

PN            16

supply and mounting

**12.1.140.**      accord. To Design Description 1206  
**compensator DN 150**

DN            150

PN            16

supply and mounting

**12.1.150.**      accord. To Design Description 1206  
**compensator DN 125**

DN            125

PN            16

supply and mounting

**12.1.160.**      accord. To Design Description 1206  
**compensator DN 100**

DN            100

PN            16

supply and mounting

### Control Valves

\*\*\* Design-Description 1207  
**Flange 3-port Control Valve**

body	grey cast iron (GJL-250),
gland seal	yellow brass
shaft	steanless steel
cone	yellow brass - DN 15 up to DN 65
	red brass - DN 80 up to DN 150
shaft sealing	EFDM - rolling o-ring joint
lift	20 mm - DN 15 up to DN 80



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40 mm - DN 100 up to DN 150

characteristic 0 up to 30 % - linear  
30 up to 100 % - equal percently

leaky range 0 up to 0,02 % from kv - value

temperature range: - 25 up to + 130 °C

nominal pressure PN 16

medium: water 27 / 36 °C

usable for water and water / glycol mixtures up to 50 %

moving with electral actuator,  
the actuators are described in separate positions

incl. mating flanges, screws, nuts and sealing

**12.1.170.** accord. To Design Description 1207  
**Control Valve DN 150 - 300**

DN 150  
Kvs 300

Supply and mounting

**12.1.180.** accord. To Design Description 1207  
**Control Valve DN 125 - 200**

DN 125  
Kvs 200

Supply and mounting

\*\*\* Design-Description 1208  
**Actuator for Control Valve**

Electralc actuator for the control valves described before

stroke 40 mm  
force 2800 N

operation current 24 V AC  
signal current 0 - 10 V  
position signal 3 P

characteristic linear or equal percentally - adjustable

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All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to lenght and connected by the trade "Measuring and control System"

**12.1.190.** accord. To Design Description 1208

**Actuator 40 mm**  
actuator stroke 40 mm

Supply and mounting

**12.1.200.** **Bimetal Thermometer**  
for temperature measurement of liquids in insulated pipes

dial: white  
graduations: black  
pointer: aluminum alloy black  
adjustment: at the back of the case  
window: normal glass  
temperature range: 0 up to 60 °C  
accuracy:class 1,0  
diameter: 100 mm  
immersion tube: ½" x 100 mm  
incl. screw - on protection pipe ½" x 100 mm out of brass

medium: water 27 / 36 °C

**12.1.210.** **Pressure Gauge**  
With liquid filling for measurement of liquids in insulated pipes

dial: white  
graduations: black  
pointer: aluminum black  
window: laminated safety glass  
Solid stainless steel separating wall between the measuring element and dial; rear wall constructed as blow out  
liquid filling: glycerin 99,5%  
pressure range: 0 up to 10 bar  
accuracy:class 1  
diameter: 100 mm  
connection: ½" at the bottom

medium: water 27 / 36 °C

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12.1.220. \*\*\* Item N/A

12.1.230. **Manometer Valve**  
out of stainless steel  
with exhausting cab  
with test flange  
  
connetion RP 15  
  
supply and mounting  
  
incl. sealing an mounting material

12.1.240. **Flow Switch**  
for monitoring flow of fluids in piping of diameter  
DN 15 up to DN 200  
  
technical data:  
rated load: 15 (8) A, 24 - 250 V AC  
enclosure: IP 65  
ambient temperature: - 40 up to 85 °C  
max. fluid temp: + 120 °C  
max. working pressure: 11 bar  
casing: impact-resistant plastic  
screw in body R1" of brass  
vanes of stainless steel

supply and mounting

All cables will be installed by the trade "Electrical Supply".

The feeding in, cutting to lenght and connection of the cables is including in this position.

12.1.250. **Measuring Nozzle**  
diameter: ½" x 100 mm  
  
with shut-off valve consisting of stainless steel 1.4401  
  
incl. welding, sealing and mounting material  
  
supply and mounting

12.1.260. **Mounting of Measuring Equipment**  
Mounting of supplied indicators, pressure switches a.s.o.

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incl. welding, sealing and mounting material

only mounting

**12.1.270. Nozzle RP 15 x 100 mm**  
with coupling sleeve for mounting of measurement equipment

incl. welding, sealing and mounting material

supply and mounting

**12.1.280.** \*\*\* Item N/A

**12.1.290. Fill and Emptying Valve RP 15**  
case out of red brass with connection fitting to flexible tube

with coupling sleeve out of stainless steel 1.4401

incl. welding, sealing and mounting material

supply and mounting

**12.1.300. Fill and Emptying Valve RP 20**  
case out of red brass with connection fitting to flexible tube

with coupling sleeve out of stainless steel 1.4401

incl. welding, sealing and mounting material

supply and mounting

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### 12.2. Pipes and Accessories

Pipes are generally out of stainless steel, material: 1.4401

Technical supply regulations acc. to ISO 9329

Pipes with nominal diameter

equal/lower DN 50: acc. to ISO 65 - 1981  
seamless

greater DN 50 up to DN 100: acc. to ISO 4200 - 1985  
seamless

greater DN 100: acc. to ISO 4200 - 1985  
full length,  
spiral welded

\*\*\* Design-Description 1209

#### **Pipe connections as self-subsistent connections**

Steel pipes have to be welded.

Welding work must be carried out using shielded arc gas welding. During the welding procedure, the seam area must be flushed with suitable forming gas. Weldings have to be brushed; prefabricated lines, distributors etc. are to be degreased, pickled and passivated.

Only licensed welders with valid papers may be allowed to carry out welding work.

A copy of the welding liceneces have to be handed out to the supervision of the customer, before starting work.

The pipelines have to be stored in impact - sound damping mounting plates.  
Impact-sound damping rate > 30 dB by reference swing velocity  
 $v_0 = 5 \times (10 \text{ E } -8) \text{ m/s}$ .

Continuous pipe mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with mineral fibre fire protection measures

These fire protection measures are described in a separate specification.

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The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components must be submitted to the constructor by the supplier before the work is carried out.

supply and mounting incl. mounting material (clamps, threaded rods, screws, nuts, dowels a.s.o.) welding and sealing material, fittings, flanges, boltings are described in separate positions.

**12.2.10. Pipe DN 15**  
DN 15 (21,3 x 2,65 mm)

Supply and mounting

**12.2.20. Pipe DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

**12.2.30. Pipe DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

**12.2.40. Pipe DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**12.2.50. Pipe DN 200**  
DN 200 (219,1 x 6,3 mm)

Supply and mounting

**12.2.60. Pipe DN 250**  
DN 250 (273,0 x 6,3 mm))

Supply and mounting

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**12.2.70.** **Pipe DN 300**  
DN 300 (323,9 x 7,1 mm)

Supply and mounting

### **Fittings for Steel Pipes**

Fittings for stainless steel pipes as described before,

connection by welding (shielded arc gas welding)  
fittings with welding phase

\*\*\* Design-Description 1210

### **Elbow**

in all angle - degrees

**12.2.80.** **Elbow DN 15**  
DN 15 (21,3 x 2,65 mm)

Supply and mounting

**12.2.90.** **Elbow DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

**12.2.100.** **Elbow DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

**12.2.110.** **Elbow DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**12.2.120.** **Elbow DN 200**  
DN 150 (219,1 x 6,3 mm)

Supply and mounting

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**12.2.130. Elbow DN 250**  
DN 200 (273,0 x 6,3 mm)

Supply and mounting

**12.2.140. Elbow DN 300**  
DN 300 (323,9 x 7,1 mm)

Supply and mounting

### **Branch - Fitting**

#### **Guide Note**

Branch fittings up to DN 40 may be build by T- fittings

Branch fittings greater than DN 40 are to be shoe curved to the pipe by shoe-bent elbows

\*\*\* Design-Description 1211

#### **T - Fitting**

as T- fitting in equal and reduced outlets

only the greatest diameter is described

**12.2.150. T - Fitting DN 15**  
DN 15 (21,3 x 2,65 mm)

Supply and mounting

**12.2.160. T - Fitting DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

\*\*\* Design-Description 1212

#### **Shoe bent Elbow**

Shoe - bent - Elbow



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incl. burning out the suitable hole in the pipe  
incl. preparing the hole for welding, grinding, phasing a.s.o

**12.2.170. Shoe-bent Elbow DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**12.2.180. Shoe-bent Elbow DN 200**  
DN 200 (219,1 x 6,3 mm)

Supply and mounting

**12.2.190. Shoe-bent Elbow DN 250**  
DN 250 (273,0 x 6,3 mm)

Supply and mounting

**12.2.200. Shoe-bent Elbow DN 300**  
DN 300 (323,9 x 7,1mm)

Supply and mounting

\*\*\* Design-Description 1213  
**Reduction Fitting**

in concentric and eccentric type

only the greatest diameter is described

**12.2.210. Reduction DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**12.2.220. Reduction DN 200**  
DN 200 (219,1 x 6,3)  
Supply and mounting

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**12.2.230. Reduction DN 250**  
DN 250 (273,0 x 6,3 mm)

Supply and mounting

**12.2.240. Reduction DN 300**  
DN 300 (323,9 x 7,1mm)

Supply and mounting

\*\*\* Design-Description 1214  
**End Cap**

als welding end cap with welngng phase

thickness of the material equal to the thickness of pipes

**12.2.250. End Cap DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**12.2.260. End Cap DN 200**  
DN 200 (219,1 x 6,3 mm)

Supply and mounting

**12.2.270. End Cap DN 250**  
DN 250 (273,0 x 6,3 mm)

Supply and mounting

\*\*\* Design-Description 1215  
**Pair of Flanges**

as welding neck flanges incl. screws, nuts and sealing

nominal pressure PN 16  
material: 1.4401 - stainless steel

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**12.2.280. Flanges DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**12.2.290. Flanges DN 200**  
DN 200 (219,1 x 6,3 mm)

Supply and mounting

\*\*\* Design-Description 1216

### **Exhausting Bottle**

Exhausting bottle to ventilate the pipe system

Consisting out of

stainlesssteel pipe, 1.4401 acc. to ISO 9329  
2 end caps in the diameter of the pipe  
2 nozzles for the pipe system in different nominal diameters,  
length 150 mm  
1 nozzle RP 15 x 150 mm for exhausting pipe

**12.2.300. Exhausting DN 300**

Length (without end cap): 300 mm  
Diameter: DN 300

Supply and mounting

**12.2.310. Exhausting DN 400**

Length (without end cap): 300 mm  
Diameter: DN 400

Supply and mountin

\*\*\* Design-Description 1217

### **Connection to Coolingwater main System**

The cooling water pipe system has to be  
Connected with the main pipe system.

This will be done by mating flanges out of stainless steel incl.

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screws and nuts

The positions includes all sealing and all mounting material.

1 each of the connections includes both connection (inlet and outlet)

**12.2.320. Connection DN 300**  
with 2 pair of mating flanges welded on to the  
supplied pipe  
incl. preparing the end of the pipe  
- grinding, phasing a.s.o  
incl. all necessary equipment

supply and mounting

\*\*\* Design-Description 1219

**Sign Post**

consisting of resopal  
according to the specifications of the customer,  
incl. all necessary accessories,  
inscription acc. to the list, which is approved by the customer

**12.2.330. Sign Post 200 / 100**  
length: 200 mm  
high. 100 mm

supply and mounting

**12.2.340. Sign Post 100 / 50**  
length: 100 mm  
high: 50 mm

supply and mounting

**12.2.350. Sign Post 50 / 25**  
length: 50 mm  
high: 25 mm

supply and mounting

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- 12.2.360. Directional Marker**  
to stick on to the pipes in long lasting execution color, text and execution acc to the requirement of the customer  
  
supply and mounting
- 12.2.370. Structural Steel Construction**  
(according to the instruction of the supervisor)  
  
in all kinds of special mounting constructions, welded and/or screwed  
  
rust protection by ground and finished painting (in different paints),  
paint acc. to the instructions of the customer  
  
incl. all necessary mounting materials  
incl. drilling of fixing holes in concrete and/or masonry walls and ceilings  
  
The accounting will be based on the avoirdupois' of the steel  
  
supply and mounting  
  
\*\*\* Design-Description 1220  
**Pressure Test**  
  
Following installation and laying of pipeline system, before the wall gaps und ceiling bushings are closed and before the insulation is installed, the pipe system is to be subjected to a pressure test.  
  
Relevant regulations and manufacturer's directives are to be followed.  
  
As test medium, water has to be used.  
  
All pipe connections have to undergo a visual examination.  
  
The test pressure is 1, 5 x nominal pressure. The test period is 12 hours.  
  
All test have are to be carried in arrangement and in presence of the construction supervisor.  
  
The test results must be recorded in protocols, countersigned by the construction supervisor and to be documented. All used protocols should agree in content with ISO 9000.

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As a function of the progress of the construction work, it will be necessary to execute the pressure tests in separate section.

**12.2.380. Pressure Test 250 liters**

Pressure test in section up to 250 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**12.2.390. Pressure Test 500 liters**

Pressure test in section up to 500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**12.2.400. Pressure Test 1000 liters**

Pressure test in section up to 1000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

\*\*\* Design-Description 1221

**Pipe Cleaning**

All pipe systems are to be flushed before connection with the main pipe - system and before commissioning.

Before the pipeline is connected to the main system, the degree of cleanness of the flushing medium has to be checked, protocolled and to be coordinated with the 'construction supervisor.

Integrated strainers are to be cleaned, if necessary in several times.

As a function of the progress of the construction work, it will be necessary to execute the pipe cleaning in separate section.

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**12.2.410. Pipe Cleaning 250 liters**

Pipe cleaning in section up to 250 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**12.2.420. Pipe Cleaning 500 liters**

Pipe cleaning in section up to 500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**12.2.430. Pipe Cleaning 1000 liters**

Pipe cleaning in section up to 1000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**12.2.440. certificazioni e documentazioni richieste  
dalla normativa P.E.D**

Il costruttore, dovrà elaborare e rilasciare tutte le certificazioni e documentazioni richieste dalla normativa vigente e dalla normativa P.E.D. comprovate da verbali di prove di pressione, test sui materiali e sulle saldature il tutto certificato da un istituto ufficiale e autorizzato. La certificazione dovrà riguardare non solo i singoli componenti e attrezzature ma l'insieme costituente l'impianto oggetto di certificazione. (Si ricorda che tra i documenti ed elaborati che devono essere prodotti sono anche compresi la stress analysis e la risk analysis).

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**13.** **Chilled and cooling water system**

**13.1.** **Liquid Chiller, Heat Exchanger, Cooling Coil**

**13.1.10.** **Centrifugal Chiller**

with evaporator and condenser as tube nest heat exchanger,  
factory installed and tested for tightness and function.

acc. to italien laws and technical rules in case of all security and  
environmental requirements,

chiller according DIN EN 378,

chiller with primer and cover coats

components

two-stage centrifugal semi-hermetic compressor with  
contact free magnetically bearing with safety system  
vertical devided housing  
rotors out of aluminum  
with low vibrations

power control

continuously power range by  
electrical adjustable inlet guide vanes with monitoring at the  
compressor  
continuously rpm-control by PWM (pulse width modulation)

electrical motor

integrated motor, cooled by the refrigerant

evaporator

horizontal tube nest heat exchanger with integrated gravity  
interceptor,  
tube saved against bending and vibration by gusset plates  
water chambers with face-placed removable connections to the  
tube system,  
water chambers cleanable

evaporator with inspection glass and shut-valves for filling,  
emptying and pressure measuring

Materials

Finned copper tubes SFCu

End caps S355J2G3/P265GH

Water chambers S355J2G3/P265GH7/



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S355J2G3

Casing tube P265GH

Interiors S235JRG2

Allowed pressure.  
Refrigerant system 15 bar  
Water system 10 bar

### Condenser

Configuration as described by evaporator **without** inspection glass

### pipes and fittings

refrigerant tubes, valves and other fittings  
refrigerant tubes out of copper  
shut off fitting at suction and pressure sides of compressor

start controlling in case of high pressures

expansion by controlled valve, valve closed by shut out

all connection to exterior pipe system have flanges acc. to  
DIN 2633

### Refrigerant

R 134a

### Controlling

All necessary equipment for controlling and observation  
consisting of

### switch cabinet

factory installed and tested and connected with the components  
of the chiller incl. all switching, controlling and security units,  
incl. SPS

brand: Siemens  
type. Simatic S7-300

incl. CPU 314C-2DP and operation panel TP 170B for  
Quantum Profibus

incl. all necessary equipment

power supply 3 x 400 V with main switch and all specific control  
units, electronic load control, system monitoring and recording  
of measuring values, clear language display panel

## Specification

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controlling of the condenser water valve

messages. compressor in operation  
compressor failure flashing  
pressure limiter  
temperature limiter  
pre alert and alert low pressure  
pre alert and alert high pressure  
pre alert and alert low temperature  
pre alert and alert low temperature  
failure compressor

external messages shut off / shut on  
ready for operation  
in operation  
general warning chiller  
general failure chiller

requirement chiller

all necessary external equipment

all cold equipments insulated with vapour barrier

### Generally Specification

compressor IP 54

chiller

electrical standards

DIN EN 50 160 (harmonic compliance)  
EN 55011 (radio shielding voltage 150 kHz  
- 30 MHz)  
acc. o EN 61000-6-4  
class A

switch cabinet: IP 54

switching devices: IP 54

security switching devices DIN EN 378 / IP 33

security and environmental  
requirements DGRL 97/23/EG  
AD-2000, DIN EN 378  
and BRG 500

mounting requirement  
geodetic high max. 1000 m oNN

## Specification

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environment temp.max. 40 °C  
min. + 0 °C  
(frost protected)

electrical requirement  
power supply 3 x 400 V / 50 Hz  
controlling 1 x 230 V / 50 Hz  
24 V DC

acc. to  
DIN EN 50160  
DIN EN 61000-6-4  
DIN EN 12 900

### Technical Data

<b>chiller</b>					
range of load	%	100	75	50	25
refrigeration load	kW	1600	1200	800	400
condenser load	kW	1902	1370	881	437
electr. power	kW	302	170	81	37
COP		5,3	7,0	9,9	10,7
<b>evaporator</b>					
medium		water	100	%	

supply, mounting and starting up of the chiller  
incl. all auxiliary devices (like mobile crane)

All cables will be installed by the trade "Electrical Supply".

The feeding in, cutting to length and connection of the cables is including in this position.

technical description, all technical documents,  
list of replacement parts,  
plan of maintenance,  
introduction of the user

**13.1.20. Heat Exchanger System K 30 - 50 °C system**  
as screwed plate exchanger,

material of the plates stainless steel 1.4571  
thickness 0,5 mm

## Specification

**Project:** 0602 **Cittadella Politecnico**  
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Ref.No.	Specification																																																				
	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">sealings</td> <td style="width: 50%;">NBR-NT</td> </tr> <tr> <td>fixing of sealing</td> <td>glue less</td> </tr> <tr> <td>number of plates</td> <td>83</td> </tr> <tr> <td>heat exchanging area</td> <td>ca. 70 m<sup>2</sup></td> </tr> <tr> <td>fouling factor</td> <td>0,107 e -4 m<sup>2</sup>/(K*W)</td> </tr> <tr> <td>heat capacity</td> <td>1050 kW</td> </tr> <tr> <td></td> <td style="text-align: center;">cold side                      warm side</td> </tr> <tr> <td>medium</td> <td style="text-align: center;">water                              water</td> </tr> <tr> <td>advance flow temperature</td> <td style="text-align: center;">27,0C                              38,0 °C</td> </tr> <tr> <td>return flow temperature</td> <td style="text-align: center;">36,0 °C                              33,0 °C</td> </tr> <tr> <td>mass flow</td> <td style="text-align: center;">27,9 kg/s                              50,2 kg/s</td> </tr> <tr> <td>volume flow</td> <td style="text-align: center;">100,9 m<sup>3</sup>/h      181,9 m<sup>3</sup>/h</td> </tr> <tr> <td>pressure loss</td> <td style="text-align: center;">17 kPa                              50 kPa</td> </tr> <tr> <td>connections</td> <td style="text-align: center;">DN 200 / PN 6                      DN 200 / PN 6 neck weldes flanges and/ or stay bolts</td> </tr> <tr> <td>operation pressure:</td> <td style="text-align: center;">max. 6 bar</td> </tr> <tr> <td>operation temperature:</td> <td style="text-align: center;">max. 100 °C</td> </tr> <tr> <td>weight netto</td> <td style="text-align: center;">1800 kg</td> </tr> <tr> <td>operation weight</td> <td style="text-align: center;">2100 kg</td> </tr> <tr> <td colspan="2">*** Design-Description 1301</td> </tr> <tr> <td colspan="2"><b>Recirculation Unit</b></td> </tr> <tr> <td colspan="2"><b>Recirculation Unit</b></td> </tr> <tr> <td>casing</td> <td>aluminium ALMg3 Painted in RAL 9003</td> </tr> <tr> <td>incl. drip tray</td> <td>aluminium Removable or to be folded down</td> </tr> <tr> <td>cooler coil</td> <td>copper tubes 15 mm diameter</td> </tr> <tr> <td></td> <td>fins out of aluminium,</td> </tr> <tr> <td></td> <td>incl. connections for ventilation and</td> </tr> </table>	sealings	NBR-NT	fixing of sealing	glue less	number of plates	83	heat exchanging area	ca. 70 m <sup>2</sup>	fouling factor	0,107 e -4 m <sup>2</sup> /(K*W)	heat capacity	1050 kW		cold side                      warm side	medium	water                              water	advance flow temperature	27,0C                              38,0 °C	return flow temperature	36,0 °C                              33,0 °C	mass flow	27,9 kg/s                              50,2 kg/s	volume flow	100,9 m <sup>3</sup> /h      181,9 m <sup>3</sup> /h	pressure loss	17 kPa                              50 kPa	connections	DN 200 / PN 6                      DN 200 / PN 6 neck weldes flanges and/ or stay bolts	operation pressure:	max. 6 bar	operation temperature:	max. 100 °C	weight netto	1800 kg	operation weight	2100 kg	*** Design-Description 1301		<b>Recirculation Unit</b>		<b>Recirculation Unit</b>		casing	aluminium ALMg3 Painted in RAL 9003	incl. drip tray	aluminium Removable or to be folded down	cooler coil	copper tubes 15 mm diameter		fins out of aluminium,		incl. connections for ventilation and
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draining

incl. all necessary mounting material

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to lenght and connected by the trade "Measuring and control System"

**13.1.30.** accord. To Design Description 1301  
**Recirculation Unit Calibration Laboratory**

for room: calibration laboratory

Technical data

capacity 34,5 kW

air volume flow 5860 m<sup>3</sup>/h

air inlet temperature 32 °C

air outlet temperature 20 °C

cooling medium water

advance flow temperature 6 °C

return flow temperature 12 °C

volume flow 5 m<sup>3</sup>/h

pressure loss 0,28 bar

fan 1 each

rpm 1380 1/min

el. power 0,50 kW

el. Current 1,05 A

3 x 400 V

dimensions

length 1396 mm

width 690 mm

high 665 mm

weight netto 77 kg

operation weight 92 kg

connetions

to pipe system 35,0 x 1,5 mm copper tube

drain RP 20

supply and mounting

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**13.1.40.** accord. To Design Description 1301  
**Recirculation Unit Metrologie Laboratory**

for room metrology laboratory

Technical data

capacity 73,3 kW

air volume flow 8440 m<sup>3</sup>/h

air inlet temperature 36 °C

air outlet temperature 18 °C

cooling medium water

advance flow temperature 6 °C

return flow temperature 12 °C

volume flow 10,5 m<sup>3</sup>/h

pressure loss 0,34 bar

fan 2 each

rpm 2 x 1400 1/min

el. power 2 x 0,36 kW

el. Current 2 x 0,74 A

3 x 400 V

dimensions

length 1996 mm

width 690 mm

high 665 mm

weight netto 123 kg

operation weight 143 kg

connetions

to pipe system 54,0 x 2,0 mm copper tube

drain RP 32

incl. all necessary mounting material

supply and mounting

## Specification

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### 13.2. Devices and Accessories

#### Guide Note

All pumps and fittings have to be calculated incl. pair of mating flanges as welding neck flanges incl. screws, nuts and sealing

Material: C22

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to lenght and connected by the trade "Measuring and control System"

\*\*\* Design-Description 1302

#### Chilled Water Pump

Horizontal volute casing pump, single stage with power ratings and dimensions to EN 733 up to DN 200, with bearing bracket, in back pull-out design

Shaft with replaceable shaft sleeve/ shaft protecting sleeve in the shaft seal area.

Volute casing and impeller with replaceable wear rings.

Volute casing with integrally cast pump feet

Deep-groove ball bearings, grease-lubricated

Shaft seal as mechanical seal to EN 12756 or gland packing

incl.

Surface-cooled IEC 3-phase squirrel case motor

Current: 3 x 400 V, 50 Hz

Design: IMB 3

Enclosure: IP 55

Thermal class: F with temperature sensors 3 x PTC

Operation mode: continuous operation S1

Suitable for operation with frequency converter

The motor has to be dimensioned for the greatest pump power over the whole pump characteristic

incl. flexible coupling

coupling guard as per EN 294

base plate out of sectional steel/ folded steel plate, fabricated

sectional steel for the complete unit (pump and motor), in

torsion-resistant design

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operation temperature range: - 30 up to +110 °C  
maximal operation pressure: 10 bar

incl. mating flanges, screws, nuts and sealing and mounting material

medium: water 6 / 12 °C  
water 15 / 21 °C  
water 30 / 50 °C

**13.2.10.** accord. To Design Description 1302  
**Pump G 150 - 200**  
**System : chiller 1 + 2**

technical data:

medium: water 6 / 12 °C  
volume flow: 233,0 m<sup>3</sup>/h  
pressure head: 0,85 bar  
rpm: 1450 1/min:  
current: 3 x 400 V  
el. Power: 11 kW  
el. Current: 22 A

supply and mounting

### Guide Note

All pumps and fittings have to be calculated incl. pair of mating flanges as welding neck flanges incl. screws, nuts and sealing

Material: C22

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to lenght and connected by the trade "Measuring and control System"

\*\*\* Design-Description 1399

### Chilled Water Pump with Frequency Converter

pump as described in Design Description 1302

additionally with

Frequency converter:  
Structural frequency converter for continuous speed control  
with speed dependent load moment.



## Specification

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Accomplished as voltage intermediate circuit converter without capacity reduction at converter exit.

Operation and programming unit with clear text display, programmable in two levels.

Integrated PID controller, suitable for volume flow, pressure or level control.

Display of control size in related size unit e.g. volume flow (m<sup>3</sup>/h,), pressure (bar) or temperature (C).

Optional display possibility in display of:

- control rated value (%)
- motor frequency (Hz)
- actual value (%),
- motor current (A)
- motor load moment (%)
- motor capacity (kW)
- electrical energy (kWh)
- motor voltage (V)
- intermediate circuit voltage (V)
- thermal motor and frequency converter load (%)
- display possibility of two data values at the same time
- as well as status and rotating direction display

Radio shielded filter: class B

Network overvoltage and network transient protection

Rated protective throttle in intermediate circuit for reduction of network harmonics.

Control connections galvanically separated from power element.

Standard equipment:

- automatic energy optimization for optimum motor effective degree in partial load area
- switching at exit
- operation hour meter
- minimum and maximum speed limit
- ramp functions
- motor trap
- d.c. brake
- variable cycle frequency
- PID controller
- multi-motor operation is possible
- same motor capacity as at direct operation at network
- V-belt monitoring
- motor PTC thermistor monitoring

Protective functions:

- motor protection (thermal copy)
- built-in motor coils (exit throttle / filter) for long motor lines and reduction of voltage increase speed du/dt
- short-circuit and ground-fault resistant
- overcurrent protection

## Specification

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**WBS:** spec1 Specification 2. tender -state of design 2007-02..

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- thermal frequency converter protection
- low voltage and overvoltage monitoring
- phase failure monitoring

Analog inputs:

0 - 10 V, 0(4) - 20 mA and inverted signal,

4 digital inputs:

start/stop, reversing, motor PTC thermistor,

quick stop/motor freewheel/d.c. brake,

receipt, fixed speed, electrical

motor potentiometer, MANUAL - 0 - AUTOMATIC

2 analog/digital output relays: 250 V AC or 24 V DC, 2 A

Profibus DP.

The manual/system book (immediately) as well as the programming and parameter list (after accomplished initial operation) shall be submitted to the Contracting Agency for each frequency converter.

The resonant frequencies shall be determined and faded out.

Accessories:

- frequency converter installed on a steel rack in the vicinity of ventilator
  - protective grid acc.to DIN EN 294
  - isolation collars (flexible connection) on suction and pressure side
- made of temperature resistant synthetic fabric with flanges
- condensate connection pieces with lock
  - spring vibration damper
  - thermal and sound insulation with exterior coat made of hot dip galvanized sheet steel
  - balancing quality G 1.0 for sub-assembly rigid
  - repair switch as main power switch completely cabled with motor and frequency converter, incl. conduit installed on clamps, and switch with 2 auxiliary contacts for message to DDC,

isupply and mounting

**13.2.20.** accord. To Design Description 1399  
**Pump G 150 - 250**  
**System: distribution K 6 - 12 °C**

technical data:

medium:	water	6 / 12 °C
volume flow:	275,0	m <sup>3</sup> /h
pressure head:	1,9	bar
rpm:	1450	1/min:
current:	3 x 400	V

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el. Power: 30 kW  
el. Current: 60 A

pump with frequency converter

supply and mounting

**13.2.30.** accord. To Design Description 1399  
**Pump G 150 - 315**  
**System: distribution K 15 - 21 °C**

technical data:

medium: water 15 / 21°C  
volume flow: 147,0 m<sup>3</sup>/h  
pressure head: 1,8 bar  
rpm: 1450 1/min:  
current: 3 x 400 V  
el. Power: 22 kW  
el. Current: 44 A

pump with

frequency converter:

**13.2.40.** accord. To Design Description 1399  
**Pump G 150 - 250**  
**System: heat exchanger K 30 - 50 °C**

technical data:

medium: water 30 / 50 °C  
volume flow: m<sup>3</sup>/h  
pressure head: bar  
rpm: 1450 1/min:  
current: 3 x 400 V  
el. Power: kW  
el. Current: A

pump with

frequency converter:

\*\*\* Design-Description 1303  
**Butterfly Valve with Hand Lever**

Butterfly valve for mounting between flanges

temperature range: - 20°C up to +160°C  
operating pressure: PN 16

## Specification

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tight closing up to pressure difference of 16 bar

body: grey cast iron GJL - 250  
seat: EPDM  
shafts: stainless steel  
disc: grey cast iron GJL - 250

incl.  
**hand lever**  
insulation shaftvapour barrier

incl. mating flanges, screws, nuts and sealing

medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

**13.2.50.** accord. To Design Description 1303  
**butterfly-valve DN 25**  
DN 25  
PN 16

supply and mounting

**13.2.60.** accord. To Design Description 1303  
**butterfly-valve DN 32**  
DN 32  
PN 16

supply and mounting

**13.2.70.** accord. To Design Description 1303  
**butterfly-valve DN 40**  
DN 40  
PN 16

supply and mounting

**13.2.80.** accord. To Design Description 1303  
**butterfly-valve DN 50**  
DN 50  
PN 16

supply and mounting

## Specification

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**13.2.90.** accord. To Design Description 1303  
**butterfly-valve DN 65**  
DN 65  
PN 16

supply and mounting

**13.2.100.** accord. To Design Description 1303  
**butterfly-valve DN 80**  
DN 80  
PN 16

supply and mounting

**13.2.110.** accord. To Design Description 1303  
**butterfly-valve DN 100**  
DN 100  
PN 16

supply and mounting

**13.2.120.** accord. To Design Description 1303  
**butterfly-valve DN 125**  
DN 125  
PN 16

supply and mounting

**13.2.130.** accord. To Design Description 1303  
**butterfly-valve DN 200**  
DN 200  
PN 16

supply and mounting

**13.2.140.** accord. To Design Description 1303  
**butterfly-valve DN 250**  
DN 250  
PN 16

supply and mounting

## Specification

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**Ref.No.** **Specification**

---

**13.2.150.** accord. To Design Description 1303

**butterfly-valve DN 300**

DN 300

PN 16

supply and mounting

\*\*\* Design-Description 1304

**Electrical Acuator for Butterfly valve**

surcharge to the above described butterfly valves

for electrical actuator completely mounted on the valve

operation current: 1 x 230 V

incl. internal wired and self operating  
limit switches for position open and shut

All cables will be installed by the trade "Electrical Supply", the  
cables will be feeded in, cutting to lenght and connected by the  
trade "Measuring and control System"

**13.2.160.** accord. To Design Description 1304

**electric actuator 100 Nm**

actuator for butterfly valve up to

torque: 400 Nm

nominal current: 0,7 A

starting current: 1 A

el. power: 0,16 kW

**13.2.170.** accord. To Design Description 1304  
**cancelled**

**13.2.180.** accord. To Design Description 1304  
**cancelled**

**13.2.190.** accord. To Design Description 1304  
**cancelled**

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**13.2.200.** accord. To Design Description 1304  
**cancelled**

\*\*\* Design-Description 1305  
**No Return Valve**

for liquids, application as gravity circulation check

body material: special brass up to DN 100  
grey cast iron over DN 100 up to DN 200

plate: stainless steel 1.4571 up to DN 100

cone: stainless steel 1.4006 over DN 100  
up to DN 200

medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

incl. mating flanges, screws, nuts and sealing

**13.2.210.** accord. To Design Description 1305  
**No Return Valve DN 200**  
DN 200  
PN 16

Supply and mounting

**13.2.220.** accord. To Design Description 1305  
**No Return Valve DN 250**  
DN 250  
PN 16

Supply and mounting

\*\*\* Design-Description 1306  
**Compensator**

for separation of the pipe system with the equipment

lateral compensator consisting of a rubber bellow with rotating  
flanges tie rods to absorb reaction force from internal pressure

rubber EPDM  
operation temperature  
range up to + 50 °C / 16 bar

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+ 80 °C / 10 bar  
+ 90 °C / 6 bar

flanges  
with drilling for through bolts  
material: steel ST 37.0 - 1.0038

PN 16

medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

**13.2.230.** accord. To Design Description 1306  
**compensator DN 150**  
DN 150  
PN 16

supply and mounting

**13.2.240.** accord. To Design Description 1306  
**compensator DN 200**  
DN 200  
PN 16

supply and mounting

**13.2.250.** accord. To Design Description 1306  
**compensator DN 250**  
DN 250  
PN 16

supply and mounting

\*\*\* Design-Description 1307

### **Strainer**

Strainer consisting of a Y-style body  
with flanges and a wide - meshed Filter element  
to protect down streammed equipments,  
straining and collecting of dirt particles

material:

body: cast iron (EN-GJL 250)  
drain flange: cast iron (EN-GJL 250)  
filter: 1.4401 - stainless steel

with 2 holes for pressure gauge connection



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with tapped hole in the drain flange  
incl. mating flanges, screws, nuts and sealing  
medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

**13.2.260.** accord. To Design Description 1307  
**strainer DN 32**  
DN 32  
PN 16

supply and mounting

**13.2.270.** accord. To Design Description 1307  
**strainer DN 50**  
DN 50  
PN 16

supply and mounting

**13.2.280.** accord. To Design Description 1307  
**strainer DN 65**  
DN 65  
PN 16

supply and mounting

**13.2.290.** accord. To Design Description 1307  
**strainer DN 80**  
DN 80  
PN 16

supply and mounting

**13.2.300.** accord. To Design Description 1307  
**strainer DN 100**  
DN 100  
PN 16

supply and mounting

**13.2.310.** accord. To Design Description 1307  
**strainer DN 125**  
DN 125

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PN 16

supply and mounting

**13.2.320.** accord. To Design Description 1307  
**strainer DN 200**  
DN 200  
PN 16

supply and mounting

**13.2.330.** accord. To Design Description 1307  
**strainer DN 250**  
DN 250  
PN 16

supply and mounting

\*\*\* Design-Description 1308  
**Balancing and Shut - Off Valve**

Maintenance-free soft seated shut-off globe valve  
With fluid rate and temperature sensor

For adjusting and measuring the flow rate

Materials

Body: lamellar graphite cast iron EN-GJL 250

Design:

Sensor (IP 54 plug) for flow rate and temperature measurement as well as nominal diameter identification  
Straight-way globe valve with slanted seat and vertical bonnet  
Non-rotating stem with protected, external thread  
Non-rising handwheel, locking device, travel stop  
Compact throttling valve plug with EPDM coating as soft main and back seat  
Maintenance-free stem seal with EPDM profile  
Free from asbestos, CFC and PCB  
Short face-to-face length to EN 558-1/14

temperature-range: - 10 up to + 120 °C

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medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

incl. mating flanges, screws, nuts and sealing

**13.2.340.** accord. To Design Description 1308  
**balancing valve DN 25**  
DN 25  
PN 16

supply and mounting

**13.2.350.** accord. To Design Description 1308  
**balancing valve DN 200**  
DN 200  
PN 16

supply and mounting

**13.2.360.** accord. To Design Description 1308  
**balancing valve DN 250**  
DN 250  
PN 16

supply and mounting

**13.2.370. Flow Switch**  
for monitoring flow of fluids in piping of diameter  
DN 15 up to DN 200

technical data:

rated load: 15 (8) A, 24 - 250 V AC  
enclosure: IP 65  
ambient temperature: - 40 up to 85 °C  
max. fluid temp: + 120 °C  
max. working pressure: 11 bar  
casing: impact-resistant plastic  
screw in body R1" of brass  
vainness of stainless steel

incl. cutting to length, feeding in and connecting the cables

supply and mounting

All cables will be installed by the trade "Electrical Supply".

## Specification

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The feeding in, cutting to length and connection of the cables is including in this position.

**13.2.380. Buffer**  
out of steel

medium: water 6 / 12 °C

volume: 5 m<sup>3</sup>  
diameter: ca. 1,60 m  
high without bottoms ca. 2,00 m:  
high incl. bottom  
and feet: ca. 2,70 m

buffer with

4 nozzles DN 300 / PN 16  
1 manhole DN 500 / PN 16 incl. cover, screws,  
nuts and sealing  
2 nozzles DN 25 / PN 16  
4 nozzles DN 15 / PN 16

length of nozzles: 150 mm  
nozzles incl. flanges PN 16

buffer with rust protection primer coat and 2 cover coats,  
paintings in different colors.

buffer with 4 thermically separated feet

incl. acceptance and certification of legal authorities  
acc. to italien law and PED certification

incl. mating flanges, screws, nuts and sealing

supply and mounting

**13.2.390. Automatically Fill Up Unit**  
for automatic water make-up according to DIN EN 171

consisting of  
shut - off valve with connection Rp ½"  
pressure sensor  
control unit  
ball valve with actuator  
system separator  
manometer connection  
dirt trap  
pressure reducer

## Specification

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technical data:

flow rate: 0,5 m<sup>3</sup>/h at dp 1,5 bar  
input pressure: max. 10 bar  
output pressure: 0,5 - 5 bar  
supply voltage: 1 x 230 V / 50 HZ

incl. bolting and sealing

medium: water 6 / 12 °C and 30 / 50 °C

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to lenght and connected by the trade "Measuring and control System"

\*\*\* Design-Description 1309

### **Expansion Tank**

expansion vessel for heating and cooling PN 10

with

flange connections PN 16  
replaceable diaphragm  
with inspection opening  
with manometer in nitrogen area

technical data:

max. operation  
temperature: vessel 120 °C  
membrane: 70 °C  
factory pressing: 3,5 bar

medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

incl. mating flanges, screws, nuts and sealing

**13.2.400.** accord. To Design Description 1309  
**Expansion Tank 80 l**  
System: chiller 1 + 2

Nominal volume 80 l

diamater: 480 mm  
high over all: 730 mm  
weight (without water): 21 kg

## Specification

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connection: DN 25 / PN 16 (flange)

supply and mounting

**13.2.410.** accord. To Design Description 1309  
**Expansion Tank 600 I**  
System: K 6 - 12

Nominal volume 600 I

diameter: 750 mm

high over all: 1830 mm

weight (without water): 175 kg

connection: DN 40 / PN 16 (flange)

supply and mounting

**13.2.420.** accord. To Design Description 1309  
**Expansion Tank 600 I**  
System: K 15 -21

Nominal volume 600 I

diameter: 750 mm

high over all: 1830 mm

weight (without water): 175 kg

connection: DN 40 / PN 16 (flange)

supply and mounting

**13.2.430.** accord. To Design Description 1309  
**Expansion Tank 1500 I**  
System: K 30 - 50

Nominal volume 1500 I

diameter: 1200 mm

high over all: 2000 mm

weight (without water): 155 kg

connection: DN 65 / PN 16 (flange)

supply and mounting

## Specification

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\*\*\* Design-Description 1310

### Cap Flange Valve

Maintenance-free soft seated shut-off globe valve

consisting of cast iron flake graphite EN-GJL-250

operating data:

temperature-range: - 10 up to + 120 °C

pressure-range: up to dp 16 bar

with cap lead-sealable against unauthorized closing

medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

incl. mating flanges, screws, nuts and sealing

**13.2.440.** accord. To Design Description 1310  
**cab flange valve DN 25**  
system: chilller 1 + 2

DN 25

PN 16

supply and mounting

**13.2.450.** accord. To Design Description 1310  
**cab flange valve DN 40**  
system: K 6 -12

DN 40

PN 16

supply and mounting

**13.2.460.** accord. To Design Description 1310  
**cab flange valve DN 40**  
system: K 15 - 21

DN 40

PN 16

supply and mounting

## Specification

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**13.2.470.** accord. To Design Description 1310  
**cab flange valve DN 65**  
system: K 30 - 50

DN 65  
PN 16

supply and mounting

\*\*\* Design-Description 1311  
**Safety Valve**

Flange safety valve with closed spring hood

direct working, spring surcharged

material: GG-25

nominal pressure: PN 16

medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

incl. mating flanges, screws, nuts and sealing

**13.2.480.** accord. To Design Description 1311  
**Safety Valve DN 32 / 50**  
System: chiller 1 + 2

DN 32 / 50  
PN 16

Blow - off - pressure: 10 bar

supply and mounting

**13.2.490.** accord. To Design Description 1311  
**Safety Valve DN 50 / 80**  
System: K 6 - 12

DN 50 / 80  
PN 16

Blow - off - pressure: 10 bar

supply and mounting



## Specification

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- 13.2.500.** accord. To Design Description 1311  
**Safety Valve DN 50 / 80**  
System: K 15 - 21
- DN 50 / 80  
PN 16  
Blow - off - pressure: 10 bar
- supply and mounting
- 13.2.510.** accord. To Design Description 1311  
**Safety Valve DN 65 / 100**  
System: K 30 - 50
- DN 65 / 100  
PN 16  
Blow - off - pressure: 10 bar
- supply and mounting
- 13.2.520.** **Bimetal Thermometer - 10 /+ 30 °C**  
for temperature measurement of liquids in insulated pipes
- dial: white  
graduations: black  
pointer: aluminum alloy black  
adjustment: at the back of the case  
window: normal glass  
temperature range: -10 up to 30 °C  
accuracy: class 1,0  
diameter: 100 mm  
immersion tube: ½" x 100 mm  
incl. screw - on protection pipe ½" x 100 mm out of brass
- medium: water 6 / 12 °C
- 13.2.530.** **Bimetal Thermometer 0 / + 40 °C**  
as described before, but
- temperature range: 0 up to + 40 °C
- medium: water 15 / 21 °C
- supply and mounting

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**13.2.540. Bimetal Thermometer 0 / + 60 °C**

as describrd before, but

temperature range: 0 up to + 60 °C

medium: water 30 / 50°C

supply and mounting

**13.2.550. Pressure Gauge**

With liquid filling for measurement of liquids in insulated pipes

dial: white

graduations: black

pointer: aluminum black

window: laminated safety glass

Solid stainless steel separating wall between the measuring element and dial; rear wall constructed as blow out

liquid filling: glycerin 99,5%

pressure range: 0 up to 10 bar

accuracy:class 1

diameter: 100 mm

connection: ½" at the bottom

medium: water 6 / 12 °C, 15 / 21 °C, 30 / 50°C

**13.2.560. \*\*\* Item N/A**

**13.2.570. Manometer Valve**

out of brass

with exhausting cab

with test flange

connetion RP 15

supply and mounting

incl. sealing an mounting material

**13.2.580. Measuring Nozzle**

diameter: ½" x 100 mm

with shut-off valve consisting of red brass

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incl. welding, sealing and mounting material

supply and mounting

**13.2.590. Mounting of Measuring Equipment**

Mounting of supplied indicators, pressure switches a.s.o.

incl. welding, sealing and mounting material

only mounting

**13.2.600. Nozzle RP 15 x 100 mm**

with coupling sleeve for mounting of measurement equipment

incl. welding, sealing and mounting material

supply and mounting

**13.2.610.** \*\*\* Item N/A

**13.2.620. Fill and Emptying Valve RP 15**

case out of red brass 58 with connection fitting to flexible tube

with coupling sleeve

incl. welding, sealing and mounting material

supply and mounting

**13.2.630. Fill and Emptying Valve RP 20**

case out of red brass 58 with connection fitting to flexible tube

with coupling sleeve

incl. welding, sealing and mounting material

supply and mounting

**13.2.640. Cloth Insert Hose RP 15**

for filling and emptying the refrigeration system

incl. connection bolting, tube hose and mounting material

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length: 20 m

supply and mounting

**13.2.650. Cloth Insert Hose RP 20**  
for filling and emptying the refrigeration system

incl. connection bolting, tube hose and mounting material

length: 20 m

supply and mounting

**13.2.660. Hose Carrier**  
for filling and emptying flexible tube

consisting of metal sheet

incl. mounting material

supply and mounting

### Control Valves

\*\*\* Design-Description 1312  
**Flange 2-port control valve**

body	grey cast iron (GJL-250),
gland seal	yellow brass
shaft	stainless steel
cone	yellow brass - DN 15 up to DN 80 red brass - DN 100 up to DN 150
shaft sealing	EFDM - rolling o-ring joint
lift	20 mm - DN 15 up to DN 50 40 mm - DN 65 up to DN 150
characteristic	0 up to 30 % - linear 30 up to 100 % - equal percently
leaky range	0 up to 0,02 % from kv - value
temperature range:	- 25 up to + 130 °C
nominal pressure	PN 25 - DN 15 up to DN 40 PN 16 - DN 50 up to DN 150

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medium: water 70 / 50°C

usable for water and water / glycol mixtures up to 50 %

moving with electro hydraulic actuator,  
the actuators are described in separate positions

incl. mating flanges, screws, nuts and sealing

**13.2.670.** accord. To Design Description 1312

**Control Valve 15 - 2,5**

DN 15  
Kvs 2,5  
PN 25

Supply and mounting

**13.2.680.** accord. To Design Description 1312

**Control Valve 25 - 6,3**

DN 25  
Kvs 6,3  
PN 25

Supply and mounting

**13.2.690.** accord. To Design Description 1312

**Control Valve 40 - 12,5**

DN 40  
Kvs 12,5  
PN 25

Supply and mounting

**13.2.700.** accord. To Design Description 1312

**Control Valve 40 - 25**

DN 40  
Kvs 25  
PN 25

Supply and mounting

**13.2.710.** accord. To Design Description 1312

**Control Valve 50 - 31**

DN 50  
Kvs 31

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PN 16

Supply and mounting

**13.2.720.** accord. To Design Description 1312

**Control Valve 65 - 49**

DN 65

Kvs 49

PN 16

Supply and mounting

**13.2.730.** accord. To Design Description 1312

**Control Valve 80 - 78**

DN 80

Kvs 78

PN 15

Supply and mounting

\*\*\* Design-Description 1313

**Flange 3-port control valve**

body	grey cast iron (GJL-250),
gland seal	yellow brass
shaft	stainless steel
cone	yellow brass - DN 15 up to DN 65 red brass - DN 80 up to DN 150
shaft sealing	EFDM - rolling o-ring joint

lift	20 mm - DN 15 up to DN 80 40 mm - DN 100 up to DN 150
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characteristic	0 up to 30 % - linear 30 up to 100 % - equal percently
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leaky range	0 up to 0,02 % from kv - value
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temperature range: - 25 up to + 130 °C

nominal pressure PN 16

medium: water 70 / 50°C

usable for water and water / glycol mixtures up to 50 %

moving with electro hydraulic actuator,

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the actuators are described in separate positions

incl. mating flanges, screws, nuts and sealing

**13.2.740.** accord. To Design Description 1313

**Control Valve 150 - 300**

DN 150

Kvs 300

Supply and mounting

\*\*\* Design-Description 1314

**Actuator for Control Valve**

Electro - pneumatic actuator for the control valves described before

stroke 20 mm and/or 40 mm

force 2800 N

operation current 24 V AC

signal current 0 - 10 V

position signal 3 P

characteristic linear or equal percentally - adjustable

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to length and connected by the trade "Measuring and control System"

**13.2.750.** **Actuator 20 mm**  
actuator with stroke 20 mm

Supply and mounting

**13.2.760.** **Actuator 40 mm**  
actuator with stroke 40 mm

Supply and mounting

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### 13.3. Pipes and Accessories

Pipes are generally out of steel, black, material ST 37.0

Technical supply regulations acc. to ISO 9329

Pipes with nominal diameter

equal/lower DN 50: acc. to ISO 65 - 1981  
seamless

greater DN 50 up to DN 100: acc. to ISO 4200 - 1985  
seamless

greater DN 100: acc. to ISO 4200 - 1985  
full length,  
spiral welded

\*\*\* Design-Description 1315

#### **Pipe connections as self-subsistent connections**

Steel pipes have to be welded.

Only licensed welders with valid papers may be allowed to carry out welding work.

A copy of the welding liceneces have to be handed out to the supervision of the customer, before starting work.

The pipelines have to be stored in impact - sound damping mounting plates.

Impact-sound damping rate > 30 dB by reference swing velocity  $v_0 = 5 \times (10 E^{-8})$  m/s.

Continuous pipe mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with mineral fibre fire protection measures

These fire protection measures are described in a separate specification.

The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components



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must be submitted to the constructor by the supplier before the work is carried out.

Pipes are to given a rusts protection double primer coat, coats with different colours.

The painting has to be usable with insulation out of closed celled expanded nautr rubber.

Following installation of the pipelines, the welds and any damage must be repaired.

On principle clamps with special cold insulation have to be used.

pipe clamp consisting out of closed celled PUR

raw density	250 kg/m <sup>3</sup>
pressure resistance	2,4 N/mm <sup>2</sup>
thermal conductivity	0,045 W/(m*K)
diffusion resistance	2500mü (mean value)
temperature range	- 160 up to + 130 °C
fire protection class acc. to DIN 4102	B2
thickness of insulation	30 mm up tp DN 80 40 mm DN 100 up to DN
150	
600	60 mm DN 200 up to DN

supply and mounting incl. mounting material (clamps, threaded rods, screws, nuts, dowels a.s.o.) welding and sealing material,

fittings, flanges, boltings are described in separate positions.

**13.3.10.** accord. To Design Description 1315  
**Pipe DN 15**  
DN 15 (21,3 x 2,65 mm) seamless

Supply and mounting

**13.3.20.** accord. To Design Description 1315  
**Pipe DN 20**  
DN 20 (26,9 x 2,65 mm) 0 seamless

Supply and mounting

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- 13.3.30.** accord. To Design Description 1315  
**Pipe DN 25**  
DN 25 (33,7 x 3,35 mm) 0 seamless  
  
Supply and mounting
- 13.3.40.** accord. To Design Description 1315  
**Pipe DN 32**  
DN 32 (42,4 x 3,25 mm) 0 seamless  
  
Supply and mounting
- 13.3.50.** \*\*\* Item N/A
- 13.3.60.** accord. To Design Description 1315  
**Pipe DN 50**  
DN 50 (60,3 x 3,65 mm) seamless  
  
Supply and mounting
- 13.3.70.** accord. To Design Description 1315  
**Pipe DN 65**  
DN 65 (76,1 x 2,9 mm) seamless  
  
Supply and mounting
- 13.3.80.** accord. To Design Description 1315  
**Pipe DN 80**  
DN 80 (88,9 x 3,2 mm) seamless  
  
Supply and mounting
- 13.3.90.** accord. To Design Description 1315  
**Pipe DN 100**  
DN 100 (114,3 x 3,6 mm) seamless  
  
Supply and mounting
- 13.3.100.** accord. To Design Description 1315  
**Pipe DN 125**  
DN 125 (139,7 x 4,0 mm) full length, spiral welded

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supply and mounting

**13.3.110.** accord. To Design Description 1315  
**Pipe DN 150**  
DN 150 (168,3 x 4,5 mm) full length, spiral welded

supply and mounting

**13.3.120.** accord. To Design Description 1315  
**Pipe DN 200**  
DN 200 (219,1 x 6,3 mm) full length, spiral welded

supply and mounting

**13.3.130.** accord. To Design Description 1315  
**Pipe DN 250**  
DN 250 (273,0 x 6,3 mm) full length, spiral welded

supply and mounting

**13.3.140.** accord. To Design Description 1315  
**Pipe DN 300**  
DN300 (323,9 x 7,1 mm) full length, spiral welded

supply and mounting

\*\*\* Design-Description 1316  
**cancelled**

**13.3.150.** accord. To Design Description 1316  
**cancelled**

**13.3.160.** accord. To Design Description 1316  
**cancelled**

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13.3.170.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.180.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.190.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.200.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.210.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.220.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.230.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.240.	accord. To Design Description 1316 <b>cancelled</b>
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13.3.250.	accord. To Design Description 1316 <b>cancelled</b>
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DN 150 (168,3 x 4,5 mm)

Supply and mounting

13.3.260.	accord. To Design Description 1316 <b>cancelled</b>
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DN 200 (219,1 x 6,3 mm)

Supply and mounting

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**13.3.270.** accord. To Design Description 1316  
**cancelled**

DN 250 (273,0 x 6,3 mm)

Supply and mounting

**Fittings for steel pipes as described before,**

\*\*\* Design-Description 1317

**Elbow**

in all angle - degrees

**13.3.280.** accord. To Design Description 1317

**Elbow DN 15**

DN 15 (21,3 x 2,65 mm)

Supply and mounting

**13.3.290.** accord. To Design Description 1317

**Elbow DN 20**

DN 20 (26,9 x 2,65 mm)

Supply and mounting

**13.3.300.** accord. To Design Description 1317

**Elbow DN 25**

DN 25 (33,7 x 3,35 mm)

Supply and mounting

**13.3.310.** accord. To Design Description 1317

**Elbow DN 32**

DN 32 (42,4 x 3,25 mm)

Supply and mounting

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13.3.320. \*\*\* Item N/A

13.3.330. accord. To Design Description 1317  
**Elbow DN 50**  
DN 50 (60,3 x 3,65 mm)  
  
Supply and mounting

13.3.340. accord. To Design Description 1317  
**Elbow DN 65**  
DN 65 (76,1 x 2,9 mm)  
  
Supply and mounting

13.3.350. accord. To Design Description 1317  
**Elbow DN 80**  
DN 80 (88,9 x 3,2 mm)  
  
Supply and mounting

13.3.360. accord. To Design Description 1317  
**Elbow DN 100**  
DN 100 (114,3 x 3,6 mm)  
  
Supply and mounting

13.3.370. accord. To Design Description 1317  
**Elbow DN 125**  
DN 125 (139,7 x 4,0 mm)  
  
Supply and mounting

13.3.380. accord. To Design Description 1317  
**Elbow DN 150**  
DN 150 (168,3 x 4,5 mm)  
  
Supply and mounting

13.3.390. accord. To Design Description 1317  
**Elbow DN 200**  
DN 200 (219,1 x 6,3 mm)  
  
Supply and mounting

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**13.3.400.** accord. To Design Description 1317  
**Elbow DN 250**  
DN 250 (273,0 x 6,3 mm)

Supply and mounting

**13.3.410.** accord. To Design Description 1317  
**Elbow DN 300**  
DN 300 (323,9 x 7,1 mm)

Supply and mounting

### Guide Note

Branch fittings up to DN 40 may be build by T- fittings

Branch fittings greater than DN 40 are to be shoe curved to the pipe by shoe-bent elbows

\*\*\* Design-Description 1318  
**T - Fitting**

as T- fitting in equal and reduced outlets

only the greatest diameter is described

**13.3.420.** \*\*\* Item N/A

\*\*\* Design-Description 1319  
**Shoe bent Elbow**

**Shoe bent Elbow**

**13.3.430.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

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**13.3.440.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 50**  
DN 50 (60,3 x 2,9 mm)

Supply and mounting

**13.3.450.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 100**  
DN 100 (114,3 x 3,6 mm)

Supply and mounting

**13.3.460.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

**13.3.470.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**13.3.480.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 200**  
DN 200 (2219,1 x 6,3 mm)

Supply and mounting

**13.3.490.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 250**  
DN 250 (273,0 x 6,3 mm)

Supply and mounting

**13.3.500.** accord. To Design Description 1319  
**Shoe-bent Elbow DN 300**  
DN 300 (323,9 x 7,1 mm)

Supply and mounting



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\*\*\* Design-Description 1320  
**Reduction Fitting**

in concentric and eccentric type

only the greatest diameter is described

**13.3.510.** accord. To Design Description 1320  
**Reduction DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**13.3.520.** accord. To Design Description 1320  
**Reduction DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

**13.3.530.** accord. To Design Description 1320  
**Reduction DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

**13.3.540.** accord. To Design Description 1320  
**Reduction DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

**13.3.550.** accord. To Design Description 1320  
**Reduction DN 80**  
DN 80 (88,9 x 3,2 mm)

Supply and mounting

**13.3.560.** accord. To Design Description 1320  
**Reduction DN 100**  
DN 100 (114,3 x 3,6 mm)

Supply and mounting

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**13.3.570.** accord. To Design Description 1320  
**Reduction DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

**13.3.580.** accord. To Design Description 1320  
**Reduction DN 150**  
DN 150 (168,3 x 4,5 mm)

Supply and mounting

**13.3.590.** accord. To Design Description 1320  
**Reduction DN 200**  
DN 200 (219,1 x 6,3 mm)

Supply and mounting

**13.3.600.** accord. To Design Description 1320  
**Reduction DN 250**  
DN 250 (273,0 x 6,3 mm)

Supply and mounting

**13.3.610.** accord. To Design Description 1320  
**Reduction DN 300**  
DN 300 (323,9 x 7,1 mm)

Supply and mounting

\*\*\* Design-Description 1321  
**End Cap**

als welding end cap with welgng phase

thickness of the material equal to the thickness of pipes

**13.3.620.** accord. To Design Description 1321  
**End Cap DN 100**  
DN 100 (114,3 x 3,6 mm)

Supply and mounting

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- 13.3.630.** accord. To Design Description 1321  
**End Cap DN 125**  
DN 125 (139,7 x 4,0 mm)  
  
Supply and mounting
- 13.3.640.** accord. To Design Description 1321  
**End Cap DN 150**  
DN 150 (168,3 x 4,5 mm)  
  
Supply and mounting
- 13.3.650.** accord. To Design Description 1321  
**End Cap DN 200**  
DN 200 (219,1 x 6,3 mm)  
  
Supply and mounting
- 13.3.660.** accord. To Design Description 1321  
**End Cap DN 250**  
DN 250 (273,0 x 6,3 mm)  
  
Supply and mounting
- \*\*\* Design-Description 1332  
**Pair of Flanges**  
  
as welding neck flanges incl. screws, nuts and sealing  
  
nominal pressure PN 16 acc. to DIN 2633  
  
material: C 22
- 13.3.670.** accord. To Design Description 1332  
**Flanges DN 32**  
DN 32 (42,4 x 3,25 mm)  
  
Supply and mounting

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**13.3.680.** accord. To Design Description 1332  
**Flanges DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

**13.3.690.** accord. To Design Description 1332  
**Flanges DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

**13.3.700.** accord. To Design Description 1332  
**Flanges DN 80**  
DN 80 (88,9 x 3,2 mm)

Supply and mounting

**13.3.710.** accord. To Design Description 1332  
**Flanges DN 100**  
DN 100 (114,3 x 3,6 mm)

Supply and mounting

**13.3.720.** accord. To Design Description 1332  
**Flanges DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

\*\*\* Design-Description 1333  
**Blind Flanges**

as blind flanges incl. screws, nuts and sealing

nominal pressure PN 16 acc. to DIN 2527

material: C 22

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**13.3.730.** accord. To Design Description 1333  
**Blind Flanges DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

**13.3.740.** accord. To Design Description 1333  
**Blind Flanges DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**13.3.750.** accord. To Design Description 1333  
**Blind Flanges DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

**13.3.760.** accord. To Design Description 1333  
**Blind Flanges DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

**13.3.770.** accord. To Design Description 1333  
**Blind Flanges DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

**13.3.780.** accord. To Design Description 1333  
**Blind Flanges DN 80**  
DN 80 (88,9 x 3,2 mm)

Supply and mounting

\*\*\* Design-Description 1334  
**Exhausting Bottle**

Exhausting bottle to ventilate the pipe system

Consisting out of

steel pipe, black, St 37.0 acc. to ISO 9329

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2 end caps in the diameter of the pipe  
2 nozzles for the pipe system in different nominal diameters,  
length 150 mm  
1 nozzle ½" x 150 mm for exhausting pipe

**13.3.790.** accord. To Design Description 1334  
**Exhausting bottle DN 100**  
Length (without end cap): 250 mm  
Diameter: DN 100  
  
supply and mounting

**13.3.800.** accord. To Design Description 1334  
**Exhausting bottle DN 200**  
Length (without end cap): 300 mm  
Diameter: DN 200  
  
Supply and mounting

**13.3.810.** accord. To Design Description 1334  
**Exhausting bottle DN 300**  
  
Length (without end cap): 300 mm  
Diameter: DN 300  
  
Supply and mounting

**13.3.820.** accord. To Design Description 1334  
**Exhausting bottle DN 400**  
Length (without end cap): 300 mm  
Diameter: DN 400  
  
Supply and mounting

\*\*\* Design-Description 1335  
**Connection to Cooling Units**

The cooling units of the Air Handling Units (AHUs) have to  
Connected with the pipe system.

This will be done by bolting out of malleable cast or  
mating flanges out of steel acc. to DIN 2633 incl. screws and  
nuts

The positions includes all sealing and all mounting material.

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1 each of the connections includes both connection (inlet and outlet)

**13.3.830.** accord. To Design Description 1335  
**Connection DN 32**  
with a pair of mating flanges DN 32 / PN 16  
  
supply and mounting

**13.3.840.** accord. To Design Description 1335  
**Connection DN 50**  
with a pair of mating flanges DN 50 / PN 16  
  
supply and mounting

**13.3.850.** accord. To Design Description 1335  
**Connection DN 65**  
with a pair of mating flanges DN 65 / PN 16  
  
supply and mounting

**13.3.860.** accord. To Design Description 1335  
**Connection DN 80**  
with a pair of mating flanges DN 80 / PN 16  
  
supply and mounting

**13.3.870.** accord. To Design Description 1335  
**Connection DN 100**  
with a pair of mating flanges DN 100 / PN 16  
  
supply and mounting

**13.3.880.** accord. To Design Description 1335  
**Connection DN 125**  
with a pair of mating flanges DN 125 / PN 16  
  
supply and mounting

\*\*\* Design-Description 1336  
**Sign Post**

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consisting of resopal  
according to the specifications of the customer,  
incl. all necessary accessories,  
inscription acc. to the list, which is approved by the customer

**13.3.890.** accord. To Design Description 1336  
**Sign Post 200 / 100**  
length: 200 mm  
high: 100 mm

supply and mounting

**13.3.900.** accord. To Design Description 1336  
**Sign Post 100 / 50**  
length: 100 mm  
high: 50 mm

supply and mounting

**13.3.910.** accord. To Design Description 1336  
**Sign Post 50 / 25**  
length: 50 mm  
high: 25 mm

supply and mounting

**13.3.920.** **Directional Marker**  
to stick on to the pipes in long lasting execution  
color, text and execution acc. to  
the requirement of the customer

supply and mounting

**13.3.930.** **Structural Steel Construction**  
(according to the instruction of the supervisor)

in all kinds of special mounting constructions, welded and/or  
screwed

rust protection by ground and finished painting (in different  
paints),  
paint acc. to the instructions of the customer

incl. all necessary mounting materials  
incl. drilling of fixing holes in concrete and/or masonry walls  
and ceilings



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The accounting will be based on the avoirdupois' of the steel supply and mounting

\*\*\* Design-Description 1337

### **Pressure Test**

Following installation and laying of pipeline system, before the wall gaps und ceiling bushings are closed and before the insulation is installed, the pipe system is to be subjected to a pressure test.

Relevant regulations and manufacturer's directives are to be followed.

As test medium, water has to be used.

All pipe connections have to undergo a visual examination.

The test pressure is 1, 5 x nominal pressure. The test period is 12 hours.

All test have are to be carried in arrangement and in presence of the construction supervisor.

The test results must be recorded in protocols, countersigned by the construction supervisor and to be documented. All used protocols should agree in content with ISO 9000.

As a function of the progress of the construction work, it will be necessary to execute the pressure tests in separate section.

**13.3.940.** accord. To Design Description 1337  
**Pressure Test 1000 liters**  
Pressure test in section up to 1000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**13.3.950.** accord. To Design Description 1337  
**Pressure Test 2500 liters**  
Pressure test in section up to 2500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

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Supply and mounting

**13.3.960.** accord. To Design Description 1337  
**Pressure Test 5000 liters**  
Pressure test in section up to 2500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

\*\*\* Design-Description 1338  
**Pipe Cleaning**

All pipe systems are to be flushed before connection with the main pipe - system and before commissioning.

Before the pipeline is connected to the main system, the degree of cleanness of the flushing medium has to be checked, protocolled and to be coordinated with the construction supervisor.

Integrated strainers are to be cleaned, if necessary in several times.

As a function of the progress of the construction work, it will be necessary to execute the pipe cleaning in separate section.

**13.3.970.** accord. To Design Description 1338  
**Pipe Cleaning 1000 liters**  
Pipe cleaning in section up to 1000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**13.3.980.** accord. To Design Description 1338  
**Pipe Cleaning 2500 liters**  
Pipe cleaning in section up to 2500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

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**13.3.990.** accord. To Design Description 1338  
**Pipe Cleaning 5000 liters**  
Pipe cleaning in section up to 5000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**13.3.1000.** **certificazioni e documentazioni richieste dalla normativa P.E.D**  
Il costruttore, dovrà elaborare e rilasciare tutte le certificazioni e documentazioni richieste dalla normativa vigente e dalla normativa P.E.D. comprovate da verbali di prove di pressione, test sui materiali e sulle saldature il tutto certificato da un istituto ufficiale e autorizzato. La certificazione dovrà riguardare non solo i singoli componenti e attrezzature ma l'insieme costituente l'impianto oggetto di certificazione. (Si ricorda che tra i documenti ed elaborati che devono essere prodotti sono anche compresi la stress analysis e la risk analysis).

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### 13.4. Insulation of Pipes

Insulation materials containing glass fibre or silicon components must not be used

\*\*\* Design-Description 1339

#### Insulation of Pipes

for pipes out of steel, black, St 37.0

pipes painted with rust protection,  
protection paint usable in combination with closed celled  
expanded natural rubber

consisting out of

expanded natural rubber as hose and/or matt  
closed celled,

thermal conductivity ca. 0,037 W/(m\*K)  
by mean

temperature 20 °C

fire protection class

acc. to DIN 4102 B1

notches and gaps glued diffusion-tight, additionally glued with  
diffusion-tight tape,

thickness sufficient for vapour barrier

wall and ceiling brushings have to build in fire resistance design  
(fire wall measures are described separately)

medium: water 6 / 12 °C and 15 / 21 °C

thickness. 19 mm

**13.4.10.** accord. To Design Description 1339  
**for pipe DN 15**  
Supply and mounting

**13.4.20.** accord. To Design Description 1339  
**for pipe DN 20**  
Supply and mounting

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13.4.30. accord. To Design Description 1339  
**for pipe DN 25**  
Supply and mounting

13.4.40. accord. To Design Description 1339  
**for pipe DN 32**  
Supply and mounting

13.4.50. accord. To Design Description 1339  
**for pipe DN 50**  
Supply and mounting

13.4.60. accord. To Design Description 1339  
**for pipe DN 65**  
Supply and mounting

13.4.70. accord. To Design Description 1339  
**for pipe DN 80**  
Supply and mounting

13.4.80. accord. To Design Description 1339  
**for pipe DN 100**  
Supply and mounting

13.4.90. accord. To Design Description 1339  
**for pipe DN 125**  
Supply and mounting

13.4.100. accord. To Design Description 1339  
**for pipe DN 150**  
Supply and mounting

13.4.110. accord. To Design Description 1339  
**for pipe DN 200**  
Supply and mounting

13.4.120. accord. To Design Description 1339  
**for pipe DN 250**  
Supply and mounting

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**13.4.130.** accord. To Design Description 1339  
**for pipe DN 300**  
Supply and mounting

\*\*\* Design-Description 1340  
**Insulation of ArmaturesMantling**

Insulation as described before for  
butterfly valves, valves in all types, strainers a.so.

**13.4.140.** accord. To Design Description 1340  
**for manometer + emptying valves DN 15**  
Supply and mounting

**13.4.150.** accord. To Design Description 1340  
**for manometer + emptying valves DN 20**  
Supply and mounting

**13.4.160.** accord. To Design Description 1340  
**for armatures DN 15**  
Supply and mounting

**13.4.170.** accord. To Design Description 1340  
**for armatures DN 25**  
Supply and mounting

**13.4.180.** accord. To Design Description 1340  
**for armatures DN 32**  
supply and mounting

**13.4.190.** accord. To Design Description 1340  
**for armatures DN 40**  
Supply and mounting

**13.4.200.** accord. To Design Description 1340  
**for armatures DN 50**  
Supply and mounting

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13.4.210. accord. To Design Description 1340  
**for armatures DN 65**  
Supply and mounting

13.4.220. accord. To Design Description 1340  
**for armatures DN 80**  
  
Supply and mounting

13.4.230. accord. To Design Description 1340  
**for armatures DN 100**  
supply and mounting

13.4.240. accord. To Design Description 1340  
**for armatures DN 125**  
Supply and mounting

13.4.250. accord. To Design Description 1340  
**for armatures DN 150**  
Supply and mounting

13.4.260. accord. To Design Description 1340  
**for armatures DN 200**  
  
Supply and mounting

13.4.270. accord. To Design Description 1340  
**for armatures DN 250**  
supply and mounting

13.4.280. accord. To Design Description 1340  
**for armatures DN 300**  
Supply and mounting

\*\*\* Design-Description 1341  
**Surcharge for manteling out of galvanized steel sheet**

for insulation of pipes out of steel, black, St 37.0  
as described before

**Mantling out of galvanized steel, crimped or bolted,**

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**The surface of the insulation must not be damaged by the mantling.  
Therefore felt-tie enclosures or distance holders have to be used.**

**13.4.290.** \*\*\* Item N/A

**13.4.300.** accord. To Design Description 1341  
**for pipe DN 20**  
Supply and mounting

**13.4.310.** accord. To Design Description 1341  
**for pipe DN 25**  
Supply and mounting

**13.4.320.** accord. To Design Description 1341  
**for pipe DN 32**  
Supply and mounting

**13.4.330.** accord. To Design Description 1341  
**for pipe DN 50**  
Supply and mounting

**13.4.340.** accord. To Design Description 1341  
**for pipe DN 65**  
Supply and mounting

**13.4.350.** accord. To Design Description 1341  
**for pipe DN 80**  
Supply and mounting

**13.4.360.** accord. To Design Description 1341  
**for pipe DN 100**  
Supply and mounting

**13.4.370.** accord. To Design Description 1341  
**for pipe DN 125**  
Supply and mounting



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13.4.380. accord. To Design Description 1341  
**for pipe DN 150**  
Supply and mounting

13.4.390. accord. To Design Description 1341  
**for pipe DN 200**  
Supply and mounting

13.4.400. accord. To Design Description 1341  
**for pipe DN 250**  
Supply and mounting

13.4.410. accord. To Design Description 1341  
**for pipe DN 300**  
Supply and mounting

\*\*\* Design-Description 1342  
**Surcharge for manteling out of galvanized steel sheet**

for insulation of armatuieres

as described before

**Mantling out of galvanized steel, crimped or bolted,**

**The surface of the insulation must not damaged by the mantling.**

**Therefore felt-tie enclosures or distance holders have to be used.**

13.4.420. \*\*\* Item N/A

13.4.430. \*\*\* Item N/A

13.4.440. \*\*\* Item N/A

13.4.450. \*\*\* Item N/A

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13.4.460. \*\*\* Item N/A

13.4.470. \*\*\* Item N/A

13.4.480. \*\*\* Item N/A

13.4.490. \*\*\* Item N/A

13.4.500. \*\*\* Item N/A

13.4.510. \*\*\* Item N/A

13.4.520. \*\*\* Item N/A

13.4.530. \*\*\* Item N/A

13.4.540. \*\*\* Item N/A

13.4.550. \*\*\* Item N/A

\*\*\* Design-Description 1343

### **Insulation of Exhausting Bottles**

Insulation as described before for

exhausting bottles

bottles totally insulated incl. bottoms and  
pipe connections

13.4.560. accord. To Design Description 1343  
**for exhausting bottle DN 100**

DN 100  
length 250 mm

Supply and mounting

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**13.4.570.** accord. To Design Description 1343  
**for exhausting bottle DN 200**  
DN 200  
length 300 mm

Supply and mounting

**13.4.580.** accord. To Design Description 1343  
**for exhausting bottle DN 300**  
DN 300  
length 300 mm

Supply and mounting

**13.4.590.** accord. To Design Description 1343  
**for exhausting bottle DN 400**  
DN 400  
length 300 mm

Supply and mounting

**13.4.600.** accord. To Design Description 1343  
**for nozzles RP 15**

**13.4.610.** accord. To Design Description 1343  
**for buffer**

**13.4.620.** accord. To Design Description 1343  
**for pumps**

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### 13.5. **Special Services**

#### 13.5.10. **Revision Documentation**

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

#### 13.5.20. **Starting UP and Test Operation**

After finishing installation, the systems have to be started up.

The systems and the components must be adjusted, so that the

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functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the testl operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

**13.5.30. Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

**13.5.40. Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate files.

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The customer has to supply these inspections by sending his  
commissioning personal so much as it is necessary

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**14.** **Heating water supply**

**14.1.** **Devices and Accessories**

### Guide Note

All pumps and fittings have to be calculated incl. pair of mating flanges as welding neck flanges incl. screws, nuts and sealing

Material: C22

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to lenth and connected by the trade "Measuring and control System"

\*\*\* Design-Description 1401

### Heating Water Pump

Maintenance - free wet rotor inline pump (glandless),  
with flanged connections  
for 4 speed levels (manual switching)

#### housing

volute casing	cast iron EN_GJL-250
shaft	chrome steel
impeller	plastic
bearings	special carbon
medium-libricated	

#### motor

canned motor	IP 42
thermal class	F
voltage	3 x 400 V, 50 Hz

with full motor protection by way of integrated temperature switches, extracted to clamps

#### operation data

temperature range	+ 20 up zo + 120°C
nominal pressure	PN 10

medium	water
glycol miture	up to 50%

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pump incl. mating flanges, screws, nuts, sealing and mounting material

### 14.1.10. Pump 64 - 48 D

System: VEN03 admixture air - left wing

technical data:

medium:	water	70 / 50 °C
volume flow:	14,7	m <sup>3</sup> /h
pressure head:	0,64	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,9	kW
el. Current:	2,2	A

supply and mounting

### 14.1.20. Pump 64 - 48 D

System: VEN01 combustion air pre heater - left wing

technical data:

medium:	water	70 / 50 °C
volume flow:	9,5	m <sup>3</sup> /h
pressure head:	0,65	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,9	kW
el. Current:	2,2	A

supply and mounting

### 14.1.30. Pump 54 - 30 D

System: VEN01 combustion air re heater - left wing

technical data:

medium:	water	70 / 50 °C
volume flow:	4,0	m <sup>3</sup> /h
pressure head:	0,53	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,54	kW
el. Current:	1,6	A

supply and mounting



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**14.1.40.      Pump 64 - 48 D**

System: VEN07 control room - left wing

technical data:

medium:	water	70 / 50 °C
volume flow:	9,2	m <sup>3</sup> /h
pressure head:	0,60	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,90	kW
el. Current:	2,2	A

supply and mounting

**14.1.50.      Pump 64 - 48 D**

System: VEN09 ground floor - left wing

technical data:

medium:	water	70 / 50 °C
volume flow:	13,8	m <sup>3</sup> /h
pressure head:	0,64	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,9	kW
el. Current:	2,2	A

supply and mounting

**14.1.60.      Pump 44 - 18 D**

System: VEN04 admixture air - right wing

technical data:

medium:	water	70 / 50 °C
volume flow:	5,9	m <sup>3</sup> /h
pressure head:	0,43	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,34	kW
el. Current:	1,1	A

supply and mounting

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**14.1.70. Pump 54 - 30 D**

System: VEN02 combustion air pre heater - right wing

technical data:

medium:	water	70 / 50 °C
volume flow:	7,8	m <sup>3</sup> /h
pressure head:	0,52	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,54	kW
el. Current:	1,6	A

supply and mounting

**14.1.80. Pump 44 - 18 D**

System: VEN02 combustion air re heater - right wing

technical data:

medium:	water	70 / 50 °C
volume flow:	3,3	m <sup>3</sup> /h
pressure head:	0,43	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,34	kW
el. Current:	1,1	A

supply and mounting

**14.1.90. Pump 54 - 30 D**

System: VEN08 control room - right wing

technical data:

medium:	water	70 / 50 °C
volume flow:	5,9	m <sup>3</sup> /h
pressure head:	0,64	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,54	kW
el. Current:	1,6	A

supply and mounting

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**14.1.100.      Pump 64 - 48 D**

System: VEN05 chassis dyno pre heater

technical data:

medium:	water	70 / 50 °C
volume flow:	12,1	m <sup>3</sup> /h
pressure head:	0,55	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,90	kW
el. Current:	2,2	A

supply and mounting

**14.1.110.      Pump 54 - 30 D**

System: VEN05 chassis dyno re heater

technical data:

medium:	water	70 / 50 °C
volume flow:	5,7	m <sup>3</sup> /h
pressure head:	0,47	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,54	kW
el. Current:	1,6	A

supply and mounting

**14.1.120.      Pump 54 - 30 D**

System: VEN10 ground floor - right wing

technical data:

medium:	water	70 / 50 °C
volume flow:	8,0	m <sup>3</sup> /h
pressure head:	0,53	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,54	kW
el. Current:	1,6	A

supply and mounting

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**14.1.130. Pump 54 - 30 D**

System: VEN06 soak area

technical data:

medium:	water	70 / 50 °C
volume flow:	4,8	m <sup>3</sup> /h
pressure head:	0,51	bar
rpm:	1400	1/min
current:	3 x 400	V
el. Power:	0,54	kW
el. Current:	1,6	A

supply and mounting

**14.1.140. Pump 27 - 70 E**

System: VEN23 + VEN24 utilities (technical floor) left + right wings

technical data:

medium:	water	70 / 50 °C
volume flow:	1,5	m <sup>3</sup> /h
pressure head:	0,53	bar
rpm:	2800	1/min
3 speed levels		
current:	1 x 230	V
el. Power:	0,18	kW
el. Current:	0,88	A

supply and mounting

**14.1.150. Pump 27 - 70 E**

System: REC01 metrologie labour

technical data:

medium:	water	70 / 50 °C
volume flow:	1,1	m <sup>3</sup> /h
pressure head:	0,53	bar
rpm:	2800	1/min
3 speed levels		
current:	1 x 230	V
el. Power:	0,18	kW
el. Current:	0,88	A

supply and mounting

## Specification

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**14.1.160. Pump 25 - 15**

System: REC02 calibration labour

technical data:

medium: water 70 / 50 °C  
volume flow: 0,5 m<sup>3</sup>/h  
pressure head: 0,13 bar  
rpm: 2600 1/min  
3 speed levels  
current: 1 x 230 V  
el. Power: 0,058 kW  
el. Current: 0,28 A

supply and mounting

**14.1.170. Pump 25 - 60**

System: VEN25 calibration gas not flammable

technical data:

medium: water 70 / 50 °C  
volume flow: 1,14 m<sup>3</sup>/h  
pressure head: 0,34 bar  
rpm: 2300 1/min  
3 speed levels  
current: 1 x 230 V  
el. Power: 0,10 kW  
el. Current: 0,44 A

supply and mounting

**14.1.180. Pump 25 - 25**

System: VEN28 calibration gas flammable

technical data:

medium: water 70 / 50 °C  
volume flow: 0,5 m<sup>3</sup>/h  
pressure head: 0,13 bar  
rpm: 2500 1/min  
3 speed levels  
current: 1 x 230 V  
el. Power: 0,063 kW  
el. Current: 0,30 A

supply and mounting

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**14.1.190. Pump 25 - 15**

System: VEN26 fuel storage - day tank

technical data:

medium: water 70 / 50 °C  
volume flow: 0,16 m<sup>3</sup>/h  
pressure head: 0,13 bar  
rpm: 2600 1/min  
3 speed levels  
current: 1 x 230 V  
el. Power: 0,058 kW  
el. Current: 0,28 A

supply and mounting

\*\*\* Design-Description 1402

**Butterfly Valve with Hand Lever**

Butterfly valve for mounting between flanges

temperature range: - 20°C up to +160°C  
operating pressure: PN 16

tight closing up to pressure difference of 16 bar

body: grey cast iron GJL - 250  
seat: EPDM  
shafts: stainless steel  
disc: grey cast iron GJL - 250

incl.

**hand lever**

insulation shaftvapour barrier

incl. mating flanges, screws, nuts and sealing

medium: water 70 / 50°C

**14.1.200. butterfly-valve DN 20**

DN 20  
PN 16

supply and mounting

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**14.1.210.** **butterfly-valve DN 25**  
DN 25  
PN 16

supply and mounting

**14.1.220.** **butterfly-valve DN 40**  
DN 40  
PN 16

supply and mounting

**14.1.230.** **butterfly-valve DN 50**  
DN 50  
PN 16

supply and mounting

**14.1.240.** **butterfly-valve DN 65**  
DN 65  
PN 16

supply and mounting

**14.1.250.** **butterfly-valve DN 80**  
DN 80  
PN 16

supply and mounting

**14.1.260.** **butterfly-valve DN 125**  
DN 125  
PN 16

supply and mounting

\*\*\* Design-Description 1403  
**No Return Valve**

for liquids, application as gravity circulation check

body material: special brass up to DN 100  
grey cast iron over DN 100 up to DN 200

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plate: stainless steel 1.4571 up to DN 100

cone: stainless steel 1.4006 over DN 100  
up to DN 200

medium: water 70 / 50 °C

incl. mating flanges, screws, nuts and sealing

**14.1.270. No Return Valve DN 20**

DN 20  
PN 16

Supply and mounting

**14.1.280. No Return Valve DN 25**

DN 25  
PN 16

Supply and mounting

**14.1.290. No Return Valve DN 40**

DN 40  
PN 16

Supply and mounting

**14.1.300. No Return Valve DN 50**

DN 50  
PN 16

Supply and mounting

**14.1.310. No Return Valve DN 65**

DN 65  
PN 16

Supply and mounting

**14.1.320. No Return Valve DN 80**

DN 80  
PN 16

Supply and mounting



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\*\*\* Design-Description 1404

### Strainer

Strainer consisting of a Y-style body  
with flanges and a wide - mashed Filter element

to protect down streamed equipments,  
straining and collecting of dirt particles

flanges

body of cast iron

with 2 holes for pressure gauge connection  
with tapped hole in the drain flange

incl. mating flanges, screws, nuts and sealing

medium: water 70 / 50 °C

**14.1.330. strainer DN 20**

DN 20

PN 16

supply and mounting

**14.1.340. strainer DN 25**

DN 25

PN 16

supply and mounting

**14.1.350. strainer DN 40**

DN 40

PN 16

supply and mounting

**14.1.360. strainer DN 50**

DN 50

PN 16

supply and mounting

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**14.1.370.** **strainer DN 65**  
DN 65  
PN 16

supply and mounting

**14.1.380.** **strainer DN 80**  
DN 80  
PN 16

supply and mounting

\*\*\* Design-Description 1405  
**Balancing and Shut - Off Valve**

Maintenance-free soft seated shut-off globe valve  
With fluid rate and temperature sensor

For injusting and measuring the flow rate

consisting of lamellar graphite cast iron EN-GJL-250

operating data:

temperature-range : - 10 up to + 120 °C

Medium: water 70 / 50 °C

incl. mating flanges, screws, nuts and sealing

**14.1.390.** **balancing valve DN 20**  
DN 20  
PN 16

supply and mounting

**14.1.400.** **balancing valve DN 25**  
DN 25  
PN 16

supply and mounting

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**14.1.410.** **balancing valve DN 40**  
DN 40  
PN 16

supply and mounting

**14.1.420.** **balancing valve DN 50**  
DN 50  
PN 16

supply and mounting

**14.1.430.** **balancing valve DN 65**  
DN 65  
PN 16

supply and mounting

**14.1.440.** **balancing valve DN 80**  
DN 65  
PN 16

supply and mounting

**14.1.450.** \*\*\* Item N/A

\*\*\* Design-Description 1406  
**Expansion Tank**

expansion tank for heating and cooling PN 10

with  
flange connections PN 16  
replaceable diaphragm  
with inspection opening  
with manometer in nitrogen area

technical data:

max. operation  
temperature: vessel 120 °C  
membrane: 70 °C  
factory pressing: 3,5 bar  
pressure: PN 16

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medium: water 70 / 50 °C

incl. mating flanges, screws, nuts and sealing

**14.1.460. Expansion Tank 400 l**

System: left wing

Nominal volume 400 l

diameter 750 mm  
high 1350 mm

weight 145 kg without water content

connection to  
pipe system DN 40 / PN 16

supply and mounting

**14.1.470. Expansion Tank 400 l**

System: right wing

Nominal volume 400 l

diameter 750 mm  
high 1350 mm

weight 145 kg without water content

connection to  
pipe system DN 40 / PN 16

supply and mounting

\*\*\* Design-Description 1407

**Cap Flange Valve**

Maintenance-free soft seated shut-off globe valve

consisting of cast iron flake graphite EN-GJL-250

operating data:

temperature-range: - 10 up to + 120 °C  
pressure-range: up to dp 16 bar

with cap lead-sealable against unauthorized closing

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Medium: water 70 / 50 °C

incl. mating flanges, screws, nuts and sealing

**14.1.480. cap flange valve DN 40**  
system: left wing

DN 40  
PN 16

supply and mounting

**14.1.490. cap flange valve DN 40**  
system: right wing

DN 40  
PN 16

supply and mounting

\*\*\* Design-Description 1408

### **Safety Valve**

Flange safety valve with closed spring hood

direct working, spring surcharged

material: GG-25  
PN 16  
Blow - off - pressure:

Medium: water 70 / 50 °C

incl. mating flanges, screws, nuts and sealing

**14.1.500. Safety Valve DN 32 / 50**  
System: left wing

DN 32 / 50  
PN 16  
Blow - off - pressure: 6 bar

supply and mounting

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**14.1.510. Safety Valve DN 25 / 40**  
System: right wing

DN 25 / 40  
PN 16  
Blow - off - pressure: 6 bar

supply and mounting

**14.1.520. Bimetal Thermometer 0 /+ 120 °C**  
for temperature measurement of liquids in insulated pipes

dial: white  
graduations black  
pointer: aluminum alloy black  
adjustment: at the back of the case  
window: normal glass  
temperature range: -10 up to 30 °C  
accuracy: class 1,0  
diameter: 100 mm  
immersion tube: ½" x 100 mm  
incl. screw - on protection pipe ½" x 100 mm out of brass

medium: water 70 / 50 °C

supply and mounting

**14.1.530. Pressure Gauge**  
With liquid filling for measurement of liquids in insulated pipes

dial: white  
graduations black  
pointer: aluminum black  
window: laminated safety glass  
Solid stainless steel separating wall between the measuring element and dial; rear wall constructed as blow out  
liquid filling: glycerin 99,5%  
pressure range: 0 up to 10 bar  
accuracy: class 1  
diameter: 100 mm  
connection: ½" at the bottom

medium: water 70 / 50 °C

supply and mounting

## Specification

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14.1.540. \*\*\* Item N/A

14.1.550. **Manometer Valve**

out of brass  
with exhausting cap  
with test flange

connetion RP 15

supply and mounting

incl. sealing an mounting material

14.1.560. **Measuring Nozzle**

diameter: ½" x 100 mm

with shut-off valve consisting of red brass

incl. welding, sealing and mounting material

supply and mounting

14.1.570. **Mounting of Measuring Equipment**

Mounting of supplied indicators, pressure switches a.s.o.

incl. welding, sealing and mounting material

only mounting

14.1.580. **Nozzle RP 15 x 100 mm**

with coupling sleeve for mounting of measurement equipment

incl. welding, sealing and mounting material

supply and mounting

14.1.590. \*\*\* Item N/A

14.1.600. **Fill and Emptying Valve RP 15**

case out of red brass 58 with connection fitting to flexible tube

with coupling sleeve

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incl. welding, sealing and mounting material

supply and mounting

**14.1.610. Fill and Emptying Valve RP 20**

case out of red brass 58 with connection fitting to flexible tube

with coupling sleeve

incl. welding, sealing and mounting material

supply and mounting

**14.1.620. Cloth Insert Hose RP 15**

for filling and emptying the refrigeration system

incl. connection bolting, tube hose and mounting material

length: 20 m

supply and mounting

**14.1.630. Cloth Insert Hose RP 20**

for filling and emptying the refrigeration system

incl. connection bolting, tube hose and mounting material

length: 20 m

supply and mounting

**14.1.640. Hose Carrier**

for filling and emptying flexible tube

consisting of metal sheet

incl. mounting material

supply and mounting

### Control Valves

\*\*\* Design-Description 1409

**Flange 3-port control valve**



## Specification

**Project:** 0602 **Cittadella Politecnico**  
**WBS:** spec1 **Specification 2. tender -state of design 2007-02..**

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body grey cast iron (GJL-250),  
gland seal yellow brass  
shaft steanless steel  
cone yellow brass - DN 15 up to DN 65  
red brass - DN 80 up to DN 150  
shaft sealing EFDM - rolling o-ring joint

lift 20 mm - DN 15 up to DN 80  
40 mm - DN 100 up to DN 150

characteristic 0 up to 30 % - linear  
30 up to 100 % - equal percently

leaky range 0 uo to 0,02 % from kv - value

temperature range: - 25 up to + 130 °C

nominal pressure PN 16

medium: water 70 / 50°C

usable for water and water / glycol mixtures up to 50 %

moving with electral actuator,  
the actuators are described in separate positions

incl. mating flanges, screws, nuts and sealing

**14.1.650. Control Valve 15 - 1,6**

DN 15  
Kvs 1,6

Supply and mounting

**14.1.660. Control Valve 15 - 2,5**

DN 15  
Kvs 2,5

Supply and mounting

**14.1.670. Control Valve 25 - 6,3**

DN 25  
Kvs 6,3

Supply and mounting

## Specification

**Project:** 0602 Cittadella Politecnico  
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**14.1.680. Control Valve 25 - 10**  
DN 25  
Kvs 10

Supply and mounting

**14.1.690. Control Valve 40 - 16**  
DN 40  
Kvs 16

Supply and mounting

**14.1.700. Control Valve 40 - 25**  
DN 40  
Kvs 25

Supply and mounting

\*\*\* Design-Description 1411

### **Electrical Actuator**

Electro hydraulic actuator for the control valves described before

stroke 20 mm  
force 2800 N

operation current 24 V AC  
signal current 0 - 10 V  
position signal 3 P

characteristic linear or equal percentally - adjustable

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to length and connected by the trade "Measuring and control System"

**14.1.710. Actuator 20 mm stroke**  
actuator with stroke 20 mm

Supply and mounting

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### 14.2. Pipes and Accessories

Pipes are generally out of steel, black, material ST 37.0

Technical supply regulations acc. to ISO 9329

Pipes with nominal diameter

equal/lower DN 50: acc. to ISO 65 - 1981  
seamless

greater DN 50 up to DN 100: acc. to ISO 4200 - 1985  
seamless

greater DN 100: acc. to ISO 4200 - 1985  
full length,  
spiral welded

\*\*\* Design-Description 1412

#### **Pipe connections as self-subsistent connections**

Steel pipes have to be welded.

Only licensed welders with valid papers may be allowed to carry out welding work.

A copy of the welding liceneces have to be handed out to the supervision of the customer, before starting work.

The pipelines have to be stored in impact - sound damping mounting plates.

Impact-sound damping rate > 30 dB by reference swing velocity  $v_0 = 5 \times (10 E^{-8})$  m/s.

Continuous pipe mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with mineral fibre fire protection measures

These fire protection measures are described in a separate specification.

The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components

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must be submitted to the constructor by the supplier before the work is carried out.

supply and mounting incl. mounting material (clamps, threaded rods, screws, nuts, dowels a.s.o.) welding and sealing material,

fittings, flanges, boltings are described in separate positions

**14.2.10.** accord. To Design Description 1412  
**Pipe DN 15**  
DN 15 (21,3 x 2,65 mm) seamless

Supply and mounting

**14.2.20.** accord. To Design Description 1412  
**Pipe DN 20**  
DN 20 (26,9 x 2,65 mm) seamless

Supply and mounting

**14.2.30.** accord. To Design Description 1412  
**Pipe DN 25**  
DN 25 (33,7 x 3,35 mm) seamless

Supply and mounting

**14.2.40.** accord. To Design Description 1412  
**Pipe DN 32**  
DN 32 (42,4 x 3,25 mm) seamless

Supply and mounting

**14.2.50.** accord. To Design Description 1412  
**Pipe DN 40**  
DN 40 (48,3 x 3,25 mm) seamless

Supply and mounting

**14.2.60.** accord. To Design Description 1412  
**Pipe DN 50**  
DN 50 (60,3 x 3,65 mm) seamless

Supply and mounting

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**14.2.70.** accord. To Design Description 1412  
**Pipe DN 65**  
DN 65 (76,1 x 2,9 mm) seamless

Supply and mounting

**14.2.80.** accord. To Design Description 1412  
**Pipe DN 80**  
DN 80 (88,9 x 3,2 mm) seamless

Supply and mounting

**14.2.90.** accord. To Design Description 1412  
**Pipe DN 100**  
DN 100 (114,3 x 3,6 mm) seamless

Supply and mounting

**14.2.100.** accord. To Design Description 1412  
**Pipe DN 125**  
DN 125 (139,7 x 4,0 mm) full length, spiral welded

Supply and mounting

### **Fittings for Steel Pipes**

\*\*\* Design-Description 1413  
**Elbow**

in all angle - degrees

**14.2.110.** accord. To Design Description 1413  
**Elbow DN 15**  
DN 15 (21,3 x 2,65 mm)

Supply and mounting

**14.2.120.** accord. To Design Description 1413  
**Elbow DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

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**14.2.130.** accord. To Design Description 1413  
**Elbow DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

**14.2.140.** accord. To Design Description 1413  
**Elbow DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**14.2.150.** accord. To Design Description 1413  
**Elbow DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

**14.2.160.** accord. To Design Description 1413  
**Elbow DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

**14.2.170.** **Elbow DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

**14.2.180.** accord. To Design Description 1413  
**Elbow DN 80**  
DN 80 (88,9 x 3,2 mm)

Supply and mounting

**14.2.190.** accord. To Design Description 1413  
**Elbow DN 100**  
DN 100 (114,3 x 3,6 mm)

Supply and mounting

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**14.2.200.** accord. To Design Description 1413  
**Elbow DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

### Guide Note

Branch fittings up to DN 40 may be build by T- fittings

Branch fittings greater than DN 40 are to be shoe curved to the pipe by shoe-bent elbows

\*\*\* Design-Description 1414

### T - Fitting

as T- fitting in equal and reduced outlets

only the greatest diameter is described

**14.2.210.** \*\*\* Item N/A

**14.2.220.** \*\*\* Item N/A

**14.2.230.** accord. To Design Description 1414  
**T - Fitting DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

**14.2.240.** accord. To Design Description 1414  
**T - Fitting DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**14.2.250.** accord. To Design Description 1414  
**T - Fitting DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

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\*\*\* Design-Description 1415  
**Shoe bent Elbow**

**Shoe bent Elbow**

**14.2.260.** accord. To Design Description 1415  
**Shoe-bent Elbow DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

**14.2.270.** accord. To Design Description 1415  
**Shoe-bent Elbow DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

**14.2.280.** accord. To Design Description 1415  
**Shoe-bent Elbow DN 80**  
DN 80 (88,9 x 3,2 mm)

Supply and mounting

**14.2.290.** accord. To Design Description 1415  
**Shoe-bent Elbow DN 100**  
DN 100 (114,3 x 3,6 mm)

Supply and mounting

**14.2.300.** accord. To Design Description 1415  
**Shoe-bent Elbow DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

\*\*\* Design-Description 1416  
**Reduction Fitting**

in concentric and eccentric type

only the greatest diameter is described



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**14.2.310.** accord. To Design Description 1416  
**Reduction DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

**14.2.320.** accord. To Design Description 1416  
**Reduction DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

**14.2.330.** accord. To Design Description 1416  
**Reduction DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**14.2.340.** accord. To Design Description 1416  
**Reduction DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

**14.2.350.** accord. To Design Description 1416  
**Reduction DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

**14.2.360.** accord. To Design Description 1416  
**Reduction DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

**14.2.370.** accord. To Design Description 1416  
**Reduction DN 80**  
DN 80 (88,9 x 3,2 mm)

Supply and mounting

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**14.2.380.** accord. To Design Description 1416  
**Reduction DN 100**  
DN 100 (114,3 x 3,6 mm)

Supply and mounting

**14.2.390.** accord. To Design Description 1416  
**Reduction DN 125**  
DN 125 (139,7 x 4,0 mm)

Supply and mounting

\*\*\* Design-Description 1417

**Pair of Flanges**

as welding neck flanges incl. screws, nuts and sealing

nominal pressure PN 16

material: C 22

**14.2.400.** accord. To Design Description 1417  
**Flanges DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

**14.2.410.** accord. To Design Description 1417  
**Flanges DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

**14.2.420.** accord. To Design Description 1417  
**Flanges DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

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**14.2.430.** accord. To Design Description 1417  
**Flanges DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

**14.2.440.** accord. To Design Description 1417  
**Flanges DN 65**  
DN 65 (76,1 x 2,9 mm)

Supply and mounting

**14.2.450.** accord. To Design Description 1417  
**Flanges DN 80**  
DN 80 (88,9 x 3,2 mm)

Supply and mounting

\*\*\* Design-Description 1418  
**Exhausting Bottle**

Exhausting bottle to ventilate the pipe system

Consisting out of

steel pipe, black, St 37.0 acc. to DIN 2448  
2 end caps in the diameter of the pipe  
2 nozzles for the pipe system in different nominal diameters,  
length 150 mm  
1 nozzle ½" x 150 mm for exhausting pipe

**14.2.460.** accord. To Design Description 1418  
**Exhausting bottle DN 100**  
Length (without end cap): 250 mm  
Diameter: DN 100

**14.2.470.** accord. To Design Description 1418  
**Exhausting bottle DN 150**  
Length (without end cap): 300 mm  
Diameter: DN 150

## Specification

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Supply and mounting

**14.2.480.** accord. To Design Description 1418  
**Exhausting bottle DN 200**

Length (without end cap): 300 mm  
Diameter: DN 200

Supply and mounting

\*\*\* Design-Description 1419  
**Connection to Heater and Main System**

The pipe system has to be connected with the main heating supply system and the heater of the Air Handling Units (AHUs) have to be connected with the pipe system.

This will be done by bolting out of malleable cast or mating flanges out of steel incl. screws and nuts

The positions includes all sealing and all mounting material.

1 each of the connections includes both connection (inlet and outlet)

**14.2.490.** accord. To Design Description 1419  
**Connection DN 20**  
with a pair of mating flanges DN 20 / PN 16

supply and mounting

**14.2.500.** accord. To Design Description 1419  
**Connection DN 25**  
with a pair of mating flanges DN 25 / PN 16

supply and mounting

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- 14.2.510.** accord. To Design Description 1419  
**Connection DN 40**  
with a pair of mating flanges DN 40 / PN 16  
  
supply and mounting
- 14.2.520.** accord. To Design Description 1419  
**Connection DN 50**  
with a pair of mating flanges DN 50 / PN 16  
  
supply and mounting
- 14.2.530.** accord. To Design Description 1419  
**Connection DN 65**  
with a pair of mating flanges DN 65 / PN 16  
  
supply and mounting
- 14.2.540.** accord. To Design Description 1419  
**Connection DN 80**  
with a pair of mating flanges DN 80 / PN 16  
  
supply and mounting
- 14.2.550.** accord. To Design Description 1419  
**Connection DN 125**  
to main pipe system  
with a pair of mating flanges DN 125 / PN 16  
  
supply and mounting
- \*\*\* Design-Description 1420  
**Sign Post**  
  
consisting of resopal  
according to the specifications of the customer,  
incl. all necessary accessories,  
inscription acc. to the list, which is approved by the customer
- 14.2.560.** accord. To Design Description 1420  
**Sign Post 200 / 100**  
length: 200 mm

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high: 100 mm

supply and mounting

**14.2.570.** accord. To Design Description 1420

**Sign Post 100 / 50**

length: 100 mm

high: 50 mm

supply and mounting

**14.2.580.** accord. To Design Description 1420

**Sign Post 50 / 25**

length: 50 mm

high: 25 mm

supply and mounting

**14.2.590.**

**Directional Marker**

to stick on to the pipes in long lasting execution  
color, text and execution acc. to  
the requirement of the customer

supply and mounting

**14.2.600.**

**Structural Steel Construction**

(according to the instruction of the supervisor)

in all kinds of special mounting constructions, welded and/or  
screwed

rust protection by ground and finished painting (in different  
paints),  
paint acc. to the instructions of the customer

incl. all necessary mounting materials

incl. drilling of fixing holes in concrete and/or masonry walls  
and ceilings

The accounting will be based on the avoirdupois' of the steel

supply and mounting

\*\*\* Design-Description 1421

**Pressure Test**

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Following installation and laying of pipeline system, before the wall gaps und ceiling bushings are closed and before the insulation is installed, the pipe system is to be subjected to a pressure test.

Relevant regulations and manufacturer's directives are to be followed.

As test medium, water has to be used.

All pipe connections have to undergo a visual examination.

The test pressure is 1, 5 x nominal pressure. The test period is 12 hours.

All test have are to be carried in arrangement and in presence of the construction supervisor.

The test results must be recorded in protocols, countersigned by the construction supervisor and to be documented. All used protocols should agree in content with ISO 9000.

As a function of the progress of the construction work, it will be necessary to execute the pressure tests in separate section.

**14.2.610.** accord. To Design Description 1421  
**Pressure Test 250 liters**  
Pressure test in section up to 250 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**14.2.620.** accord. To Design Description 1421  
**Pressure Test 500 liters**  
Pressure test in section up to 500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**14.2.630.** accord. To Design Description 1421  
**Pressure Test 1000 liters**  
Pressure test in section up to 1000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

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\*\*\* Design-Description 1422

### **Pipe Cleaning**

All pipe systems are to be flushed before connection with the main pipe - system and before commissioning.

Before the pipeline is connected to the main system, the degree of cleanness of the flushing medium has to be checked, protocolled and to be coordinated with the construction supervisor.

Integrated strainers are to be cleaned, if necessary in several times.

As a function of the progress of the construction work, it will be necessary to execute the pipe cleaning in separate section.

**14.2.640.** accord. To Design Description 1422  
**Pipe Cleaning 250 liters**  
Pipe cleaning in section up to 250 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**14.2.650.** accord. To Design Description 1422  
**Pipe Cleaning 500 liters**  
Pipe cleaning in section up to 500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**14.2.660.** accord. To Design Description 1422  
**Pipe Cleaning 1000 liters**  
Pipe cleaning in section up to 1000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**14.2.670.** **certificazioni e documentazioni richieste dalla normativa P.E.D**  
Il costruttore, dovrà elaborare e rilasciare tutte le certificazioni e documentazioni richieste dalla normativa vigente e dalla



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normativa P.E.D. comprovate da verbali di prove di pressione, test sui materiali e sulle saldature il tutto certificato da un istituto ufficiale e autorizzato. La certificazione dovrà riguardare non solo i singoli componenti e attrezzature ma l'insieme costituente l'impianto oggetto di certificazione. (Si ricorda che tra i documenti ed elaborati che devono essere prodotti sono anche compresi la stress analysis e la risk analysis).

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### 14.3. Insulation of Pipes

Insulation materials containing glass fibre or silicon components must not be used

\*\*\* Design-Description 1423

#### Insulation of Pipes

for hot water pipes

for pipes out of steel, black, St 37.0

consisting out of

shell or mats of mineral fibre

thermal conductivity 0,035 W/(m\*K)

unit weight 90 - 100 kg/m<sup>3</sup>

fire protection clas A2

shells or mats covered with stiched aluminum foile,

notchees and gaps have to be glued with aluminum tape  
shells or mats have to be fastenend by galanells binding wire,  
thickness 0,65 mm

thickness of insulation acc. to ENEV:

up to DN 32: d = 30 mm

DN 40 up to DN 100 d = equal to nominal diameter

greater DN 100 d = 100 mm

incl. cuttings off (for connections to pipes, sealing rings a.s.o)

wall and ceiling brushings have to build in fire resistance design  
(fire wall measures are described separately)

medium: water 70 / 50 °C

incl. all mounting material

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**14.3.10.** accord. To Design Description 1423  
**for pipe DN 15**  
Supply and mounting

**14.3.20.** accord. To Design Description 1423  
**for pipe DN 20**  
Supply and mounting

**14.3.30.** accord. To Design Description 1423  
**for pipe DN 25**  
Supply and mounting

**14.3.40.** accord. To Design Description 1423  
**for pipe DN 32**  
Supply and mounting

**14.3.50.** accord. To Design Description 1423  
**for pipe DN 40**  
Supply and mounting

**14.3.60.** accord. To Design Description 1423  
**for pipe DN 50**  
Supply and mounting

**14.3.70.** accord. To Design Description 1423  
**for pipe DN 65**  
Supply and mounting

**14.3.80.** accord. To Design Description 1423  
**for pipe DN 80**  
Supply and mounting

**14.3.90.** accord. To Design Description 1423  
**for pipe DN 100**  
Supply and mounting

**14.3.100.** accord. To Design Description 1423  
**for pipe DN 125**  
Supply and mounting

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\*\*\* Design-Description 1424

### **Insulation of Armatures Mantling out of Galvanized Steel**

#### **Insulation as described before for**

#### **butterfly valves, valves in all types, strainers a.s.o.**

insulation out of two- or multi part caps, crimped and bolted,  
incl. crimped end sheets  
incl. straining straps and straining closures

#### **Mantling out of galvanized steel, crimped and bolted,**

The surface of the insulation must not be damaged by the  
mantling.

incl. crimped cuttings off (for connections to pipes, sealing  
rings a.s.o)

All maintenance and operation accessories like sealing rings,  
handwheels have to be used without opening the caps.

Cleaning of strainers will be possible by taking off the caps.

Connections between caps and armatures are not allowed.

**14.3.110.** accord. To Design Description 1424  
**for armatures DN 15**  
Supply and mounting

**14.3.120.** accord. To Design Description 1424  
**for armatures DN 20**  
supply and mounting

**14.3.130.** accord. To Design Description 1424  
**for armatures DN 25**  
Supply and mounting

**14.3.140.** \*\*\* Item N/A

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**14.3.150.** accord. To Design Description 1424  
**for armatures DN 40**  
Supply and mounting

**14.3.160.** accord. To Design Description 1424  
**for armatures DN 50**  
Supply and mounting

**14.3.170.** accord. To Design Description 1424  
**for armatures DN 65**  
Supply and mounting

**14.3.180.** accord. To Design Description 1424  
**for armatures DN 80**  
  
Supply and mounting

**14.3.190.** \*\*\* Item N/A

**14.3.200.** accord. To Design Description 1424  
**for armatures DN 125**  
Supply and mounting

\*\*\* Design-Description 1425  
**Surcharge for manteling out of galvanized steel sheet**

for hot water pipes

as described before

**Mantling out of galvanized steel, crimped and bolted,**

The surface of the insulation must not be damaged by the mantling.

**14.3.210.** \*\*\* Item N/A

**14.3.220.** \*\*\* Item N/A

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**14.3.230.** accord. To Design Description 1425  
**for pipe DN 25**  
Supply and mounting

**14.3.240.** \*\*\* Item N/A

**14.3.250.** accord. To Design Description 1425  
**for pipe DN 40**  
Supply and mounting

**14.3.260.** accord. To Design Description 1425  
**for pipe DN 50**  
Supply and mounting

**14.3.270.** accord. To Design Description 1425  
**for pipe DN 65**  
Supply and mounting

**14.3.280.** accord. To Design Description 1425  
**for pipe DN 80**  
Supply and mounting

**14.3.290.** accord. To Design Description 1425  
**for pipe DN 100**  
Supply and mounting

**14.3.300.** accord. To Design Description 1425  
**for pipe DN 125**  
Supply and mounting

\*\*\* Design-Description 1426  
**Insulation of Exhausting Bottles**

Insulation as described before for  
exhausting bottles

bottles totally insulated incl. bottoms and  
pipe connections

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**14.3.310.** accord. To Design Description 1426  
**for exhausting bottle DN 100**  
DN 100  
length 250 mm

Supply and mounting

**14.3.320.** accord. To Design Description 1426  
**for exhausting bottle DN 200**  
DN 200  
length 300 mm

Supply and mounting

**14.3.330.** accord. To Design Description 1426  
**for exhausting bottle DN 300**  
DN 300  
length 300 mm

Supply and mounting

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**14.4. Recirculation Units**

**14.4.10. Recirculation Heater Utilities**

Recirculation Heating Unit Utilities

casing: galvanized steel sheet solid construction

cover protection by powder coated painting

purging lamellar: adjustable and self locking

repair switch: mounted on the casing, completely cabled

axial impeller: driven by 2 speed motor  
statically and dynamically balanced  
acc. to DIN ISO 1940, quality G 6,3

motor: protected by integrated temperature sensors

delta - wye switching

heat exchanger: steel, galvanized

mounted at the ceiling incl. bearing edge, suitable for hanging up the heater unit, consisting of galvanized structural steel construction

incl. connections to the pipe system by flanges or bolting

incl. connection for ventilation and draining

heat capacity: 35 kW

air volume flow: 4.400 m<sup>3</sup>/h

air inlet temperature: - 10 °C

air outlet temperature: + 11 °C

heating medium. water

advance flow temperature: 70 °C

return flow temperature: 50 °C

pressure loss: 0,1 bar



## Specification

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fan: 1 each  
rpm: 750 / 1000 1/min  
el. power: 0,25 / 0,35 kW  
el. Current: 0,51 / 0,88 A  
3 x 400 V  
  
dimensions  
length/ width: 700 x 700 mm  
high. 390 mm  
weight netto: 92 kg  
operation weight: 100 kg

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to length and connected by the trade "Measuring an Control System"

supply and mounting

**14.4.20. Recirculation Heater Calibration Labour**  
Recirculation Heating Unit Calibration Labour

as described before but:

heat capacity: 12,5 kW  
air volume flow: 4.500 m<sup>3</sup>/h  
air inlet temperature: + 15 °C  
air outlet temperature: + 24 °C  
heating medium. water  
advance flow temperature: 70 °C  
return flow temperature: 50 °C  
pressure loss: 0,45 bar  
fan: 1 each  
rpm: 500 / 660 1/min  
el. power: 0,21 / 0,35 kW  
el. Current: 0,39 / 0,78 A  
3 x 400 V

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dimensions

length/ width: 900 x 900 mm  
high: 260 mm

weight netto: 53 kg  
operation weight: 60 kg

All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to length and connected by the trade "Measuring an Control System"

supply and mounting

**14.4.30. Recirculation Heater Metrologie Labour**  
Recirculation Heating Unit Metrologie Labour

as described before but:

heat capacity: 12,5 kW

air volume flow: 4.500 m<sup>3</sup>/h  
air inlet temperature: + 15 °C  
air outlet temperature: + 24 °C

heating medium. water

advance flow  
temperature: 70 °C

return flow  
temperature: 50 °C

pressure loss: 0,45 bar

fan: 1 each

rpm: 500 / 660 1/min

el. power: 0,21 / 0,35 kW  
el. Current: 0,39 / 0,78 A  
3 x 400 V

dimensions

length/ width: 900 x 900 mm  
high. 260 mm

weight netto: 53 kg  
operation weight: 60 kg

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All cables will be installed by the trade "Electrical Supply", the cables will be feeded in, cutting to length and connected by the trade "Measuring an Control System"

supply and mounting

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### 14.5. Special Services

#### 14.5.10. Revision Documentation

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

#### 14.5.20. Starting UP and Test Operation

After finishing installation, the systems have to be started up.

The systems and the components must be adjusted, so that the

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functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the testl operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

**14.5.30. Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

**14.5.40. Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate files.

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The customer has to supply these inspections by sending his  
commissioning personal so much as it is necessary

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### General remark

The whole planning of the technical construction and installation was made of the basis that there are no explosion risks, caused by the Fuels and Materials in the building. There is no need for electrical classified equipment, because storage, handling and dispensing of Diesel don't cause EX-Zones, that is classified location.

This is also corresponding to the GM Standards, the NFPA (US National Fire Protection Agency) Codes and European ATEX Rules. Diesel Fuel is classified as Class II liquid and area are no more classified as hazardous.

According to the special utilities layouts, the Building Automation Control System (BACS) and the special installed devices (sensor, ventilation, alarm system, monitoring system, relief venting walls and explosion-proof-doors) there are no areas with explosion residual risk.

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**The fuel system to be installed will supply the 15 test benches.**

For fundamental ex-planations see fuel scheme No. 670-01.  
Important remarks to all positions:

1. all materials with contact to the fuel must be free of non-ferrous metall.
2. pressure of project 2,5 bar, pressure stage of the components, pipes and devices PN16
3. All installation must be conform and according to the Decreto Ministeriale 28.4.2005 and the regulations of the local authorities and the UNJ and EN.
4. All pipes must be pressure proof tested according to the P.E.D.
5. All pipes an medium contracted material must be stainless steel.
6. Guide note for pipe installation  
Pipes are generally out of stainless steel,  
Technical supply regulations acc. to ISO 9329

Pipes with nominal diameter

equal/lower DN 50:	acc. to ISO 65 - 1981 seamless
greater DN 50 up to DN 100:	acc. to ISO 4200 - 1985 seamless
greater DN 100:	acc. to ISO 4200 - 1985 full length, spiral welded

Stainless steel pipes have to be welded.

Only licensed welders with valid papers may be allowed to carry out welding work.

Welding seams must be subjected to a random-sample, non destructive seam test. This will be described in separate positions.

Following installation of the pipelines, the welds and any damage must be repaired.



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The pipelines have to be stored in impact - sound damping mounting plates.  
Impact-sound damping rate > 30 dB by reference swing velocity  
 $v_0 = 5 \times (10 \text{ E } -8) \text{ m/s}$ .

Continuous mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing must be filled with rock wool or sealing floss and sealed waterproof and dustproof using suitable sealing material

The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components must be submitted to the constructor by the supplier before the work is carried out.

supply and mounting incl. mounting material (clamps, threaded rods, screws, nuts, dowels a.s.o.) welding and sealing material,

fittings, flanges, boltings are described in separate position

### 7. Welding Seam Test

Steel pipes have to be welded. Only licensed welders with valid papers (acc to DIN EN 287 part. 1) may be allowed to carry out welding work.

An operating skill record has to be produced by the appointed welders on the job site in the presence of a specialist. A copy of welding license as well as operating skill examination have to be handed over to the local construction supervision prior to construction start

Welding seams must be subjected to a random-sample, non destructive welding seam test.

The x-ray inspections are to be performed acc. to DIN EN 25817.

The documentation file to be set up contains all films, evaluation papers, pipe plans with welding seam markings, welder list with welding license.

10% of all welding seams are to be inspected.

At a defect frequency of 10%, relating to 30% testing

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range, the testing range is increased to all welding seams.

X-ray films must be evaluated by an expert.

Repair seams are to be marked and retested.

Testing fees for repair seams and all seams above the 10% testing range have to be paid by the contractor.

Execution and quality of the welding seams according to DIN EN 25817.

The installation of the fuel supply system is divided in several parts:

- Installation of 3 double-walled controlled buried tanks  
Filling procedure over the shaft on a secured place
- Installation of the fuel-pump in a second shaft on each tank
- Installation of double-walled, buried pipes from the buried tank  
depot into the building, incl. installation of connection to the tanks and safety devices. The pipes are sloped towards the tank depot.
- Barrel Room with pumps and equipment for special fuel.
- Installation of the fuel pipes as single-walled pipes inside the building.
- Installation of a day-tank room in the building 2nd floor, with one 50 L and 3 x 500 L day-tank systems
- Installation of the distribution pipes from the day-tank to the test benches in the ground floor
- Installation of the test bench fuel consumption measuring system (FCMS)
- Supply of equipment for control and monitoring of the system,  
incl. power switch cabinet.

storage tanks:

A buried tank depot is installed to store the following fuel amounts:

- |           |                 |              |
|-----------|-----------------|--------------|
| • tank 1: | special diesel  | 40.000 Litre |
| • tank 2: | CSC Test diesel | 20.000 Litre |
| • tank 3: | standard diesel | 40.000 Litre |

All tank modules are provided for storage of fuel sorts.  
Filling procedure according to the fuel vapor recycling principle

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is provided.

Tank 2 allows to be filled with special fuels, and tank 1.

In a Barrel-Room a 200 L Barrel with special diesel is installed to fill the 50 L Day-Tank. A pump and safety devices are installed. The barrel is placed in a monitored spilling tray.

### buried fuel pipes:

The buried tanks and the buried fuel pipes (double-walled) are provided with a leakage alarm system. One pressure pipe and return pipe each has to be installed per fuel sort.

### Pipe routing within the building

The pipes (pressure pipe, return (drain) / vapor recycling pipe) enter the building in first floor. From there the pipes run into a vertical shaft to the day tank room. From there pipes (atmosphere-pressure pipe and vapor recycling pipe) are running to the test benches. The venting pipes from each day tank will be installed outside of the building.

### Description of day tank room

Each day tank is outfitted with a level detector with 4 limits:

1. minimum
2. Fill pump on
3. Fill pump off
4. Overload alarm (separate system)

The filling pipe is closed by a shut-off-valve outside the day tank room.

The return pipe (function: drain day tank) is closed by an manual and a automatic valve.

The venting pipe of each day-tank is closed with 2 check valves, the inlet air is going through a humidity dryer.

The installation height of the day tank must be as high as possible in the room, to allow the maximum possible atmospheric-high-pressure to the fuel running to the test benches.

### Fuel pre-selection via solenoid valves

The fuel type will be selected at the operation panel of each test cell.

The fuel type selected at the operation panel of the corresponding test cell causes the pre selection of certain components. So the operating pumps and valves corresponding the level control were determined.

When the level in the filling unit drops under the switch level for the refilling signal, the valve will be opened and simultaneously the pump is activated and it supplies the fuel into the day-tank, until the probe signals the required filling level. Each pump can be addressed by different test benches.

The containers are additionally monitored with regard to

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maximum and minimum alarm.

### Leakage Alarm Tank Shaft

The tank shaft (where the main fuel pumps are housed) is provided with a leakage alarm. It is monitored with the zero signal current principle, breaking of a wire as well as activation is transmitted potential-free. This is indicated by a LED at the switch cabinet. When the alarm is activated, the fuel pump is switched currentless, but fuel supply to the test benches from the day tanks is not interrupted.

The message has to be acknowledged at the switch cabinet.

### Addressing of fuel pumps

The fuel pumps are addressed (ON/OFF) in two different ways:

1. dependent on the filling level of the buried tank  
pump OFF when the minimum level in underrun
2. depending on the filling level of the day tank:  
pump ON when the min level is reached  
pump OFF when the max level ist reached

### Monitoring minimum filling level of day tank

When the minimum filling level in the day tank is underrun, it is signaled potential-free to the test bench and indicated at the switch cabinet by LED. When the mini-mum level is exceeded, the contact is automatically released.

## 15. Discription of fuel supply system

### 15.1. Tankfarm and accessories

#### 15.1.10. Buried Tank 40 m<sup>3</sup> (Standard Diesel)

according to EN 12285-2 and RAL RG 998, explosion proofed (to avoid the explosion guard for the tank-pipes), for underground storage of Gasoline and Fuel, double-walled, controlled with vacuum leakage detection, outside-wall with glass fibre reinforced bitumen coating, overlaid max 1.5 m, 2 tank domes, one for connection, one for inspection with one common welded shaft in stainless steel 1.4571, adjustable to variable overlay from 1.0 to 1.5 m, with two central lockable caps, able to drive on class D 400kN, caps with gas-filled strut for easy lifting. Shaft width 1,0 x 2,0 m.

Complete field installation with crane into an on site prepared pit.

Tank inside & outside wall in stainless steel, with medium specification, inside security coating of 1/3 of the tank.

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- 15.1.20. Buried Tank 40 m<sup>3</sup> (Special Diesel)**  
specification as above  
Ø 2500 mm; Length: 8700 mm
- 15.1.30. Buried Tank 20 m<sup>3</sup> (CSC Test Diesel)**  
specification as above  
Ø 2500 mm; Length: 4550 mm
- 15.1.40. Connection pipes to buried tank**  
the pipes in the tank with connection to the dome flange as follows:
- Tank fill pipe DN80 with tanker connection  
Tank suction pipe with clapper valve DN 32 and flange  
Tank return pipe DN32 with flange  
Tank breath pipe DN 40 with flange  
Manual level detector, complete  
Flange for testing probe of continuous level detector  
Flange for testing probe of level limiter  
Reserve connection DN 50
- All pipes with flexible connections to the further pipes (compensators) and in quality stainless steel 1.4301 or higher quality
- 15.1.50. Tank shaft grommets**  
The pipes from outside must be leaded through the tank shaft with a grommet (e.g. LINKK SEAL) for each pipe is to use a water proofed grommet.  
1 tank suction pipe DN 32/50 (double-walled)  
2 tank return pipe DN 32/50 (double-walled)  
3 tank breath pipe DN 40  
4 PVC pipe DN 100 (for E-Inst.)  
5 reserve grommet DN 50
- 15.1.60. Vacuum leakage detection system for buried tank**  
complete system with connecting pipes, vacuum pump, suitable to the buried tanks below, with potential-free alarm contact, alarm horn and alarm light
- 15.1.70. Filling Limit detection for buried tank**  
System to avoid the overfill of the buried tanks by the tanker, with electrical connection to the tanker, according to the requirement of the authorities

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- 15.1.80. Filling level detector for buried tank**  
System to show continuously the filling level of the buried tank,  
with two free selectable limits (Order / Dry Running),  
complete with:  
sensor in the tank,  
display for the switchboard  
output 4 - 20 mA for control  
Calibration of the system
- 15.1.90. Double-wall pipe DN 25/40 pressure pipe to the daytank**  
inside pipe in 1.4301 or higher quality outside pipe in St.37,  
outside pipe with PE-coating, installed according to regulations  
of the authorities.  
included all form- and connection pipes, welding and on site PE-  
coating, test valves at the beginning and the end of each pipe,  
connecting each pipe to the monitoring device, System e.g.  
DRK 30
- 15.1.100. Double-wall pipe DN 25/40 return pipe from the day tank**  
same spec. as above
- 15.1.110. N2 Leakage detection system for double-wall pipes**  
complete system with pipes, detection medium, suitable to the  
pipes below, with potential-free alarm contact,  
shut-off valves to check one pipe after another  
each pipe with manometer
- 15.1.120. Fuel Pump inside tank shaft 25 L/min**  
dry self suction centrifugal pump, suitable for Diesel fuel and  
modified diesel fuel, complete with flange connection to the  
pipes, maintenance-free double mechanical seal,  
  
pump rate 25 L/min  
suction head 0.3 bar  
pressure head 1.5 bar  
  
no medium contact with non-ferrous metal, minimum stainless  
steel 1.4301  
flange DN 25  
220/380V 50 Hz 0,5kW  
  
with steel construction to fasten the pump and accessories  
inside the tank shaft

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- 15.1.130. Fuel filter DN 32**  
fuel filter 100 micron, with flange half-coupling, no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes
- 15.1.140. Full-wayl-valve DN 25**  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes
- 15.1.150. Relief valve DN 25**  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes  
adjustment range 1.0 to 2.0 bar
- 15.1.160. Magnetic valve DN 25**  
used to shut-off the pressure pipe in the shaft to prevent fuel delivery into the building in case of fire or other danger.

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**15.2.** **Daytank and accessories**

**15.2.10.** **Day tank 500 Litre**

stainless steel 1.4571, pressure proofed to 0.5 bar, material thickness according to pressure but not less than 3mm, dimensions:

pipe diameter 1.000 mm, length 800 mm, top and bottom with flange and blank-flange

with the following connections on top

- a) tank fill pipe DN 32 with flange
- b) tank breath pipe DN 25 with flange
- c) flange for testing probe of level limiter
- d) reserve connection DN 25
- e) flange for filling level detector

with the following connections on bottom

- a) tank drain pipe DN 32 with flange
- b) tank emptying pipe DN 32 with flange
- c) reserve connection DN 25
- d) flange for filling level detector

with a overfill limit connection DN 25 about 10 cm below the top-flange

**15.2.20.** **Day tank 50 Litre**

stainless steel 1.4571, pressure proofed to 0.5 bar, material thickness according to pressure but not less than 3mm, dimensions:

pipe diameter 400 mm, length 500 mm, top and bottom with flange and blank-flange

with the following connections on top

- a) tank fill pipe DN 20 with flange
- b) tank breath pipe DN 20 with flange
- c) flange for testing probe of level limiter
- d) reserve connection DN 20
- e) flange for filling level detector

with the following connections on bottom

- a) tank drain pipe DN 20 with flange
- b) tank emptying pipe DN 15 with flange
- c) reserve connection DN 20
- d) flange for filling level detector

with a overfill limit connection DN 15 about 10 cm below the top-flange

**15.2.30.** **Flashback valve DN 40**  
for breath pipe of the day tank 500 L



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- 15.2.40. Flashback valve DN 20**  
for breath pipe of the day tank 50 L
- 15.2.50. Filling Limit detection for day tank 500 Litre**  
System to avoid the overflow of the day tank, with signal to the electrical switch cabinet, according to the requirement of the authorities
- 15.2.60. Filling Limit detection for day tank 50 Litre**  
System to avoid the overflow of the day tank, with signal to the electrical switch cabinet, according to the requirement of the authorities
- 15.2.70. Filling level detector for day tank 500 Litre**  
System to show (optical) continuously the filling level of the day tank, with three free se-lectable limits from bottom to top as follows: Dry Running, Pump on, Pump off complete with.  
flange connection, display for the switchboard, output 4 - 20 mA for control  
Calibration of the system
- 15.2.80. Filling level detector for day tank 50 Litre**  
System to show (optical) continuously the filling level of the day tank, with three free se-lectable limits from bottom to top as follows: Dry Running, Pump on, Pump off complete with.  
flange connection, display for the switchboard, output 4 - 20 mA for control  
Calibration of the system
- 15.2.90. Magnetic valve DN 40**  
used as:  
shut-off-fire valve outside the day tank room  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes  
24 V DC
- 15.2.100. Magnetic valve DN 20**  
used as:  
shut-off-fire valve outside the day tank room  
drain valve for day tank

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with flange half-coupling  
no medium contact with non-ferrous metal or material less than  
1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with  
flange connection to the pipes  
24 V DC

**15.2.110. Magnetic valve DN 25**  
used to shut-off the pipe to the test benches, positioned inside  
the day tank room  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than  
1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with  
flange connection to the pipes  
24 V DC

**15.2.120. Full-way-valve DN 32**  
used for the emptying pipe of the day tank  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than  
1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with  
flange connection to the pipes

**15.2.130. Full-way-valve DN 15**  
used for the emptying pipe of the day tank  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than  
1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with  
flange connection to the pipes

**15.2.140. Silicagel dry system day tank**  
The dry system for the incoming breath-air of the daytank  
consists of 2 checkvalves and a plastic container 2 Litre,  
fulfilled with Silicagel, installed in the breath pipe of each day  
tank outside the day tank.

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**15.3. Piping in the building**

**15.3.10. Steel pipe DN 40**

stainless steel, quality 1.4301 or better, installed according to the requirements of the authorities.  
Complete installation with all accessories like welding, connection- and flange parts, wall thickness according norm pressure 16 bar.  
visible and revisible layed in the building

**15.3.20. Steel pipe DN 32**  
as above

**15.3.30. Steel pipe DN 25**  
as above

**15.3.40. Steel pipe DN 20**  
as above

**15.3.50. Steel pipe DN 15**  
as above

**15.3.60. Steel pipe DN 10**  
as above

**15.3.70. Steel Elbow DN 40**  
Stainless Steel quality 1.4301 or better, complete installation, welded, wall thickness according norm pressure 16 bar

**15.3.80. Steel Elbow DN 32**  
Stainless Steel quality 1.4301 or better, complete installation, welded, wall thickness according norm pressure 16 bar

**15.3.90. Steel Elbow DN 25**  
Stainless Steel quality 1.4301 or better, complete installation, welded, wall thickness according norm pressure 16 bar

**15.3.100. Steel Elbow DN 20**  
as above

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Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.110. Steel Elbow DN 15**  
as above

Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.120. Steel Elbow DN 10**  
as above

Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.130. Steel T-Fitting DN 40**  
Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.140. Steel T-Fitting DN 32**  
as above

Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.150. Steel T-Fitting DN 25**  
as above

Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.160. Steel T-Fitting DN 20**  
as above

Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.170. Steel T-Fitting DN 15**  
as above

Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

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**15.3.180. Steel T-Fitting DN 10**  
as above

Stainless Steel quality 1.4301 or better, complete installation,  
welded, wall thickness according norm pressure 16 bar

**15.3.190. Fastening construction**

Form-Steel parts for pipe hanger, fixed und unfixed points of the  
piping system in the building, hot-dip-galvanized steel or anti-  
rust coated, with all accessories like welding, steel conduit  
clamp.

**15.3.200. Steel tub**

to survey the pipe lines in the building the lines must be covered  
with a steel tub of galvanised carbon steel. The tub must have a  
descent to little pits all 15 meters. There a leakage sond can  
detect the possible leakage of fuel.

**15.3.210. Inspection of welding (inside and outside pipes)**

welding seam test for pipes DN 10 up to DN 40

incl. documentation and all auxiliary devices

supply and execution, according to description point 7

**15.3.220. certificazioni e documentazioni richieste  
dalla normativa P.E.D**

Il costruttore, dovrà elaborare e rilasciare tutte le certificazioni e  
documentazioni richieste dalla normativa vigente e dalla  
normativa P.E.D. comprovate da verbali di prove di pressione,  
test sui materiali e sulle saldature il tutto certificato da un istituto  
ufficiale e autorizzato. La certificazione dovrà riguardare non  
solo i singoli componenti e attrezzature ma l'insieme costituente  
l'impianto oggetto di certificazione. (Si ricorda che tra i  
documenti ed elaborati che devono essere prodotti sono anche  
compresi la stress analysis e la risk analysis).

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**15.4. Test bench equipment**

**15.4.10. Shut-off ball-valve DN 10**

used to shut-off the pipe outside the test bench for each fuel pipe  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes

**15.4.20. Magnetic valve DN 10**

used to shut-off the pipe outside the test bench for each fuel pipe  
with flange half-coupling  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes  
24 V DC

**15.4.30. Relief valve DN 10**

to limit the pressure of a enclosed fuel volume  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes  
adjustment range 1.5 bar

**15.4.40. Fuel filter DN 10**

fuel filter 50 micron, with flange half-coupling, no medium contact with non-ferrous metal or material less than 1.4301 quality  
suitable for Diesel fuel and modified diesel fuel, complete with flange connection to the pipes

**15.4.50. Fuel distributor 4 in 1**

consisting of:  
4 Clean-Break Quick-Connection with screw connection to steelpipe and hosepipe.  
The 4 mother-parts are fastened on the wall and are connected with the incoming fuel-pipes from the daytanks. The father-part is connected with a hosepipe leading to the Fuel-consumption-measuring-system (FCMS).  
No medium contact with non-ferrous metal, or material less than 1.4301 quality suitable for Diesel fuel and modified diesel fuel, complete with all accessories like pipes, hoses, steel

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construction to fasten, welding, anti-rost coating. Hose according to the regulations of the authorities, steel reinforced, proof pressure 16 bar

**15.4.60. Connection to the FCMS**  
consisting of:  
4 hosepipes to connect the uncoming steelpipes with the FCMS  
- fill pipe  
- pipe to engine  
- pipe from engine  
- overflow pipe  
hose according to the regulations of the authorities, steel reinforced, proof pressure 10 bar.  
stainless steel quality 1.4301 or better

**15.4.70. Overflow tank 5 Litre**  
stainless steel 1.4571, pressure proofed to 3.5 bar,  
dimensions:  
pipe diameter 200 mm, length 400 mm, top and bottom with flange and blank-flange  
with the following connections on top  
1 overflow fill pipe DN 15 with flange  
2 tank breath pipe DN 15 with flange  
3 flange for testing probe of level limiter  
4 reserve connection DN 15  
with the following connections on bottom  
1 tank drain pipe DN 15 with flange  
2 reserve connection DN 15

**15.4.80. Filling Limit detection for overflow tank**  
System to avoid the overfill of the overflow tank, with electrical signal to the switch cabi-net, according to the requirement of the authorities

**15.4.90. Steel pipe DN 10**  
stainless steel quality 1.4301 or better, installed according to the requirements of the authorities.  
Complete installation with all accessories like welding, form-connection- and flange parts, wall thickness according norm pressure 10 bar.  
visible and revisible layed in the building

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**15.5. Barrel special fuel equipment**

**15.5.10. Fuel Pump 10 L/min**

dry self suction centrifugal pump, suitable for modified diesel fuel, complete with flange connection to the pipes, maintenance-free double mechanical seal,  
pump rate 10 L/min  
suction head 0.2 bar  
pressure head 1.5 bar  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
flange DN 15

220/380V 50 Hz 0,5kW  
with steel construction to fasten the pump and accessories at the wall in the barrel room

**15.5.20. Fuel filter DN 25**

fuel filter 50 micron, with flange half-coupling, no medium contact with non-ferrous metal or material less than 1.4301 quality. Suitable for modified diesel fuel, complete with flange connection to the pipes

**15.5.30. Full way valve DN 25**

with flange half-coupling  
no medium contact with non-ferrous metal or material less than 1.4301 quality. Suitable for modified diesel fuel, complete with flange connection to the pipes

**15.5.40. Relief valve DN 25**

with flange half-coupling  
no medium contact with non-ferrous metal  
suitable for modified diesel fuel, complete with flange connection to the pipes  
adjustment range 1.0 to 2.0 bar

**15.5.45. Magnetic valve DN 25**

used to shut-off the pressure pipe in the barrel room to prevent fuel delivery into the building in case of fire or other danger.

**15.5.50. Barrel docking system suction and return pipe**

To connect the fuel pump to the 200 L barrel it needs a barrel docking system consisting of:

Adapter with thread for the great barrel thread-mouth  
The adapter inholds a pipe as long as to reach nearly the



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bottom of the 200 L barrel (suction pipe) and a pipe which reaches nearly 10 cm into the barrel (return pipe).  
The head of this adapter has two quick-connects, which allows to connect the suction hosepipe and the return hosepipe.  
Two hosepipes ca. 1.5 m long with one end connected with screw to the steelpipe other end with clean-break-quick-connect to the barrel adapter  
The return pipe is to drain the 50 L daytank as well as to return the flow from the relief valve  
with a wall tightened cover to lay down the system if it is not in use  
All pipes in material stainless steel

**15.5.60. Barrel docking for breath pipe**  
To connect the breath pipe to the barrel it needs an adapter with thread for the little barrel thread-mouth  
The adapter inholds a pipe nearly 5 cm reaching the gas room of the barrel.  
The head of this adapter has a quick-connect, which allows to connect the breath hose-pipe  
One hosepipes ca. 1.5 m long with one end connected with screw to the steelpipe other end with clean-break-quick-connect to the barrel adapter  
The breath pipe is to vent the barrel in case of emptying and in case of return flow by draining day tank  
with a wall tightened cover to lay down the system if it is not in use

**15.5.70. Steel pipe DN 15**  
Stainless steel in quality 1.4301 or better, installed according to the requirements of the authorities.  
Complete installation with all accessories like welding, form-connection- and flange parts, wall thickness according norm pressure 10 bar.  
visible and revisible layed in the building.  
To connect the barrel pump with the accessories of the barrel docking system and as pressure and return pipe inside the barrel room.

**15.5.80. Double-wall pipe DN 15/25 pressure and return pipe to/from the daytank**  
inside stainless steel 1.4301 or better, outside pipe in St.37, outside pipe with PE-coating, installed according to regulations of the authorities.  
included all form- and connection pipes, welding and on site PE-coating, test valves at the beginning and the end

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**15.5.90.** **Annex to the N2 Leakage detection system**  
the above described system is to extend for the two pipes used  
for the barrel system.  
Additional shut-off valves to check one pipe after another and  
additional manometer

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**15.6. Car tank drain and refill system**

**15.6.10. Fuel Pump 10 L/min for draining car tank**

dry self suction centrifugal pump, suitable for diesel and modified diesel fuel, complete with flange connection to the pipes, maintenance-free double mechanical seal, convenient for dry run, to drain the car tank, with relief valve pressure to suction head.  
pump rate 10 L/min  
suction head 0.5 bar  
pressure head 0.5 bar  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
flange DN 15  
220/380V 50 Hz 0,5kW  
with steel construction to fasten the pump and accessories on the floor or at the wall

**15.6.20. Barrel Fuel Pump 20 L/min**

dry self suction centrifugal pump, suitable for diesel and modified diesel fuel.  
Barrel pump with screw connection to the barrel and suction pipe for 200 L barrel complete with quick connect to the pressure hosepipe, maintenance-free double mechanical seal, convenient for dry run, to fill the car tank, with relief valve pressure to suction head.  
pump rate 20 L/min  
suction head 0.5 bar  
pressure head 1.5 bar  
no medium contact with non-ferrous metal or material less than 1.4301 quality  
flange DN 15  
220/380V 50 Hz 0,5kW  
with a wall tightened cover to lay down the system if it is not in use

**15.6.30. Barrel docking system pressure and breath (venting) pipe (for drain car system)**

To connect the pressure and breath pipe to the barrel it needs a barrel docking system consisting of:  
Adapter with thread for the great barrel thread-mouth  
The adapter inholds a pipe nearly 5 cm (breath pipe) and a pipe which reaches nearly to the bottom of the 200 L barrel (fill pipe).  
The head of this adapter has two quick-connects, which allows to connect the fill hose-pipe and the breath hosepipe.  
Two hosepipes ca. 1.5 m long with one end connected with screw to the steel pipe other end with clean-break-quick-

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connect to the barrel adapter  
with a wall tightened cover to lay down the system if it is not in  
use

**15.6.40. Barrel docking for breath pipe (for car tank system)**  
To connect the breath pipe to the barrel it needs an adapter with  
thread for the little barrel thread-mouth  
The adapter inholds a pipe nearly 5 cm reaching the gas room  
of the barrel.  
The head of this adapter has a quick-connect, which allows to  
connect the breath hose-pipe  
One hosepipes ca. 1.5 m long with one end connected with  
screw to the steelpipe other end with clean-break-quick-connect  
to the barrel adapter  
with a wall tightened cover to lay down the system if it is not in  
use

**15.6.50. Steel pipe DN 15**  
Stainless steel 1.4301 or better, installed according to the italian  
law and to the requirements of the authorities.  
Complete installation with all accessories like welding, form-  
connection- and flange parts, wall thickness according norm  
pressure 10 bar.  
Visible and revisible layed in the building.  
To connect the pumps and the accessories of the car fill and  
drain system

**15.6.60. Fill hosepipe and tank pistol**  
Car tank system with fill pipe 4.0 m long, one end with clean  
break quick connect to the Barrel pump quick connect, other  
end with car tank pistol convenient to diesel and modi-fied  
diesel, with auto shut system

**15.6.70. Suction hosepipe**  
Car tank drain hosepipe 2.5 m long, one end fastened with  
screw to the car drain pump suction head, other end open. In a  
distance of about 1 m from the open end is to integrate a shut-  
off ball valve to close the suction hosepipe when the draining is  
finished.

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**15.7. H Electrical switch cabinet an accessories**

**15.7.10. Switch Cabinet for the fuel supply system**

The electric supply and the control and monitoring of the fuel system is integrated in a electrical switch cabinet.

All used electrical parts of the system e.g. Tankfarm, Day Tank, safety equipment, described below is supplied and controlled by this switch cabinet.

It is built according to the EN regulations, and according to the requirements of the authorities.

Including the connection sitches to the electrical power supply.

The safety switches with the gas detection and fire detection system has to be integrated.

In the door of the cabinet are the displays of the tank niveau and for all pumps the lighth to indicate run,stop, failure.

**15.7.20. Leakage Detector**

for several places is to install a leakage detector in a little pit.

In case of leakage detection in the day tank room or the barrel room the systems are shutt-off and a alarm is sent to the central.

The leakage detectors are also signalled in the door of the switch cabinet

**15.7.30. ON/OFF Box for Pumps**

To switch ON/OFF the pumps of the Car Tank/Drain System and the Barrel room are Switch boxes with ON/OFF Bottoms and control lights to install near the pumps on the wall.

**15.7.40. Emergency Stop**

In the building and in the fuel rooms are Central Emergency Stop buttons to install. So that the fuel system can be shut-off in case of leakage or other danger situations. The places are to be determined in time.

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**15.8. Additional services**

**15.8.10. Starting UP and Test Operation**

After finishing installation, the systems have to be started up.

The systems and the components must be adjusted, so that the functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the test operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting UP of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

**15.8.20. Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

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**15.8.30. Revision Documentation**

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

**15.8.40. Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate files.

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The customer has to supply these inspections by sending his commissioning personal so much as it is necessary.



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### 16. **Operation and calibration gas supply**

The calibration gas supply system consists of following main parts:

- Operation and calibration gas supply room with:
  - 3 operation gas types with 2 x 4 bottles 2 reducer stations from bottle pressure to middle pressure (10 bar overpressure) and an automatic switcher which will connect the stand-by battery if the pressure of the connected battery goes down.
  - 2 operation gas types (N2) with 4 bottles and a GM - rented N2 external tank, 2 reducer stations from bottle pressure to middle pressure (10 bar overpressure) and an automatic switcher which will change from external tank supply to the battery if the pressure of the tank goes down.
  - 24 calibration gases in which 5 reserve gases are included, with 2 x 1 bottles 2 reducer stations from bottle pressure to middle pressure (10 bar overpressure) and an automatic switcher which will connect the stand-by bottle if the pressure of the connected bottle goes down.
  - Compressed air as steering energy with a singular reducer station
- Fuel gas supply room
  - 1 fuel gas with 2 x 4 bottles 2 reducer stations from bottle pressure to middle pressure (10 bar overpressure) and an automatic switcher which will change the supply battery if the pressure of the connected battery goes down.
- Piping
  - All operation and the most calibration gases will be executed in stainless steel, orbital welded, Quality TCC
  - Low doped calibration gases f.e.: CO-L and CO2-L will be executed in the quality finetron (Ra<0,4im)
  - Extreme sensible low doped calibration gases f.e.: HC-L and NO-L will be executed in the quality ultron (Ra<0,2im)
- 2nd stage reducer panels:
  - 1 panels placed in the control room at the wall with 30 types of gases at each CVS room for the left engine dyno, the right engine dyno and the CVS room. The engine dynos will be supplied with 20 types and the CVS rooms will be supplied with 30 types. Position according to the control room layout
  - 1 panels placed in the control room at the wall with 20 types of gases at each engine dyno 11 15. The engine dynos will be supplied with 20 types each. Exact position according to the control room layout.
  - 1 panel placed in the chassis dynamometer at the wall

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with 30 types of gases. Exact position according to the chassis dynamometer layout

- Withdrawal panel
- Panel in the raised floor space with 20 gases for each rough analysis of each engine dynamometer with a clamp ring screwing for each gas type. The exact position according to the control room layout
- Panel in the raised floor space with 30 gases for each diluted analysis of each CVS room with a clamp ring screwing for each gas type. The exact position according to the control room layout
- Panel in the raised floor space with 30 gases for diluted analysis of the chassis dynamometer, and 2 x 20 gases for the rough analysis with a clamp ring screwing for each gas type in the chassis dynamometer. The exact position according to the chassis dynamometer layout.
- Purging
- The systems will be purged via the exhaust analysis purge system
- Monitoring: The availability of each gas type will be monitored via 2 contacts:
  - Availability: green LED on a panel in each control room
  - Bottles empty: red LED on a panel in each control room
- Following operation and calibration gas types are planned:

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llne NR.	kind of gas	detail
2	CO 50ppm	3
3	CO 100ppm	3
4	CO 200ppm	3
7	CO 2000ppm	3
11	CO 2%	3
12 b	CO 5%	3
14	compressed air	
15	CO2 1%	3
16	CO2 2%	3
17	CO2 2%	3
19	CO2 20%	3
22	CH4 50ppm	3
23	C3H8 50ppm	3
24	C3H8 100ppm	3
27	C3H8 1000ppm	3
32	Nox 25ppm	3
33	Nox 100ppm	3
37	Nox 2000ppm	3
40	Lambda	3
51	res.1	3
52	res.2	3
53	res.3	3
54	res.4	3
55	res.5	3
42	O2 100%	2
45	O2 10%	2
2 x 46	SL	2
48	N2 Super pure	1
2 x 49	N2 Super pure	1
2 x 50 b	H2He	2
	<b>N2</b>	<b>4</b>

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The calculation of the calibration gas supply system is based on the informations of GM PTE about the intended Exhaust Analysis benches:

- 1 rough exhaust analysis each test bench with EGR analyser
- 1 CVS - diluted exhaust analysis each CVS room
- 1 CVS - diluted exhaust analysis chassis dynamometer
- 2 rough exhaust analysis chassis dynamometer one bench with EGR analyser

All numbers of consumption, of Analysers and the simultaneous factors are assumed by SBI. On base of this numbers the pipe dimensions are calculated. All numbers have to be checked by the analysis engineering

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						tion per analyser	tion SF = 1		tion total	tion total	
						IN/h	IN/h			m3N/h	m3/h
N <sub>2</sub>	N2 Purge gas exepeted FID	Engine Dyno dynamisch	10	5	50	60	3000	0,2	600	0,6	1,452
		CVS	5	6	30	60	1800	0,2	360	0,36	
		Engine Dyno transient	5	5	25	60	1500	0,2	300	0,3	
		Chassis Dyno	1	16	16	60	960	0,2	192	0,192	
N <sub>2</sub>	N2 Zerogas exepeted FID	Engine Dyno dynamisch	10	5	50	60	3000	0,2	600	0,6	1,452
		CVS	5	6	30	60	1800	0,2	360	0,36	
		Engine Dyno transient	5	5	25	60	1500	0,2	300	0,3	
		Chassis Dyno	1	16	16	60	960	0,2	192	0,192	
SA	Synthetic Air Burngas for FID's	Engine Dyno dynamisch	10	5	50	24	1200	1	1200	1,2	2,904
		CVS	5	6	30	24	720	1	720	0,72	
		Engine Dyno transient	5	5	25	24	600	1	600	0,6	
		Chassis Dyno	1	16	16	24	384	1	384	0,384	
SA	Synthetic Air Zerogas for FID's	Engine Dyno dynamisch	10	5	50	210	10500	0,2	2100	2,1	5,082
		CVS	5	6	30	210	6300	0,2	1260	1,26	
		Engine Dyno transient	5	5	25	210	5250	0,2	1050	1,05	
		Chassis Dyno	1	16	16	210	3360	0,2	672	0,672	
FG	HeH2 Fuelgas for FID's	Engine Dyno dynamisch	10	5	50	19,2	960	1	960	0,96	2,3232
		CVS	5	6	30	19,2	576	1	576	0,576	
		Engine Dyno transient	5	5	25	19,2	480	1	480	0,48	
		Chassis Dyno	1	16	16	19,2	307,2	1	307	0,3072	
O <sub>2</sub>	O2 Ozonator	Engine Dyno dynamisch	10	5	50	15	750	1	750	0,75	1,815
		CVS	5	6	30	15	450	1	450	0,45	
		Engine Dyno transient	5	5	25	15	375	1	375	0,375	
		Chassis Dyno	1	16	16	15	240	1	240	0,24	
CAL	Calibration gases	Engine Dyno dynamisch	10	1	10	120	1200	0,2	240	0,24	0,696
		CVS	5	2	10	120	1200	0,2	240	0,24	
		Engine Dyno transient	5	1	5	120	600	0,2	120	0,12	
		Chassis Dyno	1	4	4	120	480	0,2	96	0,096	
N <sub>2</sub>	N2 60 bar supply	Hydraulic bench 1	1	50	300	15000	3	1	625	0,625	1,875
		hydraulic bench 2	1	50	300	15000	3	1	625	0,625	
		spray characteristic rig	1	50	300	15000	3	1	625	0,625	

gas piping dimensions:

- Operation gases: main supply pipe 15 x 1,5 mm  
(internal diameter 12 mm)

- subsidiary pipe: 12 x 1 mm

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(internal diameter 10 mm)

- Calibration gases: 8 x 1mm  
(internal diameter 6 mm)

### 16.1. **bottle pressure reducers and auxiliary devices**

#### 16.1.10. **bottle reducer unit (SS)**

gas bottle pressure reducer control valve unit without auxiliary energy mounted on a console out of stainless metal sheet, complete carried out in stainless steel incl. piping, high precision, pressure reducer with casing out of stainless steel 1.4404 (DIN EN 10088-2) / AISI 316L and membrane out of Hastelloy C inlet pressure 200 bar (bottle pressure at 15°C), secondary pressure 1,0 - 12 bar, control accuracy  $\pm 1,0$  bar at the withdrawel flow rate 0...30m<sup>3</sup>/h, , all sealings have to be gas sort applicable,

high pressure side:

with coil pipe and threaded connection acc. to the ISO 477 and ISO 5145 closing manually by hand force, grab handle, changable filter 15 $\mu$ m, purge function with purge outlet membrane valve and cut off mambrane valve, inlet pressure manometer with limit stop at the pipe spring, 2-stage pressure switcher for 2 potential free deficiency signals at adjustable levels

secondary pressure side:

secondary pressure manometer with limit stop at the pipe spring, adjustable overrun control valve, with check valve, and cut off membrane valve

secondary pressure pipe connection with swagelok clamp ring screw joint diameter 15/1,5 or 12/1 or 10/1mm in each case acc. to the required pipe diameter

all gas carring surfaces are polished with high surface finish with a pipe roughness Ra < 0,8 $\mu$ m

All components including the flanges have to be connected by a equipotential bonding

cutting to length, feeding in and connecting the cables

Manufacturer: DRUVA EMD/MVA 400,  
Messer Griesheim, Air Liquid or equivalent

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16.1.20. \*\*\* Item N/A

16.1.30. **bottle battery reducer change over unit (SS)**

gas bottle battery pressure reducer control valve change over unit without auxiliary energy, mounted on a console out of stainless metal sheet, complete carried out in stainless steel incl. piping, 2 high precision pressure reducer, casing in stainless steel 1.4404 (DIN EN 10088-2) / AISI 316L and membrane out of Hastelloy C inlet pressure 200 bar (bottle pressure at 15°C), secondary pressure 1,0 - 12 bar, control accuracy  $\pm 1,0$  bar at the withdrawal flow rate 0...30m<sup>3</sup>/h, , all sealings have to be gas sort applicable,

each battery side high pressure side:  
with coil pipe and threaded connection acc. to the ISO 477 and ISO 5145 closing manually by hand force, grab handle, changable filter 15 $\mu$ m, purge function with purge outlet membrane valve and cut off mambrane valve, inlet pressure manometer with limit stop at the pipe spring, 2 pressure switcher for 2 potential free deficiency signals at adjustable levels

each battery side secondary pressure side:  
secondary pressure manometer with limit stop at the pipe spring, adjustable overrun control valve, with check valve, and cut off membrane valve

secondary pressure connection with swagelok clamp ring diameter 15/1,5 or 12/1 or 10/1 mm in each case acc. to the required pipe diameter

all gas carrying surfaces are polished with high surface finish with a pipe roughness Ra < 0,8 $\mu$ m

All components including the flanges have to be connected by a equipotential bonding

cutting to length, feeding in and connecting the cables

Manufacturer: DRUVA, Messer Griesheim, Air Liquid or equivalent,

16.1.40. \*\*\* Item N/A

16.1.50. **bottle rack**

gas bottle rack out of galvanized steel profiles with bottle height adjustable bottle support consol and clamp bracket made of Nylon and bottle cap holder, simultaneously for installing the

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bottle reducer units or the bottle battery reducer change over units, bottle console and clamp bracket for bottles with a diameter of 250 mm

usable for the installation on the floor and the wall, with mounting material, dowels and screws. The racks have to be executed for future extensions

After technical clarifications the supplier has to deliver an erection drawing

All components have to be connected and to be provided with equipotential bonding

**16.1.60. bottle holder**

bottle holder for gas bottles consisting of a form stopper, which is directly fixed at the wall, with tension belt, (no height adjustment)

**16.1.70. Flow rate limiter HeH2/ O2, passiv (E)**

gas flow rate limiter as pipe burst valve for flow rates of 2.6 - 36 m<sup>3</sup>/h at 1 to 12 bars adjustable overpressure in the low pressure zone of the bottle reducer unit, made of stainless steel 1.4404 (DIN EN 10088-2) / AISI 316L pipe connections with swagelok clamp ring screw joint diameter 10/1 mm

all sealings have to be gas sort applicable,

all gas carrying surfaces are polished with high surface finish with a pipe roughness Ra < 0,8µm

All components including the flanges have to be connected by a equipotential bonding

cutting to length, feeding in and connecting the cable

Manufacturer.: Swagelok, Druva, Krohne or equivalent.

**16.1.80. solenoid valve DN 8 (E)**

gas solenoid valve for cutting off or purging DN 8/PN 25, stainless steel, made of stainless steel 1.4404 (DIN EN 10088-2) / AISI 316L controlled by an external potential free contact (closed without voltage or pressure), the compressed air pilot valve is working with 6 baro and will be installed in the switch cabinet, 10 meters of compressed air hose diameter 8 mm are included

pipe connections swagelok clamp ring, diameter 10/1 mm, all sealings have to be gas sort applicable.

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all gas carrying surfaces are polished with high surface finish with a pipe roughness Ra < 0,8µm

All components including the flanges have to be connected by a equipotential bonding

cutting to length, feeding in and connecting the cable

Manufacturer: Norgren Herion, Druva, Air Liquid or equivalent,

**16.1.90.** \*\*\* Item N/A

**16.1.100.** **security bottle cabinet 4 x 50 l**  
security cabinet for high pressure gas bottles according to the DIN 12925 /2 and the relevant italian regulations for the use of gas bottles, made of double walled steel plates, empty space filled with non combustibile fire resistant materials, with lockable double door, for installing bottle racks and a bottle reducer unit or a bottle battery reducer from above description

dimensions:  
W: 2000 mm  
H: 2000 mm  
D: 800 mm



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**16.2.** **withdrawel pressure reducers and auxiliary devices**

**16.2.10.** **Membrane valve DN 8, PN 40 (E)**

Membrane cutt off valve with thumb grip-handle casing made of stainless steel 1.4404 (DIN EN 10088-2) / AISI 316L, pipe connections with swagelok clamp ring screw joint diameter: 8/1mm, pressure stage PN 40 with membrane made of Hastelloy C, all sealings have to be gas sort applicable, fitted out as "quater turn" valve with limiter and click into place

all gas carrng surfaces are polished with high surface finish with a pipe roughness Ra < 0,8µm

All components including the flanges have to be connected by a equipotential bonding

manufactureert: DRUVA, Messer Griesheim, AirLiquid or equivalent,

**16.2.20.** accord. to Item 16.2.10.

**Membrane valve DN 6, PN 40 (E)**

as described before, but DN 6, PN 40 (E)

**16.2.30.** **precision pressure reducer 40 NL (E)**

precision gas pressure reducer control valve unit without auxiliary energy, one stage construction, with post pressure manometer with limit stop at the pipe spring, scale to fine adjustment 0,1 bar, carried out of stainless steel 1.4404 (DIN EN 10088-2) / AISI 316 including piping, Membrane made of Hastelloy C, casing and valve seat sealing have to be gas type applicable. Prepressure maximum. 10 baro, post pressure adjustable range 0,5 - 2,5 baro, control accuracy: ± 0,05 bar at the flow rate 0-40NI/min (Norm litre per minute)

Pipe connections with swagelok clamp ring screw joint diameter: 10/1 mm

primary and secondary pressure pipe connection with swagelok clamp ring screw joint diameter 8/1mm

all gas carrng surfaces are polished with high surface finish with a pipe roughness Ra < 0,8µm

All components including the flanges have to be connected by a equipotential bonding

Manufacturer: DRUVA, Messer Griesheim, Air Liquid or equivalent,

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- 16.2.40. precision pressure reducer 10 NL (E)**  
as described before, but flow rate 0-10NL/min (Norm litre per minute)
- primary and secondary pressure pipe connection with swagelok clamp ring screw joint diameter 8/1mm
- Manufacturer: DRUVA, Messer Griesheim, Air Liquid or equivalent,
- 16.2.50. pressure reducer panel (30+5)**  
folded and inforced stainless steel front end sheet metal, thickness minimum 2mm for installation at the wall, for mounting the before described membrane valves and pressure reducers,
- Installation of pressure reducers and membrane valves including the complete hidden piping of the compounds so that only the control elements are sightable at the operation side, the pipe connections have to be equipped with swagelok clamp ring screw joints diameter 8mm, complete with stainless steel piping 6mm orbital welded, with all fittings, screw joint connections and attaching parts
- number of pressure reducers: 30  
number of membrane valves: 30  
reserve number of pressure reducers: 5  
reserve number of number of membrane valves: 5
- all gas carrying surfaces are polished with high surface finish with a pipe roughness  $Ra < 0,8\mu m$
- the adjustment has to be clearly arranged, the gas types specific compounds has to be labeled with shields, the supplier has to submit a drawing with all the supplier specific compounds to be accepted by the user
- 16.2.60.** accord. to Item 16.2.50.  
**pressure reducer panel (20+5)**  
as described before, but for 20 gas types extensible by 5 additional gas types
- 16.2.70.** \*\*\* Item N/A
- 16.2.80. clamp ring screw joint**  
clamp ring srew joint for the installation in a sheet metal withdrawel panel (gas terminal), rear side of the panel for connecting with a stainless steel pipe, front side of the panel for

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connecting with a PTFE tube connection with the exhaust analysis bench.

Pipe connections diameter: 8 x 1mm, tube connection PTFE 8 x 1 mm

materials: stainless steel 1.4401 (DIN EN 10088-2) / AISI 316 pressure stage PN 40, all sealings have to be gas sort applicable,

installation of the female part into one of the sheet metal panels of the following specified positions

all gas carrying surfaces are polished with high surface finish with a pipe roughness  $R_a < 0,8\mu\text{m}$

manufacturert: Swagelok, Air Liquid, Druva or equivalent

**16.2.90. withdrawel connection interface panel 30/5**

folded and inforced stainless steel front end sheet metal, thickness minimum 2mm for installation at the wall or in the false floor space, for mounting the before described female quick connect parts or clamp ring screw joints for tubes, complete with hidden stainless steel piping 6mm orbital welded, with all fittings, screw joint connections and attaching parts

number of gas types: 30  
reserve for number of gas types: 5

all gas carrying surfaces are polished with high surface finish with a pipe roughness  $R_a < 0,8\mu\text{m}$

the adjustment has to be clearly arranged, the gas types specific compounds has to be labeled with shields, the supplier has to submit a drawing of the panel with all the supplier specific compounds to be accepted by the user

**16.2.100. accord. to Item 16.2.90.  
withdrawel connection interface panel 20/5  
as described before, but withdrawel panel for:**

number of gas types: 20  
reserve for number of gas types: 5

**16.2.110. panel design drawings**

full scale drawings showing the arrangement of the compounds of the described panels which have to be submitted 2 weeks after technical clarification and which have to be accepted by the test cell user and the engineering before the execution of

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the installation works for following panels

pressure reducer panel (30+5)  
pressure reducer panel (20+5)  
withdrawel connection interface panel 30/5  
withdrawel connection interface panel 20/5

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**16.3. piping and accessories**

**16.3.10. stainless steel pipes 15 x 1,5 (E-TCC) Ra < 0,8µm**  
seamless drawn stainless steel pipe 15 x 1,5 mm (E),

internal diameter: 12 mm  
wall thickness: 1,5 mm  
material No.: 1.4404/1.4435 (DIN EN 10088-2) / AISI 316L  
piping acc. to DIN 17458 (ISO 2604-2, ISO/DIS 9329-4)

delivery in properly closed state, completely orbital welded,  
without contraction, accurate joint preparation by cutting to  
length and grinding, including fastening clamps and c-profile  
rails, including the bended bows welding and tightning  
accessories, the laying has to be done properly parallel side by  
side.

all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,8µm

**16.3.20. stainless steel pipes 12 x 1 (E-TCC) Ra < 0,8µm**  
seamless drawn stainless steel as described before, but

internal diameter: 10 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,8µm

**16.3.30. stainless steel pipes 10 x 1 (E-TCC) Ra < 0,8µm**  
seamless drawn stainless steel as described before, but

internal diameter: 8 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,8µm

**16.3.40. stainless steel pipes 8 x 1 (E-TCC) Ra < 0,8µm**  
seamless drawn stainless steel as described before, but

internal diameter: 6 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,8µm

**16.3.50. stainless steel pipes 12 x 1 (E-FIN) Ra < 0,4µm**  
seamless drawn stainless steel as described before, but

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internal diameter: 10 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,4µm

**16.3.55. stainless steel pipes 10x1 (E-FIN) Ra < 0,4µm**  
seamless drawn stainless steel as described before , but

internal diameter: 8mm  
wall thickness: 1 mm  
pipe roughness: Ra< 0,4µm

**16.3.60. stainless steel pipes 8 x 1 (E-FIN) Ra < 0,4µm**  
seamless drawn stainless steel as described before, but

internal diameter: 6 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,4µm

**16.3.70. stainless steel pipes 12 x 1 (E-ULT) Ra < 0,2µm**  
seamless drawn stainless steel as described before, but

internal diameter: 10 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,2µm

**16.3.75. stainless steel pipes 10 x 1 (E-ULT) Ra < 0,2µm**  
seamless drawn stainless steel as described before, but

internal diameter: 8 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,2µm

**16.3.80. stainless steel pipes 8 x 1 (E-ULT) Ra < 0,2µm**  
seamless drawn stainless steel as described before, but

internal diameter: 6 mm  
wall thickness: 1 mm  
pipe roughness Ra < 0,2µm

Welding Fittings, delivery in properly closed state, with grinded cut surface, connected to the pipe by orbital welding , accurate joint preparation at the pipe end pieces by cutting to length and grinding, including welding and tightening accessories, the placement has to be done properly parallel side by side

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material No.: 1.4404/1.4435 (DIN EN 10088-2) / AISI 316L  
piping acc. to DIN 17458 (ISO 2604-2, ISO/DIS 9329-4)

**16.3.90. welding Tee pipe 15 x 15 x 15 mm (E\_TCC) Ra < 0,8µm**  
welding Tee pipe, as described before but:  
internal diameters: 12 x 12 x 12  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,8µm

**16.3.95. welding Tee pipe 12 x 12 x 12 mm (E\_TCC) Ra < 0,8µm**  
welding Tee pipe, as described before but:  
internal diameters: 10 x 10 x 10  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,8µm

**16.3.100. welding Tee pipe 10 x 10 x 10 mm (E-TCC) Ra < 0,8µm**  
welding Tee pipe as described before, but:

internal diameters 8 x 8 x 8 mm,  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,8µm

**16.3.110. welding Tee pipe 8 x 8 x 8 mm (E-TCC) Ra < 0,8µm**  
welding Tee pipe as described before, but:

internal diameters 6 x 6 x 6 mm,  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,8µm

**16.3.120. welding Tee pipe 12 x 12 x 12 mm (E\_FIN) Ra < 0,4µm**  
welding Tee pipe, as described before but:  
internal diameters 10 x 10 x 10 mm,  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,4µm

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- 16.3.125. welding Tee pipe 10 x 10 x 10 mm (E\_FIN) Ra < 0,4µm**  
welding Tee pipe, as described before but:  
internal diameters 8 x 8 x 8 mm,  
wall thickness 1mm  
  
all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,4µm
- 16.3.130. \*\*\* Item N/A**
- 16.3.140. welding Tee pipe 12 x 12 x 12 mm (E\_ULT) Ra < 0,2µm**  
welding Tee pipe, described )  
internal diameters 10 x 10 x 10 mm,  
wall thickness 1mm  
  
all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,2µm
- 16.3.145. welding Tee pipe 10 x 10 x 10 mm (E\_ULT) Ra < 0,2µm**  
welding Tee pipe, described as before but:  
internal diameters 8 x 8 x 8 mm,  
wall thickness 1mm  
  
all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,2µm
- 16.3.150. \*\*\* Item N/A**
- 16.3.160. welding reduction pipe 15 - 12 mm (E-TCC) Ra < 0,8µm**  
welding reduction pipe as described before, but:  
  
internal diameters 12 / 10 mm,  
wall thickness 1mm  
  
all gas carrying surfaces are polished with high surface finish with a  
pipe roughness Ra < 0,8µm
- 16.3.170. welding reduction pipe 12 - 10 mm (E-TCC) Ra < 0,8µm**  
welding reduction pipe as described before, but:  
  
internal diameters 10 / 8 mm,  
wall thickness 1mm



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all gas carrying surfaces are polished with high surface finish with a pipe roughness  $Ra < 0,8\mu m$

**16.3.175. welding reduction pipe 10 - 8 mm (E-TCC)  $Ra < 0,8\mu m$**   
welding reduction pipe as described before, but:

internal diameters 8 / 6 mm,  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a pipe roughness  $Ra < 0,8\mu m$

**16.3.180. welding reduction pipe 12 - 10 mm (E-FIN)  $Ra < 0,4\mu m$**   
welding reduction pipe as described before, but:

internal diameters 10 / 8 mm,  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a pipe roughness  $Ra < 0,4\mu m$

**16.3.185. welding reduction pipe 10 - 8 mm (E-FIN)  $Ra < 0,4\mu m$**   
welding reduction pipe as described before, but:

internal diameters 8 / 6 mm,  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a pipe roughness  $Ra < 0,4\mu m$

**16.3.190. welding reduction pipe 12 - 10 mm (E-ULT)  $Ra < 0,2\mu m$**   
welding reduction pipe as described before, but:

internal diameters 10 / 8 mm,  
wall thickness 1mm

all gas carrying surfaces are polished with high surface finish with a pipe roughness  $Ra < 0,2\mu m$

**16.3.195. welding reduction pipe 10 - 8 mm (E-ULT)  $Ra < 0,2\mu m$**   
welding reduction pipe as described before, but:

internal diameters 8 / 6 mm,  
wall thickness 1mm

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all gas carrying surfaces are polished with high surface finish with a pipe roughness  $Ra < 0,2\mu m$

**16.3.200. purging and tightness check up**

the pipe system has to be purged with compressed air and inert gas, after that the system has to be set in overpressure with inertgas to the 1.3 fold operation pressure (210 baro respectively 16 baro, N2 hydraulic lab: 390 baro), the joints have to be tightness checked by the aid of leakage searching spray

the specified pipe system has to be set in overpressure with helium over 12 hours, the pressure history has to be recordered respectively the temperature compensation. The operation materials and the auxiliary devices are included.

before putting into operation the pipe system has to be made exempt from humidity and other pollutants and has to be evacuated and purged with dry nitrogen

This works have to be executed after the appointment with the site supervision of the orderer and in presence of a representative of the orderer

The purging and tightness check has to be executed in several stages according to the building phases

**16.3.210. special locksmith parts**

special locksmith parts, workshop manufactured as support and installation construction, for bottle holders and pipe trays in positions with big distances to the wall or the ceiling, made of steel profiles, galvanized after fabrication, after demand and agreement of the site supervision, including welding and fastening devices.

**16.3.220. identification plates**

identification plates made of multilayered plastic with individual gravure, colors and inscriptions according to the demands of the site supervision.

width : app. 35 mm

height: app. 25 mm

**16.3.230. pipe identifications labels**

self adhesive durable identification labels for the pipes according to the flow media, the flow direction and the objective

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- 16.3.240. security certification acc. to PED**  
security certification of the complete system by the PED after completion an before acceptance
- 16.3.250. CE conformance**  
check of all functions acc. to the security requierements
- 16.3.260. acceptance of an official European security**  
isntitute check up and acceptance by the organisation, contract, coordinate and dcoument the whole acceptance procedure the fee is in charge of the constructor.
- 16.3.270. certificazioni e documentazioni richieste dalla normativa P.E.D**  
Il costruttore, devra elaborare e rilasciare tutte le certificazioni e documentazioni richieste dalla normativa vigente e dalla normativa P.E.D. comprovate da verbali di prove di pressione, test sui materiali e sulle saldature il tutto certificato da un istituto ufficiale e autorizzato. La certificazione devra riguardare non solo i singoli componenti e attrezzature ma l´insieme costituente l´impianto oggetto di certificazione. (Si ricorda che tra i documenti ed elaborati che devono essere prodotti sono anche compresi la stress analysis e la risk analysis).

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**16.4. monitoring system**

**16.4.10. control panel**

control panel to indicate the filling state of each bottle and to announce the need of change of each bottle changover equipped as a wall mounted switch cabinet.

for each gas a green LED has to be provide for the indication of the availability and the state of readiness of the gas type (pressure > 10 baro) and a red LED has to be installed to announce the need of a bottle changover

At the signal red LED for bottle chageover simultaneously an internal buzzer resounds

The LEDs have to be placed in a folded and inforced stainless steel front end sheet metal, thickness minimum 2mm for installation at the wall. stainless steel wall panel

number of green LEDs: 30  
number of red LEDs: 30  
reserve number of green LEDs: 5  
reserve number of red LEDs: 5

the signal of the need of bottle changeover of one gas type has to be given over to the measurement and control system via potential free collective contact.

The control panel has to be equiped with the necessary voltage supply for 230V/50Hz, the transformer, the horn, the circuit board and it has to be completely wired.

The intrinsic safety of the circuits that will have explosion proofed contacts for the flammable gas type has to be considered

cutting to length, feeding in and connecting the cables

**16.4.20. connections box**

connection box for collecting the cables of the contact manometers of 10 bottle reducers and to multiply and transform them to 2 multicore cable (40 x 2 cores), with cable passages.

cutting to length, feeding in and connecting the cables

**16.4.30. Emergency Stop switch**

weather resistant and stabil emergency stop hand pusher for interrupting the H2He supply by hand. The pusher will be installed at the outdoor wall adjacent to the door of the

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flammable calibration gas supply room.

cutting to length, feeding in and connecting the cables

**16.4.40.**

**switch cabinet**

switch cabinet acc. to the relevant italian regulation,s installation at the wall in the corridor of the parking house for the voltage supply and the control of the solenoid valve of the He/H2 gas type and for the emergency stop control circuit, including the voltage feed in, including the main switcher, the control voltage supply, including 21 potential free contacts to cutt off the H2/He gas supply in the cases of fire alarm and air monitoring alarm

cutting to length, feeding in and connecting the cables

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**16.5.** **Additional works**

**16.5.10.** **Revision Documentation**

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement
- switch gear drawings
- Atex certification

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

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### 16.5.20. **Starting UP and Test Operation**

After finishing installation, the systems have to be started up.

The systems and the components must be adjusted, so that the functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the test operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

### 16.5.30. **Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

### 16.5.40. **Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters

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and test measuring values have to be handed over in separate files.

The customer has to supply these inspections by sending his commissioning personal so much as it is necessary.



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**17. Compressed air supply**

**17.1. Devices and Accessories**

**17.1.10. Screw Compressor with Refrigeration Dryer**  
compressor unit as screw compressor with integrated  
refrigeration dryer for the compressed air

factory installed and tested for tightness and function

### **General design of Compressor**

- Robust base frame mounted on antivibration pads
- Piped and wired complete with flexible connections
- Bonded fibre-glass mineral wool internal lining
- Powder-coated panel
- Large and wide-opening inspection doors and cover

### **Compressor unit**

- Airend with proprietary SIGMA Profil
- Polly-vee belt drive with auto tensioner
- Heavy-duty bearings
- Air filter with silencer
- Multiple-use filter cartridge
- Multi-stage fluid separator cartridge

### **Electrical Motor**

- Standard 3-phase motor with high power reserve (IP 55)  
and high efficiency (EFF 1)
- Permanently greased bearings

### **Cooling air flow**

- Cooling fan mounted on the motor shaft  
(included in motor output power)

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- Cooling air ducted directly out of aluminum

### Cooling fluid circulation

- Coolant filling inclusive
- Valveless fluid circulation with thermostat element, bypass and microfilter
- Fluid cooling via aluminium, swing-out air-cooled heat exchanger
- Combined reservoir and separator with fluid level sight glasses, drain valve and hose

### Controlling

- Fully automatic load/idle/stop control with adjustable idling time
- Automatic restart after power failure

### Control cabinet (IP 54)

factory wired with all electrical field components and tested

- Automatic star-delta starter and control contactor

### Control panel

- ON/OFF switch
- EMERGENCY STOP button
- clear indication, plain text display, all functions can be called up by displayed key
- SIGMA control or SIGMA Control BASIC according to version selected

### General design of Dryer

- Low pressure drop
- Powder coated panels

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- All materials used are CFC-free
- All refrigeration components insulated with vapour barrier
- Automatic condensate drain
- Separator
- Supplied with charge of refrigerant and oil
- Ready for operation

### Refrigerant circuit

- Permanently sealed system, fitted with service valves
- Hot-gas bypass regulation

### Technical Data

#### Compressor

FAD according to ISO 1217, 1996 annex C at final discharge pressure(g)	2.60 Nm <sup>3</sup> /min
Compressor discharge pressure	8 bar(g)
Pressure at the refrigeration dryer discharge	7.8 bar
Rated motor power	15 kW
Efficiency	91.5 %
Total power consumption at final discharge pressure(g)	19.5 kW
in idle running	5,6 kW
Motor speed	2945 rpm
Protection	IP 55
Power supply	3 x 400 V, 50 Hz
Cooling medium	air
Compressed air outlet temperature above ambient	6 °C
Cooling air volume flow	3800 m <sup>3</sup> /h

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Compressed air connection	G 1 Zoll
Cooling fluid capacity	11 l
Dimensions (W x D x H):	1480 x 830 x 1255 mm
Sound level to PN8NTC2.3 at 1 m distance, free field measurement	66 dB(A)
Weight	465 kg

### Refrigeration dryer

compressed air working pressure	16 bar(g)
Pressure drop	0.2 bar
Pressure dew point with ambient air at +20°C and 30 % humidity	+3 °C
Air outlet temperature above inlet temp.	1-2 °C
Refrigerant	R 134a

### Control System

#### Hardware

- Compact computerised controller
- User interface with soft-touch keys
- Back-lit, 4-line, plain text display
- LED main functions display
- Stabilised 24V DC power supply with
- Relay output (volt-free)

#### Display of

- Measured data: air main pressure  
cut-out pressure  
air end discharge  
temperature

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- Status data: machine readiness condition  
alarm registered  
service due

- Operating hours counter: total time  
time under load  
service interval remaining

Standard output signals

- Group alarm all alarms, including  
externals (digital output)

Standard monitoring possibilities

- Direction of rotation

- Machine pressure

- Emergency stop button

- Air end discharge temperature

- Door interlocks

- Motor protection switch

- Refrigeration dryer

Standards, Regulations and Recommendations for Installation

- Conforms to all technical regulations including:

98/37/EC	Machinery directive
73/23/EWG	Low voltage directive
87/404/EWG	Simple, unfired pressure vessels
89/336/EWG	Electromagnetic compatibility
EN 1012-2	Safety requirements for compressors
EN 292-1+2	Safety of machinery
EN 294	Safe distances
EN 378	Refrigeration systems and heat pumps
EN 60204-1	Safety of electrical equipment
EN 50081-2	Electromagnetic compatibility - Generic emission
EN 50082-2	Electromagnetic compatibility - Generic immunity

Service Manual to EU Machinery Directive 98/37/E comprising:

- Operating Instructions

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- Maintenance Instructions
- P & I Flow Diagram
- Electrical and Interconnection Diagrams

Temperature limits at the installation: +3 °C to +4.5 °C

The compressor space must be provided with sufficiently sized air inlet and air outlet apertures

A main switch/HRC fuse combination must be provided by the user as determined by safety regulations on site.

incl. cutting to length, feeding in and connecting the cables

All cables will be installed by the trade "Electrical Supply".

The feeding in, cutting to length and connection of the cables is included in this position

incl. all auxiliary devices (like mobile crane)

supply, mounting and starting up of the compressor unit

**17.1.20. Buffer for Compressed Air  
General design**

- Galvanised surface to ISO 1461

- Connection ports for:

inlet	DN 50
outlet,	DN 50
condensate drainage,	DN 25
pressure relief valve,	DN 25
pressure gauge,	DN 15
pressure switch,	DN 15
test flange and	
check valve	DN 25

length of nozzles: 150 mm  
nozzles incl. flanges PN 16

- Provided with an inspection/maintenance port and with 4 separated feet

Standards, regulations and installation recommendations

- Constructed to the official provisions of the Italian Trade

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(P.E.D)

Cooperative Associations and to the German Pressure Vessels Act, including an authorised test approval certificate covering the construction and pressure tests.

- Temperature limits at place of installation -10 to +50°C
- A firm, even floor is necessary

### Accessories

- Basic set of fittings comprising:
  - type approved pressure relief valve,
  - pressure gauge,
  - outlet ball valve,
  - test flange,
  - condensate tap (manual),
  - set of gaskets and minor items

### Technical Data

Capacity	500	litre
Permissible working pressure	11	bar(g)
Diameter	600	mm
Height, without fittings	1925	mm
Weight	110	kg

incl. mating flanges, screws, nuts, sealings and mounting material

incl. cutting to length, feeding in and connecting the cables

incl. all auxillary devices (like mobile crane)

supply, mounting and starting up

**17.1.25. Condense Trap**  
for compressed air

2 - port valve

direct operation

operation current 24 V AC

incl. damping in shutting operation

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air pressure (abs.) 8 bar  
closing pressure difference up to 8 bar  
dimensions DN 20  
PN 16  
kvs 67  
max. operation temperature 90 °C  
incl.mating flanges, screwcs, nuts, sealing and mounting material  
supply and mounting

**17.1.30. Micro Activated Carbon Filter Combination**  
Quality classification in accordance with ISO 8573-1

- separated particle size > 0.01 µm  
class 1  
- remaining oil aerosol content < 0.001 mg/m<sup>3</sup>  
class 1  
- remaining oil vapour content < 0.003 mg/m<sup>3</sup>  
class 1

### Applications

- food and beverage industries, bottle-filling plants  
- medical, pharmaceutical, packaging, breathing air

### General design

- Combination microfilter and activated carbon filter  
- Rugged housings, epoxy coated inside and out  
- Turbulence-free zone in lower part of the bowls  
- Float-controlled condensate drain on the micro filter  
- Bayonet bowl-to-head fittings  
- Pressure differential indicator on the micro filter  
- Acoustic warning to prevent filter opening under pressure



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Function

Micro filter

- Two-stage filtration
- Multi-layered fibre glass as particle retainer
- Laminated membrane in epoxy strengthened fibre glass
- High efficiency even under partial loading down to 5% of rated flow capacity
- Plug-in filter element

Activated carbon filter

- Membrane of finest carbon particles
- Multiple layers of fibre material with bonded micro fine carbon particles

### Standards, Regulations and Installation Recommendations

- Conforms to all technical regulations including EN 286 Simple, unfired pressure vessels
- Temperature limits at the installation: + 5°C to +46 °C

Medium:	compressed air	
Flow capacity	2.83	m <sup>3</sup> /min
(related to 1 bar(a) and 20°)	169.8	m <sup>3</sup> /h
Working pressure	7	bar(g)
Min. working pressure	1.4	bar(g)
Max. permissible working pressure	16	bar(g)
Number of filter elements	each 1	
Dimensions (H x W)	389 x 266	mm
Weight	.7	kg
Air connection	R 3/4	Zoll

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incl. cutting to length, feeding in and connecting the cables

All cables will be installed by the trade "Electrical Supply."

supply, mounting and starting up

### 17.1.40. Oil Water Separator

#### Design and construction

- Delivered ready to use
- Patented expansion chamber with integrated exhaust air filter
  
- 4 positions for pipe connections on the decompression Chamber
- Dirt trap integrated in the decompression
- Gravitational separation of oil and water
- Height adjustable oil overflow
- Prefilter
- Adsorption filter
- Differential pressure indicator
- Turbidity reference set
- Sampling valve in the adsorption filter
- Overflow-proof oil container
- Arranged to accept thermostatic heater

Applied standards and directives

- 73/23/EU Low-voltage regulation
- EN 292 T1 und T2 Safety of machines
- EN 29001/ISO 9001 Standard of quality assurance
- 

#### Technical Data

## Specification

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	Tank volume 55 l
	Tank capacity 40 l
	Prefilter (one) 2 l
	Adsorption filter (one) 3 l
	Condensate inlet 3 x G 1/2 Zoll 1 x G 1 Zoll
	Water outlet DN 13
	Oil outlet DN 20
	Weight, empty 10 kg
	Permissible condensate temperature +1 to +60 °C

incl. cutting to length, feeding in and connecting the cables

All cables will be installed by the trade "Electrical Supply.

supply, mounting and starting up

**17.1.50. Air Main Charging System  
Function (standard set-up)**

A pressure switch upstream of the shut-off valve is set to trigger the valve opening when the pressure in the supply system reaches 1.5 bar.

Below the maximum air main working pressure. The air main begins to fill, pressure in the supply system sinks and the valve closes again.

The sequence is repeated until the air main is fully charged. In this way the air main is filled gradually and air treatment devices are protected from overloading by an uncontrolled, full capacity airflow into an empty air main.

The shut-off valve isolates the air supply system from the air main retaining pressure when the air main is empty or pressure is low.

The shut-off valve is held closed by spring pressure and opened by a pneumatic drive controlled by a solenoid valve and throttle to regulate speed of opening.

## Specification

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Set-up alternatives

- Ensured air quality (standard set-up)

If the solenoid valve controlling the shut-off valve is de-energised by an alarm signal or power failure the shut-off valve closes ensuring that no untreated air is fed to the air main. In this case, the air treatment devices are still protected against overload in the event of failure of the air main charging system.

- Ensured air supply (modification to standard set-up made on site)

In this set-up the shut-off valve opens in response to a demand for air and if the solenoid valve is de-energised.

Supply to the consumers is ensured in the event of a failure in the air main charging system.

Air quality, however, is only ensured by normal functioning of the air main charging system.

Scope of supply

Ball valve with single-acting pneumatic drive working against spring pressure; integrated solenoid control valve (230 V) and throttle; integrated pressure switch; 1/2" male thread connection for control air.

### Specification

Shut-off device	ball or butterfly valve
Rated pressure	10 bar
Connection	1 Zoll
Permitted ambient temperature range	-20 to +90 °C
Power supply	230 V

incl. cutting to length, feeding in and connecting the cables

All cables will be installed by the trade "Electrical Supply.

supply, mounting and starting up

## Specification

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**17.1.60. Compressed Air Filter**  
filter for compressed air acc. to DIN/ISO 8573-1

for mounting inline of pipe system

power coated case

conecction

- with bayonet joints DN 40
- with safety device against opening under pressure

incl.

- electronic filter monitoring IP 54
- LCD pressure difference incicator IP 54
- electronic condensate seperator IP 54
- maintenace monitoring with external message to the central control managaement
- alert message to the central control managaement (voltage free)
- condensate ball valve

### Technical Data

volume flow	3,82	Nm <sup>3</sup> /min
pressure (abs.)	8	bar
connection	DN 40/ PN 16	
resudial oil content	<= 1	mg/m <sup>3</sup>
resudial particle dimension	<= 1	micro meter
max. fluid content	<= 2000	mg/m <sup>3</sup>
efficiency	99,99999	%
pressure difference by clean filter	<= 0,07	bar
allowed surrounding temperature	45	°C

dimension

- width 164 mm
- high 826 mm

incl. bracket, mounting and sealing material

incl. replacment filter cartridge

supply and mounting

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**17.1.70. Pressure Reducing Valve**  
for compressed air

case out of yellow brass

### Technical Data

volume flow 3,82 Nm<sup>3</sup>/min  
pressure reduce 0,5 up to 10 bar

connection DN 40/ PN 16

dimension

- width 164 mm  
- high 826 mm

incl.

- 2 manometer
- 2 manometer valves
- bracket, mounting and sealing material

supply and mounting

**17.1.80. Solenoid Valve DN 20**  
for compressed air

2 - port valve

direct operation

operation current 24 V AC

incl. damping in shutting operation

air pressure (abs.) 8 bar

closing pressure difference up to 8 bar

dimensions DN 20  
PN 16  
kvs 67

max. operation temperature 90 °C

incl. mating flanges, screws, nuts, sealing and mounting

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material

supply and mounting

\*\*\* Design-Description 1701

**Ball Valves**

for compressed air

case out of yellow brass, nickelized,  
ball out of brass, chromated

as 2 port valve

operation pressure 8 bar

incl. lever, bolting, sealing and mounting material

supply and mounting

**17.1.90.** accord. To Design Description 1701

**ball valve DN 10**

DN 10

PN 25

supply and mounting

**17.1.100.** accord. To Design Description 1701

**ball valve DN 15**

DN 15

PN 25

supply and mounting

**17.1.110.** accord. To Design Description 1701

**ball valve DN 20**

DN 20

PN 25

supply and mounting

**17.1.120.** accord. To Design Description 1701

**ball valve DN 25**

DN 25

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PN 25

supply and mounting

**17.1.130.** accord. To Design Description 1701  
**ball valve DN 32**  
DN 32  
PN 25

supply and mounting

**17.1.140.** accord. To Design Description 1701  
**ball valve DN 40**  
DN 40  
PN 25

supply and mounting

**17.1.150.** accord. To Design Description 1701  
**ball valve DN 50**  
DN 50  
PN 25

supply and mounting

\*\*\* Design-Description 1702  
**Quick Coupling Valve**

for connection to mobile consumers

out of yellow brass

- with bayonet joints
- with safety device against opening under pressure

incl. sleeve - connection to pipe system

incl. mounting and sealing material



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17.1.160. \*\*\* Item N/A

17.1.170. accord. To Design Description 1702

**Qucik Coupling valve DN 15**

DN 15

PN 16

supply and mounting

17.1.180. **Pressure Gauge**

With liquid filling for measurement of liquids in insulated pipes

dial: white  
graduations black

pointer: aluminum black

window: laminated safety glass

Solid stainless steel separating wall between the measuring element and dial; rear wall constructed as blow out

liquid filling: glycerin 99,5%

pressure range: 0 up to 16 bar

accuracy: class 1

diameter: 100 mm

connection: ½" at the bottom

medium: compressed air - 8 bar

supply and mounting

17.1.190. **Manometer Valve**

supply and mounting

17.1.200. **Measuring Nozzle**

diameter: ½" x 100 mm

with shut-off valve consisting of red brass

incl. welding, sealing and mounting material

supply and mounting

17.1.210. **Mounting of Measuring Equipment**

Mounting of supplied indicators, pressure switches a.s.o.

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incl. welding, sealing and mounting material

only mounting

**17.1.220. Nozzle RP 15 x 100 mm**  
with coupling sleeve for mounting of measurement equipment

incl. welding, sealing and mounting material

supply and mounting

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### 17.2. Pipes and Accessories

Pipes are generally out of steel, black, material ST 37.0

Technical supply regulations acc. to ISO 9329

Pipes with nominal diameter

equal/lower DN 50: acc. to ISO 65 - 1981  
seamless

greater DN 50 up to DN 100: acc. to ISO 4200 - 1985  
seamless

greater DN 100: acc. to ISO 4200 - 1985  
full length,  
spiral welded

\*\*\* Design-Description 1703

#### **Pipe connections as self-subsistent connections**

Steel pipes have to be welded.

Only licensed welders with valid papers may be allowed to carry out welding work.

Welding seams must be subjected to a random-sample, non destructive seam test. This will be described in separate positions.

Pipes are to given a rusts protection double primer coat an a cover coat - coats with different colours.

Following installation of the pipelines, the welds and any damage must be repaired.

The pipelines have to be stored in impact - sound damping mounting plates.  
Impact-sound damping rate > 30 dB by reference swing velocity  
 $v_0 = 5 \times (10 \text{ E } -8) \text{ m/s.}$

Continuous mantles are to be used for all wall and ceiling bushings with friction-free interiors. The gap between pipeline and pipe bushing mustbe filled with rock wool or sealing floss and sealed waterproof and dustproof using suitable sealing material

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The fixed points must be designed so as to absorb the resulting tensions and reactive forces. Nominal pipe width, temperature and operating pressure must be taken into account. Proof of strength with statics calculations for these system components must be submitted to the constructor by the supplier before the work is carried out.

supply and mounting incl. mounting material (clamps, threaded rods, screws, nuts, dowels a.s.o.) welding and sealing material, fittings, flanges, boltings are described in separate position

**17.2.10.** accord. To Design Description 1703  
**Pipe DN 10**  
DN 10 (17,2 x 2,65 mm) seamless

Supply and mounting

**17.2.20.** accord. To Design Description 1703  
**Pipe DN 15**  
DN 15 (21,3 x 2,65 mm) seamless

Supply and mounting

**17.2.30.** accord. To Design Description 1703  
**Pipe DN 20**  
DN 20 (26,9 x 2,65 mm) seamless

Supply and mounting

**17.2.40.** accord. To Design Description 1703  
**Pipe DN 25**  
DN 25 (33,7 x 3,35 mm) seamless

Supply and mounting

**17.2.50.** accord. To Design Description 1703  
**Pipe DN 32**  
DN 32 (42,4 x 3,25 mm) seamless

Supply and mounting

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**17.2.60.** accord. To Design Description 1703  
**Pipe DN 40**  
DN 40 (48,3 x 3,25 mm) seamless

Supply and mounting

**17.2.65.** accord. To Design Description 1703  
**Pipe DN 50**  
DN 50 (60,3 x 3,65 mm) seamless

Supply and mounting

### **Fittings for Steel Pipes**

\*\*\* Design-Description 1704  
**Elbow**

in all angle - degrees

**17.2.70.** accord. To Design Description 1704  
**Elbow DN 10**  
DN 10 (17,2 x 2,65 mm)

Supply and mounting

**17.2.80.** accord. To Design Description 1704  
**Elbow DN 15**  
DN 15 (21,3 x 2,65 mm)

Supply and mounting

**17.2.90.** accord. To Design Description 1704  
**Elbow DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

**17.2.100.** accord. To Design Description 1704  
**Elbow DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

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**17.2.110.** accord. To Design Description 1704  
**Elbow DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**17.2.120.** accord. To Design Description 1704  
**Elbow DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

**17.2.125.** accord. To Design Description 1704  
**Elbow DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

### Guide Note

Branch fittings up to DN 40 may be build by T- fittings

Branch fittings greater than DN 40 are to be shoe curved to the pipe by shoe-bent elbows

\*\*\* Design-Description 1705  
**T - Fitting**

as T- fitting in equal and reduced outlets

only the greatest diameter is described

**17.2.130.** accord. To Design Description 1705  
**T - Fitting DN 10**  
DN 10 (17,2 x 2,65 mm)

Supply and mounting

**17.2.140.** \*\*\* Item N/A

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**17.2.150.** accord. To Design Description 1705  
**T - Fitting DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

**17.2.160.** accord. To Design Description 1705  
**T - Fitting DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

**17.2.170.** accord. To Design Description 1705  
**T - Fitting DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**17.2.180.** accord. To Design Description 1705  
**T - Fitting DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

**17.2.185.** accord. To Design Description 1705  
**T - Fitting DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

\*\*\* Design-Description 1706  
**Reduction Fitting**

in concentric and eccentric type

only the greatest diameter is described

**17.2.190.** \*\*\* Item N/A

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**17.2.200.** accord. To Design Description 1706  
**Reduction DN 20**  
DN 20 (26,9 x 2,65 mm)

Supply and mounting

**17.2.210.** accord. To Design Description 1706  
**Reduction DN 25**  
DN 25 (33,7 x 3,35 mm)

Supply and mounting

**17.2.220.** accord. To Design Description 1706  
**Reduction DN 32**  
DN 32 (42,4 x 3,25 mm)

Supply and mounting

**17.2.230.** accord. To Design Description 1706  
**Reduction DN 40**  
DN 40 (48,3 x 3,25 mm)

Supply and mounting

**17.2.235.** accord. To Design Description 1706  
**Reduction DN 50**  
DN 50 (60,3 x 3,65 mm)

Supply and mounting

\*\*\* Design-Description 1707  
**Connection to Consumer**

The consumer of compressed air have to  
connected with the pipe system.

This will be done by bolting out of malleable cast or  
mating flanges out of steel incl. screws and nuts

The positions includes all sealing and all mounting material.



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- 17.2.240.** accord. To Design Description 1707  
**Connection fuel valve**  
connection to fuel control valve  
with a bolting DN 10  
  
supply and mounting
- 17.2.250.** accord. To Design Description 1707  
**Connection exhaust gas flap**  
connection to exhaust gas flap  
with a bolting DN 10  
  
supply and mounting  
  
\*\*\* Design-Description 1708  
**Sign Post**  
  
consisting of resopal acc. to DIN 2401  
according to the specifications of the customer,  
incl. all necessary accessories,  
inscription acc. to the list, which is approved by the customer
- 17.2.260.** accord. To Design Description 1708  
**Sign Post 200 / 100**  
length: 200 mm  
high: 100 mm  
  
supply and mounting
- 17.2.270.** accord. To Design Description 1708  
**Sign Post 100 / 50**  
length: 100 mm  
high: 50 mm  
  
supply and mounting
- 17.2.280.** \*\*\* Item N/A
- 17.2.290.** **Directional Marker**  
to stick on to the pipes in long lasting execution  
color, text and execution acc. to DIN 2403 and

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the requirement of the customer

supply and mounting

**17.2.300. Structural Steel Construction**  
(according to the instruction of the supervisor)

in all kinds of special mounting constructions, welded and/or  
screwed

rust protection by ground and finished painting (in different  
paints),  
paint acc. to the instructions of the customer

incl. all necessary mounting materials  
incl. drilling of fixing holes in concrete and/or masonry walls  
and ceilings

The accounting will be based on the 'avoids' of the steel  
supply and mounting

\*\*\* Design-Description 1709

### **Pressure Test**

Following installation and laying of pipeline system, before the  
wall gaps and ceiling bushings are closed and before the  
insulation is installed, the pipe system is to be subjected to a  
pressure test.

Relevant regulations and manufacturer's directives are to be  
followed.

As test medium, compressed air has to be used.

The necessary mobile compressor has to be supplied by loan.

All pipe connections have to undergo a visual examination.

The test pressure is 1,5 x nominal pressure. The test period is  
12 hours.

All tests have to be carried out in arrangement and in presence  
of the construction supervisor.

The test results must be recorded in protocols, countersigned by  
the construction supervisor and to be documented. All used  
protocols should agree in content with ISO 9000.

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As a function of the progress of the construction work, it will be necessary to execute the pressure tests in separate section.

**17.2.310.** accord. To Design Description 1709  
**Pressure Test 250 liters**  
Pressure test in section up to 250 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**17.2.320.** accord. To Design Description 1709  
**Pressure Test 500 liters**  
Pressure test in section up to 500 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**17.2.330.** accord. To Design Description 1709  
**Pressure Test 1000 liters**  
Pressure test in section up to 1000 l volume capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

\*\*\* Design-Description 1710  
**Pipe Cleaning**

All pipe systems are to be flushed before connection with the main pipe - system and before commissioning with compressed air.

The necessary mobile compressor has to be supplied by loan.

Before the pipeline is connected to the main system, the degree of cleanness of the flushing medium has to be checked, protocolled and to be coordinated with the construction supervisor.

Integrated strainers are to be cleaned, if necessary in several times.

As a function of the progress of the construction work, it will be necessary to execute the pipe cleaning in separate section.

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**17.2.340.** accord. To Design Description 1710  
**Pipe Cleaning 250 liters**  
Pipe cleaning in section up to 250 l volume capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**17.2.350.** accord. To Design Description 1710  
**Pipe Cleaning 500 liters**  
Pipe cleaning in section up to 500 l volume capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

**17.2.360.** accord. To Design Description 1710  
**Pipe Cleaning 1000 liters**  
Pipe cleaning in section up to 1000 l water capacity of pipe system, incl. all necessary equipment and secondary works.

Supply and mounting

\*\*\* Design-Description 1711  
**Welding Seam Test**

Steel pipes have to be welded. Only licensed welders with valid papers (acc to DIN EN 287 part. 1) may be allowed to carry out welding work.

An operating skill record has to be produced by the appointed welders on the job site in the presence of a specialist. A copy of welding license as well as operating skill examination have to be handed over to the local construction supervision prior to construction start

Welding seams must be subjected to a random-sample, nondestructive welding seam test.

All welding seams in compressed air systems are to be labeled with welder and welding seam numbers (stamp die). Welding seams to be examined will be announced by construction supervision, included in the pipe welding plan and provided unchangeable with

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consecutive numbers as well as welding numbers.

The x-ray inspections are to be performed acc. to DIN EN 25817.

The documentation file to be set up contains all films, evaluation papers, pipe plans with welding seam markings, welder list with welding license.

10% of all welding seams are to be inspected.

At a defect frequency of = 30 % relating to 10% testing range, the total testing range is increased to 30% of all welding seams.

At a defect frequency of =10%, relating to 30% testing range, the testing range is increased to all welding seams.

X-ray films must be evaluated by an expert.

Repair seams are to be marked and retested.

Testing fees for repair seams and all seams above the 10% testing range have to be paid by the contractor.

Execution and quality of the welding seams according to DIN EN 25817.

**17.2.370.** accord. To Design Description 1711  
**Welding Seam Test DN 10 to DN 40**

welding seam test for pipes DN 10 up to DN 40

incl. documentation and all auxiliary devices

supply and execution

**17.2.380.** **certificazioni e documentazioni richieste dalla normativa P.E.D**

Il costruttore, dovrà elaborare e rilasciare tutte le certificazioni e documentazioni richieste dalla normativa vigente e dalla normativa P.E.D. comprovate da verbali di prove di pressione, test sui materiali e sulle saldature il tutto certificato da un istituto ufficiale e autorizzato. La certificazione dovrà riguardare non solo i singoli componenti e attrezzature ma l'insieme costituente

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l'impianto oggetto di certificazione. (Si ricorda che tra i documenti ed elaborati che devono essere prodotti sono anche compresi la stress analysis e la risk analysis).

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### 17.3. Special Services

#### 17.3.10. Revision Documentation

The supplier has to hand over a documentation of the systems which are erected by him.

The documentation includes

- system and functional descriptions
- maintenance and operating instructions
- maintenance lists
- spare and wear-and-tear parts lists
- technical data sheets of delivered components
- layout data
- calculations
- circuit diagrams
- measuring and adjustment records
- records about operator instructions
- commissioning records
- test certificates
- pressure test records
- installation and workshop drawings
  - floor drawings (ground, 1st and 2nd)
  - section drawings
  - schematic drawings
- manufacturer's certification resp. conforming statement

The documentations have to be handed over in english and in italian language, three-times each as paper, and pdf -file on CD or DVD, drawings in format dwg on CD or DVD)

For all systems, a coloured schematic drawing has to be posted at a central place.

The drawings have to be light resistant covered by foil or glass

For all systems and parts of systems, which are obligated for approval or notification and for all systems which need periodic tests by legal experts, all necessary documents have to be handed over to the customer in separate files (one file for each equipment / system).

#### 17.3.20. Starting UP and Test Operation

After finishing installation, the systems have to be started up.

The systems and the components must be adjusted, so that the

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functions and performances are achieved.

The adjusted parameters (hydraulically, measuring and controlling parameters) have to be recorded.

The functional tests of the entire systems have to be verified by operation tests including

- Safety equipment
- Regulatory and switching equipment
- Hydraulic compensations, etc.
- Power measuring and others

During the testl operations all relevant measuring sizes are to be recorded and they are part of the documentation.

During the time of starting up and test operation, the supplier must use his own operating and commissioning personal

The supplier has to supply the starting ups of the other trades by sending his commissioning personal so much as it is necessary.

After finishing the setting up the function of the systems have to be approved by a test operation during a time of 14 days.

During this time, all functions have to be tested in full and idle running, in manually and automatically operation.

**17.3.30. Instruction of Operation Personal**

During the test operation, the supplier has to instruct the operation personal of the user into the function of the erected systems.

The instruction has to be documented. The document will include the names of the instructed personal and the scope of the instruction.

**17.3.40. Acceptance by Legal Experts**

All systems have to be inspected by the competent legal experts.

Therefore the documentation and the necessary parameters and test measuring values have to be handed over in separate files.



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The customer has to supply these inspections by sending his  
commissioning personal so much as it is necessary

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**18. Sprinkler system**

**18.1. Distributor structure and distribution**

**18.1.10. Wet alarm valve station DN 200 PN 16**

Accomplishment for the sprinkler protection in frost-free rooms.  
Assembly to an existing distributor acc. to MFPA 13 latest edition.

Consisting of:

- 1 wet alarm valve DN 200, PN 16 UL / FM / VDS etc. listed
- 1 gate valve DN 200 with display device monitored via end switch
- 1 combined test and drainage valve DN 15/DN 50 PN 16
- 1 alarm shut-off cock DN 15 PN 16, monitored
- 2 manometers 0-16 bar with manometer valves
- 1 membrane pressure switches as pulser

as well as all required seals, screws, form and connection pieces and  
bracket fastenings

complete delivery and installation

**18.1.20. Desk made of sheet steel**

with one set tools,

consisting of:

- 1 % max. 100 pcs. per installed sprinkler
- sprinkler typ and rate
- 1 srpinkler key
- 1 operating instructions
- 1 maintenance report portfolio

complete delivery and installation

**18.1.30. Pipeline DN 200**

as main line for connection between sprinkler distribution and sprinkler  
pipe network as well as for connection within the pipe network made of  
steel pipes. With arrangement, dimensioning and installation of  
pipelines acc. to NFPA sprinkler guidelines. Pipelines DN 25 up to DN  
200 acc. to DIN 10 220 in welded make as well as pipe grooved  
couplings.

Black steel pipe with cover coat RAL 3000 or galvanized, if galvanized  
each fitting must be colored RAL 3000.

complete delivery and installation

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- 18.1.40. Pipe elbow DN 200, 90°, cover coat RAL 3000**  
for steel pipe DN 200, grooved on both sides, incl. two removable pipe couplings as well as all required seals and screws  
  
cover coat RAL 3000  
  
complete delivery and installation
- 18.1.50. Flange DN 200, cover coat RAL 3000**  
grooved on one side for the connection of a pipe coupling DN 200, incl. sealing, screws and nuts  
  
cover coat RAL 3000  
  
complete delivery and installation
- 18.1.60. Pipe coupling DN 200, cover coat RAL 3000**  
for the connection to grooved form parts and pipelines  
  
cover coat RAL 3000  
  
complete delivery and installation
- 18.1.70. Identification signs 100 x 60 mm**  
consisting of:  
universal holder, base panel colored, one, two or three lines, with standard or special lettering, engraved and lightfast, exchangeable strips and/or acc. to direction of Contracting Agency, incl. transparent covering,  
  
complete delivery and installation
- 18.1.80. Direction arrows**  
for gluing on media lines, in permanent make. Color, lettering and accomplishment acc. to directions of Contracting Agency,  
  
complete delivery and installation
- 18.1.90. Small iron parts**  
in shape of angle, flat, T-, U-iron, C-profile rails, angle brackets galvanized, for the fastening of pipelines, support scaffolds and pipe bridges, fixed points and large pipe fastenings;  
  
delivery, processing e.g. screwing, doweling etc. installation. Incl. fastening material.

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**18.2.** **Basement/1st floor ceiling protection; zone 9,  
installation height up to 5.0 m**

**18.2.10.** **Sprinkler UL/FM or VdS etc. listed, standing, exposed pipe, 68°C/12 mm**

Response temperature: 68°C gloss bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12 mm/min  
Installation height max.: 5.0 m  
For component: ceiling protection zone 9

complete delivery and installation

**18.2.20.** **Sprinkler UL/FM or VdS etc. listed, hanging, concealed pipe, 68°C/12 mm,  
chrominiumplated**

Response temperature: 68°C gloss bulb  
Connection thread: R 1/2"  
RTI > 50  
RTI < 80  
spec. water capacity: 12 mm/min  
Installation height max.: 5.0 m  
For component: ceiling protection zone 9

complete delivery and installation

**18.2.30.** **Sprinkler rebounding plates**

for protection of sprinkler against wetting and cooling at installation  
layers arranged one upon the other

complete delivery and installation

**18.2.40.** **Bend single**

return bend arrangements including all fittings, pipes and escutcheon  
plates

complete delivery and installation

**18.2.50.** **Riser or drop pipe and/or downspout 1" - short**

lmax. = 500 mm

cover coat RAL 3000 or galvanized

complete delivery and installation

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- 18.2.60. Riser or drop pipe and/or downspout 1" - long**  
lmax. = 1000 mm  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.2.70. Drainage and/or ventilation DN 25**  
with appropriate pipelines DN 25 accord NFPA 13 in screwed make up to a length of 5 m incl. bracket fastenings, one-time protective paint coat and identification sign  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.2.80. Flushing connection DN 50**  
incl. pipe nipple, ball cock and plug  
  
complete delivery and installation
- 18.2.90. Test connection sprinkler system**  
(Accord. NFPA 13) with appropriate pipelines DN 25 DIN EN 10 255 in screwed make up to a length of 5 m, incl. ball cock, manometer and holding devices, one-time protective paint coat and 1 identification sign  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.2.100. Grading DN 25 - DN 50**  
Main and distributor lines  
  
cover coat RAL 3000 or galvanized  
  
consisting of:  
2 pipe elbows, galvanized  
4 pipe couplings  
1 pipe piece lmax.: 1.0 m  
  
complete delivery and installation
- 18.2.110. Grading for DN 40 - DN 80**  
Main and distribution lines  
  
cover coat RAL 3000 or galvanized

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consisting of:

4 elbows, grooved on both sides, incl. two removable pipe couplings  
as well as all required seals and screws  
3 pipe pieces lmax.: 1.0 m

complete delivery and installation

**18.2.120. Grading for DN 100 - DN 150**  
same as described above

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.130. Pipeline DN 200, installation height 5 m**  
changes see item 18.1.40

as main line for connection between sprinkler distribution and sprinkler  
pipe network as well as for connection within the pipe network made of  
steel pipes. With arrangement, dimensioning and installation of  
pipelines acc. to NFPA sprinkler guidelines. Pipelines DN 25 up to DN  
200 acc. to DIN 10 220 in welded make as well as pipe grooved  
couplings.

Black steel pipe with cover coat RAL 3000 or galvanized, if galvanized  
each fitting must be colored RAL 3000.

complete delivery and installation

**18.2.140. Pipeline DN 150**  
same as described above

complete delivery and installation

**18.2.150. Pipeline DN 100**  
same as described above

complete delivery and installation

**18.2.160. Pipeline DN 80**  
same as described above

complete delivery and installation

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- 18.2.170. Pipeline DN 65**  
same as described above  
  
complete delivery and installation
- 18.2.180. Pipeline DN 50**  
same as described above  
  
complete delivery and installation
- 18.2.190. Pipeline DN 32**  
same as described above  
  
complete delivery and installation
- 18.2.200. Pipeline DN 25**  
same as described above  
  
complete delivery and installation
- 18.2.210. Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 20  
max. 2 fittings, galvanized  
1 pipe piece lmax. 5.0 m  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.2.220. Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 50  
max. 1 fitting, galvanized  
1 pipe piece lmax. 1.5 m  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.2.230. Pipe elbow DN 150, cover coat RAL 3000 or galvanized**  
for steel pipe DN 125, DIN EN 10 220, grooved on both sides, incl. two  
removable pipe couplings as well as all required seals and screws

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.240. Pipe elbow DN 80, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80, DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.250. Pipe elbow DN 50, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50, DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.260. Pipe elbow DN 32, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 32, DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.270. Pipe elbow DN 25, 90°, cover coat RAL 3000 or galvanized**  
for steel pipe DN 25, R 1" with interior thread  
DIN EN 10 255/10 220 incl. sealing material

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.280. Reduction DN 200/150, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200 to steel pipe DN 150, DIN EN 10 220,

incl. two removable pipe couplings as well as all required seals and screws

cover coat RAL 3000 or galvanized

complete delivery and installation



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**18.2.290.** **Reduction DN 150/100, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 150 to steel pipe  
DN 100

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.300.** **Reduction DN 100/80, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 100 to steel pipe  
DN 80

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.310.** **Reduction DN 80/65, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80 to steel pipe  
DN 65

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.320.** **Reduction DN 80/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80 to steel pipe  
DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.330.** **Reduction DN 65/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 65 to steel pipe  
DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.340.** **Reduction DN 50/32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50 to steel pipe  
DN 32

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.350. Reduction DN 32/25, galvanized**  
for steel pipe DN 32, R 5/4" to steel pipe DN 25, R 1", DIN EN  
10 255/10 220,

incl. two removable pipe couplings as well as all required seals and  
screws

complete delivery and installation

**18.2.360. T-piece DN 200, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200, DIN EN 10 220, grooved on all sides

incl. two removable pipe couplings as well as all required seals and  
screws

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.370. T-piece DN 150, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 125

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.380. T-piece DN 80, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.2.390. T-piece DN 50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

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- 18.2.400.** **T-piece DN 32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 32  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.2.410.** **Identification signs 100 x 60 mm**  
consisting of:  
universal holder, base panel colored, one, two or three lines, with standard or special lettering, engraved and lightfast, exchangeable strips, acc. to direction of Contracting Agency, incl. transparent covering,  
  
complete delivery and installation
- 18.2.420.** **Direction arrows**  
for gluing on media lines, in permanent make. Color, lettering and accomplishment acc. to directions of Contracting Agency,  
  
complete delivery and installation
- 18.2.430.** **Protective basket**  
for protection against mechanical influences; for hanging and standing sprinklers  
surface: chromium-plated  
  
complete delivery and installation
- 18.2.440.** **Pressure test**  
Lump sum for the provision of devices, measurement facilities as well as all auxiliary and work agents for pressure test and flushing of stainless steel line.  
  
The flushing of pipe networks and provision of test protocols, also in partial sections shall be included for the pressure tests.  
  
The pressure test shall be accomplished with 1.5-fold rated pressure = PN x 1.5 for 24 hours. The supervisor shall be informed prior to pressure test. A measurement protocol shall be prepared and submitted.
- 18.2.450.** **Small iron parts**  
cover coat RAL 3000 or galvanized  
  
in shape of angle, flat, T-, U-iron, C-profile rails, angle brackets

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galvanized, for the fastening of pipelines, support scaffolds and pipe bridges, fixed points and large pipe fastenings;

delivery, processing e.g. screwing, doweling etc. installation. Incl. fastening material.

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**18.3.** **PST, ceiling protection; test area zone 1 and 2, installation height up to 7.0 m**

**18.3.10.** **Sprinkler UL/FM/VdS etc. listed, standing, exposed pipe, 68°C/12 mm**

Response temperature: 68°C glass bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12 mm/min  
Installation height max.: 7.0 m  
For component: operation and feeding passage

complete delivery and installation

**18.3.20.** **Sprinkler UL/FM/VdS, standing, exposed pipe, 93°C/24 mm**

Response temperature: 93°C glass bulb  
Connection thread: R 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 24 mm/min  
Installation height max.: 7 m  
For component: test stands with cell and pit

complete delivery and installation

**18.3.30.** **Sprinkler UL/FM/VdS, hanging, concealed pipe, 68°C/12 mm, chromium plated**

Response temperature: 68°C glass bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12 mm/min  
Installation height max.: 2.0 m  
For component: false floor

complete delivery and installation

**18.3.40.** **Bend or 1" single**

return bend arrangements including all Fittings, pipes and escutcheonplates complete delivery and installation

**18.3.50.** **Riser or drops pipe and/or downspout 1" - short**

lmax. = 500 mm

complete delivery and installation

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- 18.3.60. Riser or drops pipe and/or downspout 1" - long**  
lmax. = 1000 mm  
  
complete delivery and installation
- 18.3.70. Drainage and/or ventilation DN 25**  
with appropriate pipelines DN 25 DIN EN 10 2550, in screwed make up to a length of 5 m incl. bracket fastenings, one-time protective paint coat and 1 identification sign  
  
complete delivery and installation
- 18.3.80. Flushing connection DN 32**  
incl. pipe nipple, ball cock and plug  
  
complete delivery and installation
- 18.3.90. Test connection sprinkler system**  
(Accord. NFPA 13) with appropriate pipelines DN 25 DIN EN 10 255 in screwed make up to a length of 5 m, incl. ball cock, manometer and holding devices, one-time protective paint coat and 1 identification sign  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.3.100. \*\*\* Item N/A**
- 18.3.110. Grading DN 25 - DN 50**  
Main and distributor lines  
  
consisting of:  
2 pipe elbows, galvanized  
4 pipe couplings  
1 pipe piece lmax.: 1.0 m  
  
complete delivery and installation
- 18.3.120. Grading for DN 40 - DN 80**  
Main and distribution lines  
  
consisting of:  
4 elbows, grooved on both sides, incl. two removable pipe couplings  
as well as all required seals and screws

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3 pipe pieces lmax.: 1.0 m  
complete delivery and installation

**18.3.130. Grading for DN 100 - DN 150**  
same as described above

complete delivery and installation

**18.3.140. Pipeline DN 200, installation height 5 m**  
as main and distributor line for connection between sprinkler center and sprinkler pipe network as well as for connection within the pipe network made of steel pipes. With arrangement, dimensioning and installation of pipelines acc. to NFPA sprinkler guidelines. Pipelines DN 25 up to DN 200 acc. to DIN 10 220 in welded make as well as pipe grooved couplings.  
Black steel pipe with cover coat RAL 3000 or galvanized, if galvanized each fitting must be colored RAL 3000

Corrosion protection pipelines:  
shot-blasted and powder coated.

for steel pipe DN 200, grooved on both sides, incl. two removable pipe couplings as well as all required seals and screws

cover coat RAL 3000

complete delivery and installation

**18.3.150. Pipeline DN 150**  
same as described above

complete delivery and installation

**18.3.160. Pipeline DN 100**  
same as described above

complete delivery and installation

**18.3.170. Pipeline DN 80**  
same as described above

complete delivery and installation

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- 18.3.180. Pipeline DN 65**  
same as described above  
  
complete delivery and installation
- 18.3.190. Pipeline DN 50**  
same as described above  
  
complete delivery and installation
- 18.3.200. Pipeline DN 40**  
same as described above  
  
complete delivery and installation
- 18.3.210. Pipeline DN 32**  
same as described above  
  
complete delivery and installation
- 18.3.220. Pipeline DN 25**  
same as described above  
  
complete delivery and installation
- 18.3.230. Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 20  
max. 2 fittings, galvanized  
1 pipe piece lmax. 5.0 m  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.3.240. Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 20  
max. 2 fittings, galvanized  
1 pipe piece lmax. 1.5 m  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation



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- 18.3.250. Riser pipe DN 32, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 25  
max. 2 fittings, galvanized  
1 pipe piece lmax. 5 m
- cover coat RAL 3000 or galvanized
- complete delivery and installation
- 18.3.260. Riser pipe DN 32, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 25  
max. 2 fittings, galvanized  
1 pipe piece lmax. 1.5 m
- cover coat RAL 3000 or galvanized
- complete delivery and installation
- 18.3.270. Pipe elbow DN 200, 90°, cover coat RAL 300 0 or galvanized**  
for steel pipe DN 200, DIN EN 10 220, grooved on both sides, incl. two  
removable pipe couplings as well as all required seals and screws
- cover coat RAL 3000 or galvanized
- complete delivery and installation
- 18.3.280. Pipe elbow DN 150, 90°, cover coat RAL 300 0 or galvanized**  
same as described above, however, for steel pipe DN 150  
DIN EN 10 255
- cover coat RAL 3000 or galvanized
- complete delivery and installation
- 18.3.290. Pipe elbow DN 100, 90°, cover coat RAL 300 0 or galvanized**  
as described above, however, for steel pipe DN 100,  
DIN EN 10 255
- cover coat RAL 3000 or galvanized
- complete delivery and installation

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**18.3.300.** **Pipe elbow DN 80, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80,  
DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.310.** **Pipe elbow DN 65, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 65,  
DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.320.** **Pipe elbow DN 50, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50,  
DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.330.** **Pipe elbow DN 32, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 32,  
DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.340.** **Pipe elbow DN 32, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 32,  
DIN EN 10 255,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.350.** **Pipe elbow DN 25, 90°, cover coat RAL 3000 or galvanized**  
for steel pipe DN 25, R 1" with interior thread  
DIN EN 10 255/10 220 incl. sealing material

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.360. Reduction DN 200/150, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200 to steel pipe DN 150, DIN EN 10 220,

incl. two removable pipe couplings as well as all required seals and screws

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.370. Reduction DN 150/100, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 150 to steel pipe DN 100

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.380. Reduction DN 100/80, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 100 to steel pipe DN 80

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.390. Reduction DN 80/65, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80 to steel pipe DN 65

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.400. Reduction DN 80/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80 to steel pipe DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

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**18.3.410.** **Reduction DN 65/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 65 to steel pipe  
DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.420.** **Reduction DN 50/32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50 to steel pipe  
DN 32

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.430.** **Reduction DN 50/40, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50 to steel pipe  
DN 40

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.440.** **Reduction DN 40/32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 40 to steel pipe  
DN 32

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.450.** **Reduction DN 32/25**  
for steel pipe DN 32, R 5/4" to steel pipe DN 25, R 1", DIN EN  
10 255/10 220,

incl. two removable pipe couplings as well as all required seals and  
screws

complete delivery and installation

**18.3.460.** **T-piece DN 200, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200, DIN 2448 or 2458, grooved on all sides

incl. two removable pipe couplings as well as all required seals and  
screws

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.470. T-piece DN 150, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 150

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.480. T-piece DN 100, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 100

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.490. T-piece DN 80, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.500. T-piece DN 65, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 65

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.510. T-piece DN 50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.520. T-piece DN 40, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 40

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.530. T-piece DN 32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 32

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.540. T-piece DN 25, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 25

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.3.550. Cover plate**  
for decorative covering of hanging sprinklers in suspended ceiling, in plastic white

complete delivery and installation

**18.3.560. Identification signs 100 x 60 mm**  
consisting of:  
universal holder, base panel colored, one, two or three lines, with standard or special lettering, engraved and lightfast, exchangeable strips, acc. to direction of Contracting Agency, incl. transparent covering,

complete delivery and installation

**18.3.570. Direction arrows**  
for gluing on media lines, in permanent make. Color, lettering and accomplishment acc. to directions of Contracting Agency,

complete delivery and installation

**18.3.580. Protective basket**  
for protection against mechanical influences; for hanging and standing sprinklers  
surface: chromium-plated

complete delivery and installation

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**18.3.590. Pressure test**

Lump sum for the provision of devices, measurement facilities as well as all auxiliary and work agents for pressure test and flushing of stainless steel line.

The flushing of pipe networks and provision of test protocols, also in partial sections shall be included for the pressure tests.

The pressure test shall be accomplished with 1.5-fold rated pressure = PN x 1.5 for 24 hours. The supervisor shall be informed prior to pressure test. A measurement protocol shall be prepared and submitted.

**18.3.600. Small iron parts**

cover coat RAL 3000 or galvanized

in shape of angle, flat, T-, U-iron, C-profile rails, angle brackets galvanized, for the fastening of pipelines, support scaffolds and pipe bridges, fixed points and large pipe fastenings;

delivery, processing e.g. screwing, doweling etc. installation. Incl. fastening material.

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**18.4.** **1st floor, ceiling protection; zone 3 and 4, up to 9.0 m**

**18.4.10. Sprinkler, standing, exposed pipe, 68°C/32 mm**  
Response temperature: 68°C glas bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 32 mm/min  
Installation height max.: 9.0 m  
For component: ceiling protection, zone 3 and 4  
motor components

complete delivery and installation

**18.4.20. Sprinkler, standing, exposed pipe, 68°C/12 mm**  
Response temperature: 68°C glas bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12 mm/min  
Installation height max.: 9.0 m  
For component: ceiling protection, zone 3 and 4

complete delivery and installation

**18.4.30. Sprinkler, hanging, concealed pipe, 68°C/12 mm, chromium plated**  
Response temperature: 68°C glas bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12.0 mm/min  
Installation height max.: 5.0 m  
For component: suspended ceilings

complete delivery and installation

**18.4.40. Bend 1" single**  
return bend arrangements including all fittings, pipes and  
esutcheon plates

complete delivery and installation

**18.4.50. Riser or drops pipe and/or downspout 1" - short**  
lmax. = 500 mm

complete delivery and installation



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- 18.4.60. Riser or drops pipe and/or downspout 1" - long**  
lmax. = 1000 mm  
  
complete delivery and installation
- 18.4.70. Drainage and/or ventilation DN 25**  
with appropriate pipelines DN 25 DIN EN 10 2550, in screwed make up to a length of 5 m incl. bracket fastenings, one-time protective paint coat and 1 identification sign  
  
complete delivery and installation
- 18.4.80. Flushing connection DN 25**  
incl. pipe nipple, ball cock and plug  
  
complete delivery and installation
- 18.4.90. Test connection sprinkler system**  
(Accord. NFPA 13) with appropriate pipelines DN 25 DIN EN 10 255 in screwed make up to a length of 5 m, incl. ball cock, manometer and holding devices, one-time protective paint coat and 1 identification sign  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.4.100. Grading DN 25 - DN 50**  
Main and distributor lines  
  
consisting of:  
2 pipe elbows, galvanized  
4 pipe couplings  
1 pipe piece lmax.: 1.0 m  
  
complete delivery and installation
- 18.4.110. Grading for DN 40 - DN 80**  
Main and distribution lines  
  
consisting of:  
4 elbows, grooved on both sides, incl. two removable pipe couplings as well as all required seals and screws  
3 pipe pieces lmax.: 1.0 m  
  
complete delivery and installation

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**18.4.120. Grading for DN 100 - DN 150**

same as described above

complete delivery and installation

**18.4.130. Pipeline DN 200, installation height 5 m**

as main line for connection between sprinkler distribution and sprinkler pipe network as well as for connection within the pipe network made of steel pipes. With arrangement, dimensioning and installation of pipelines acc. to NFPA sprinkler guidelines. Pipelines DN 25 up to DN 200 acc. to DIN 10 220 in welded make as well as pipe grooved couplings.

Black steel pipe with cover coat RAL 3000 or galvanized, if galvanized each fitting must be colored RAL 3000.

complete delivery and installation

Corrosion protection pipelines:  
shot-blasted and powder coated.

for steel pipe DN 200, grooved on both sides, incl. two removable pipe couplings as well as all required seals and screws

cover coat RAL 3000

complete delivery and installation

**18.4.140. Pipeline DN 150**

same as described above

complete delivery and installation

**18.4.150. Pipeline DN 100**

same as described above

complete delivery and installation

**18.4.160. Pipeline DN 80**

same as described above

complete delivery and installation

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- 18.4.170.** **Pipeline DN 65**  
same as described above  
  
complete delivery and installation
- 18.4.180.** **Pipeline DN 50**  
same as described above  
  
complete delivery and installation
- 18.4.190.** **Pipeline DN 32**  
same as described above  
  
complete delivery and installation
- 18.4.200.** **Pipeline DN 25**  
same as described above  
  
complete delivery and installation
- 18.4.210.** **Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 20  
max. 2 fittings, galvanized  
1 pipe piece lmax. 5.0 m  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.4.220.** **Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 20  
max. 1 fitting, galvanized  
1 pipe piece lmax. 1.5 m  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.4.230.** **Pipe elbow DN 150, 90°, cover coat RAL 300 0 or galvanized**  
for steel pipe DN 125, DIN EN 10 220, grooved on both sides,  
incl. two removable pipe couplings as well as all required seals  
and screws

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.240. Pipe elbow DN 80, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 80,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.250. Pipe elbow DN 50, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 50,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.260. Pipe elbow DN 32, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 32,

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.270. Pipe elbow DN 25, 90°, cover coat RAL 3000 or galvanized**  
for steel pipe DN 25, R 1" with interior thread  
DIN EN 10 255/10 220 incl. sealing material

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.280. Reduction DN 200/150, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200 to steel pipe DN 150, DIN EN 10 220,

incl. two removable pipe couplings as well as all required seals  
and screws

cover coat RAL 3000 or galvanized

complete delivery and installation

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**18.4.290.** **Reduction DN 150/100, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 150 to  
steel pipe DN 100

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.300.** **Reduction DN 100/80, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 100 to  
steel pipe DN 80

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.310.** **Reduction DN 80/65, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80 to  
steel pipe DN 65

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.320.** **Reduction DN 80/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80 to  
steel pipe DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.330.** **Reduction DN 65/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 65 to  
steel pipe DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.340.** **Reduction DN 50/32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50 to  
steel pipe DN 32

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.350. Reduction DN 32/25, galvanized**  
same as described above, however, for steel pipe DN 32, R 5/4"  
to steel pipe DN 25, R 1", DIN EN 10 255/10 220,

complete delivery and installation

**18.4.360. T-piece DN 200, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200, DIN 2448 or 2458, grooved on all sides

incl. two removable pipe couplings as well as all required seals  
and screws

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.370. T-piece DN 150, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 150

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.380. T-piece DN 100, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 100

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.390. T-piece DN 80, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.400. T-piece DN 50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.410. T-piece DN 32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 32

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.4.420. Identification signs 100 x 60 mm**  
consisting of:  
universal holder, base panel colored, one, two or three lines,  
with standard or special lettering, engraved and lightfast,  
exchangeable strips, acc. to direction of Contracting Agency,  
incl. transparent covering,

complete delivery and installation

**18.4.430. Direction arrows**  
for gluing on media lines, in permanent make. Color, lettering  
and accomplishment acc. to directions of Contracting Agency,

complete delivery and installation

**18.4.440. Protective basket**  
for protection against mechanical influences; for hanging and standing  
sprinklers  
surface: chromium-plated

complete delivery and installation

**18.4.450. Pressure test**  
Lump sum for the provision of devices, measurement facilities  
as well as all auxiliary and work agents for pressure test and  
flushing of stainless steel line.

The flushing of pipe networks and provision of test protocols,  
also in partial sections shall be included for the pressure tests.

The pressure test shall be accomplished with 1.5-fold rated  
pressure = PN x 1.5 for 24 hours. The supervisor shall be  
informed prior to pressure test. A measurement protocol shall  
be prepared and submitted.

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**18.4.460.** **Small iron parts**  
cover coat RAL 3000 or galvanized

in shape of angle, flat, T-, U-iron, C-profile rails, angle brackets  
galvanized, for the fastening of pipelines, support scaffolds and pipe  
bridges, fixed points and large pipe fastenings;

delivery, processing e.g. screwing, doweling etc. installation. Incl.  
fastening material.



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**18.5. 2nd floor, ceiling protection; zone 7 and 8, up to 5.0 m**

Glass bulb sprinkler  
Accomplishment for the sprinkler protection in frost-free rooms  
and  
acc. to UNI EN 12 845 latest edition.

Consisting of:  
corrosion resistant material with special lock,  
metal parts at standing and hanging sprinklers nickel-plated  
or chromium-plated

incl. sealing material

**18.5.10. Sprinkler, standing, exposed pipe, 68°C/12 mm**

Response temperature: 68°C glas bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12 mm/min  
Installation height max.: 5.0 m  
For component: ceiling protection, mechanical  
and adjoining rooms  
zone 7 and 8

complete delivery and installation

**18.5.20. Sprinkler, standing, exposed pipe, 68°C/12 mm**

Response temperature: 68°C glas bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12 mm/min  
Installation height max.: 1.0 m  
For component: false floor, zone 7 and 8

complete delivery and installation

**18.5.30. Sprinkler, hanging, concealed pipe, 68°C/12 mm, chromium plated**

Response temperature: 68°C glas bulb  
Connection thread: R 1/2" or 3/4"  
RTI > 50  
RTI < 80  
spec. water capacity: 12.0 mm/min  
Installation height max.: 5.0 m  
For component: suspended ceilings

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adjoining rooms zone 7 and 8

complete delivery and installation

**18.5.40. Open nozzle, DN 20**

Installation position hanging,  
installation location is the waste gas pipeline DN 200

Material is made of brass, with exterior thread R 3/4"  
work pressure between 0.5 and 15 bar

complete delivery and installation

**18.5.50. Sprinkler rebounding plates**

for protection of sprinkler against wetting and cooling at  
installation layers arranged one upon the other

complete delivery and installation

**18.5.60. Bend 1" single**

return bend arrangements including all fittings, pipes and  
escutcheon plates

complete delivery and installation

**18.5.70. Riser or drops pipe and/or downspout 1" - short**

lmax. = 500 mm

complete delivery and installation

**18.5.80. Riser or drops pipe and/or downspout 1" - long**

lmax. = 1000 mm

complete delivery and installation

**18.5.90. Drainage and/or ventilation DN 25**

with appropriate pipelines DN 25 DIN EN 10 2550, in screwed  
make up to a length of 5 m incl. bracket fastenings, one-time  
protective paint coat and identification sign

complete delivery and installation

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- 18.5.100. Sleeve sliding valve, DN 25**  
Casing made of brass  
handwheel made of zinc die-cast, red coated  
interior thread R 1", PN 16, as shut-off for manual release  
to waste gas line  
  
complete delivery and installation
- 18.5.110. Mud trap, DN 25**  
As stone trap for installation in pipelines, filter casing hanging  
towards bottom at each installation location  
casing made of red brass  
mesh width 1 mm  
interior thread R 1", PN 16  
  
complete delivery and installation
- 18.5.120. Flushing connection DN 25**  
incl. pipe nipple, ball cock and plug  
  
complete delivery and installation
- 18.5.130. Test connection sprinkler system**  
(Accord. NFPA 13) with appropriate pipelines DN 25 DIN EN 10 255 in  
screwed make up to a length of 5 m, incl. ball cock, manometer and  
holding devices, one-time protective paint coat and 1 identification sign  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.140. Grading DN 25 - DN 50**  
Main and distributor lines  
  
consisting of:  
4 pipe elbows, galvanized  
3 pipe pieces lmax.: 1.0 m  
  
complete delivery and installation
- 18.5.150. Grading for DN 40 - DN 80**  
Main and distribution lines  
  
consisting of:  
4 elbows, grooved on both sides, incl. two removable pipe  
couplings as well as all required seals and screws

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3 pipe pieces lmax.: 1.0 m  
complete delivery and installation

**18.5.160. Grading for DN 150 - DN 200**  
same as described above

complete delivery and installation

**18.5.170. Pipeline DN 200, installation height 5 m**  
as main and distributor line for connection between sprinkler center and sprinkler pipe network as well as for connection within the pipe network made of steel pipes. With arrangement, dimensioning and installation of pipelines acc. to NFPA sprinkler guidelines. Pipelines DN 25 up to DN 200 acc. to DIN 10 220 in welded make as well as pipe grooved couplings

Black steel pipe with cover coat RAL 3000 or galvanized, if galvanized each fitting must be colored RAL 3000

Cover coat RAL 3000

complete delivery and installation

**18.5.180. Pipeline DN 150**  
same as described above

complete delivery and installation

**18.5.190. Pipeline DN 100**  
same as described above

complete delivery and installation

**18.5.200. Pipeline DN 65**  
same as described above

complete delivery and installation

**18.5.210. Pipeline DN 40**  
same as described above

complete delivery and installation

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- 18.5.220. Pipeline DN 50**  
same as described above  
  
complete delivery and installation
- 18.5.230. Pipeline DN 32**  
same as described above  
  
complete delivery and installation
- 18.5.240. Pipeline DN 25**  
same as described above  
  
complete delivery and installation
- 18.5.250. Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 20  
max. 2 fittings, galvanized  
1 pipe piece lmax. 5.0 m  
with groove on both sides incl. two removable pipe couplings  
as well as all seals and screws  
  
complete delivery and installation
- 18.5.260. Riser pipe DN 25, cover coat RAL 3000 or galvanized**  
consisting of:  
welded sleeves DN 20  
max. 1 fitting, galvanized  
1 pipe piece lmax. 1.5 m  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.270. Pipe elbow DN 200, 90°, cover coat RAL 300 0 or galvanized**  
for steel pipe DN 200, DIN EN 10220, grooved on both sides,  
incl. two removable pipe couplings as well as all required seals  
and screws  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation

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- 18.5.280.** **Pipe elbow DN 65, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 65,  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.290.** **Pipe elbow DN 50, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 50,  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.300.** **Pipe elbow DN 32, 90°, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 32,  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.310.** **Pipe elbow DN 25, 90°, cover coat RAL 3000 or galvanized**  
for steel pipe DN 25, R 1" with interior thread DIN EN 10 255  
incl. sealing material  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.320.** **Reduction DN 200/150, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200 to steel pipe DN 150, DIN EN 10220  
  
incl. two removable pipe couplings as well as all required seals  
and screws  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.330.** **Reduction DN 150/100, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 150 to  
steel pipe DN 125

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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.5.340. Reduction DN 100/80, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 100 to  
steel pipe DN 80

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.5.350. Reduction DN 80/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 80 to  
steel pipe DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.5.360. Reduction DN 65/50, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 65 to  
steel pipe DN 50

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.5.370. Reduction DN 50/40, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50 to  
steel pipe DN 40

cover coat RAL 3000 or galvanized

complete delivery and installation

**18.5.380. Reduction DN 50/32, cover coat RAL 3000 or galvanized**  
same as described above, however, for steel pipe DN 50 to  
steel pipe DN 32

cover coat RAL 3000 or galvanized

complete delivery and installation

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- 18.5.390.** **Reduction DN 32/25,**  
for steel pipe DN 32, R 5/4" to steel pipe DN 25, R 1", DIN EN 10 255,  
  
incl. two removable pipe couplings as well as all required seals and screws  
  
complete delivery and installation
- 18.5.400.** **T-piece DN 200, cover coat RAL 3000 or galvanized**  
for steel pipe DN 200, DIN EN 10 220, grooved on all sides  
  
incl. two removable pipe couplings as well as all required seals and screws  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.410.** **T-piece DN 100, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 100  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.420.** **T-piece DN 65, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 65  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.430.** **T-piece DN 50, cover coat RAL 3000 or galvanized**  
same as described above, however, DN 50  
  
cover coat RAL 3000 or galvanized  
  
complete delivery and installation
- 18.5.440.** **T-piece DN 25, cover coat RAL 3000 or galvanized**  
for pipelines acc. to DIN EN10 255 galvanized,  
with interior thread R 1"



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cover coat RAL 3000 or galvanized

complete delivery and installation

**18.5.450. Cover plate**  
for decorative covering of hanging sprinklers in suspended ceiling, in plastic white

complete delivery and installation

**18.5.460. Identification signs 100 x 60 mm**  
consisting of:  
universal holder, base panel colored, one, two or three lines, with standard or special lettering, engraved and lightfast, exchangeable strips, acc. to direction of Contracting Agency, incl. transparent covering,

complete delivery and installation

**18.5.470. Direction arrows**  
for gluing on media lines, in permanent make. Color, lettering and accomplishment acc. to directions of Contracting Agency,

complete delivery and installation

**18.5.480. Pressure test**  
Lump sum for the provision of devices, measurement facilities as well as all auxiliary and work agents for pressure test and flushing of stainless steel line.

The flushing of pipe networks and provision of test protocols, also in partial sections shall be included for the pressure tests.

The pressure test shall be accomplished with 1.5-fold rated pressure = PN x 1.5 for 24 hours. The supervisor shall be informed prior to pressure test. A measurement protocol shall be prepared and submitted.

**18.5.490. Protective basket**  
for protection against mechanical influences; for hanging and standing sprinklers  
surface: chromium-plated

complete delivery and installation

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- 18.5.500. Small iron parts**  
cover coat RAL 3000 or galvanized
- in shape of angle, flat, T-, U-iron, C-profile rails, angle brackets galvanized, for the fastening of pipelines, support scaffolds and pipe bridges, fixed points and large pipe fastenings;
- delivery, processing e.g. screwing, doweling etc. installation. Incl. fastening material.
- 18.5.510. certificazioni e documentazioni richieste dalla normativa P.E.D**  
Il costruttore, dovrà elaborare e rilasciare tutte le certificazioni e documentazioni richieste dalla normativa vigente e dalla normativa P.E.D. comprovate da verbali di prove di pressione, test sui materiali e sulle saldature il tutto certificato da un istituto ufficiale e autorizzato. La certificazione dovrà riguardare non solo i singoli componenti e attrezzature ma l'insieme costituente l'impianto oggetto di certificazione. (Si ricorda che tra i documenti ed elaborati che devono essere prodotti sono anche compresi la stress analysis e la risk analysis).

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**18.6. Overhead costs**

**18.6.10. Initial operation of complete system**

- The initial operation will be accomplished after completion of individual installation sections
- The date for initial operation shall be determined each to the time prior or during the installation phase, however, not later than 5 working days prior to total initial operation
- Instruction of operation personnel and turn-over

The initial operation costs include:

- Review and initial operation of system
- Personnel costs, incl. required measuring and test equipment
- Travel and charges
- Costs for required function measurement
- Costs for sound measurements

**18.6.20. Inspection with the property insurer and authorities**  
after completion and initial operation

The inspection shall be requested in time.  
The inspection certificate shall be submitted until total inspection by the authorities.  
All costs of inspection as well as secondary costs shall be included. The Contracting Agency and the supervisor shall be informed in time above the inspection date.

**18.6.30. Engineering performance acc. GM, NFPA and GAPS**  
including drawings for pre acceptance by GAPS, installation drawings, hydraulic calculations, as-built drawings, revicer of inventory, participation at meetings etc.

Complete planning with

1. providing necessary documents as:
  - survey of situation
  - installation drawings
  - hydraulic pipeline calculations
  - detail drawings
  - breaching drawings
  - accounting drawings
  - as-built drawings (revised)
  - documentation
  - operation instructions
  - maintenance instructions
  - supervision of flushing and pressure festing
  - see following
2. participation at:

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- construction meetings
- coordination meetings
- site walks

Minor plan revisions must be included in calculations.

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### System description fire alarm system

The fire alarm system for the test building will be requested in the following service description. It is in connection with the fire alarm center of residual building:

The system will be constructed area-wide. Optical smoke detectors, thermal differential and flame detectors will be used. Non-automatic manual detectors are installed at the exits. Alarm horns and flash lamps will alarm the personnel. A retransmission will be accomplished only to the central indicating board on 1st floor. Flame detectors and thermal differential detectors in one-detector-dependence are switched in test stands. No extinguishing will be released. The alarms will be processed further via safety matrix. The appropriate potential-free contacts shall be provided for this.

**19. Fire alarm center**

**19.1. Fire alarm center and accessories**

**19.1.10. Fire alarm center+**

with microprocessor supported system technology

with free programmable BUS-system, ring line operation. The center shall correspond to the requirements acc. to EN as well as guidelines of local authorities and be approved as system.

Following characteristics are required:

- ring line operation BUS system
- optical operator guidance
- clear text display of incoming messages
- internal registration facility of all procedures on protocol printer, memory of last 500 events
- connection of an offset operation unit and clear text indicating board
- serial interface
- one-man inspection with cut-off bridging

Extension of center with following functions:

- main detector plug-in unit (ÜE)
- alarm rings
- programmable detector groups with up to 32 automatic or 10 non-automatic detectors
- monitored control lines for cut-off of peripheral systems
- Fire Department operation panel acc. to local authority requirements
- monitored control line for release of evacuation alarm, control of alarm horns

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- control of a visualization system
- data interface cross-linking with 2nd building center

Automatic optical and acoustical display of:

- fire alarm
- wire break
- short circuit
- earth fault
- failure of power supply
- cut-off of external signal units
- central operation display

Network and battery supply for the fire alarm center and alarming facilities battery level with emergency power battery for 30 hours mains back-up. Complete unit ready to operate for erection in building, delivery and installation.

**19.1.15. Potential free contacts**

To distribute the alarm files of the fire alarm systems to the other switch cabinet described in the security matrix. In the fire alarm central station are to install to each alarm a 4-times potential free contact as opener or shutter. The switch cabinet must be able to distribute 50 contacts to the peripherie.

**19.1.20. Alert card provision**

Provision of alert cards for information for Fire Department. Details of alert cards shall be coordinated with the Fire Department.

Alert cards for placing in alert plan folder. Completely provided and printed on basis of provided alarm structure.

Complete delivery and installation.

**19.1.30. Offset display and operation panel fire alarm system**

for offset operation of fire alarm center,  
- microprocessor controlled system technology  
- display of operation conditions fire alarm center  
- access operation via key switch and locking cylinder acc. to direction of Contracting Agency  
- interface for connection to fire alarm center  
- surface mounted casing  
estimated dimensions:  
w: ..... mm  
d: ..... mm

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h: ..... mm

Wall installation on 1st floor.

**19.1.40. Manual fire detector**

for manual immediate release of a fire alarm or hazard alarm.

The detector is planned for the use in dry and wet rooms.

The manual fire detector corresponds to EN 54 part 11.

Lettering: "Fire Department"

The detector casing consists of red Makrolon plastic and protects the detector insert acc. to EN 60529 against dust penetration and splash water.

Connection to ring bus technology. Single addressing.

LED display of alarm release.

The detector door will be opened with a key for exchange of pane. The knob will be reset at closing of door for reprovision of operation standby.

Incl. integrated short-circuit separator.

**19.1.50. Optical smoke detector**

For a wide utilization range. The detector detects all fire types, the entire smoke spectrum and all open fires.

Opto-electronical sensor system with smoke quantity evaluation for optimized fire detection.

Automatic adjustment to changing surrounding conditions.

High failure resistance of digital data transmission by symmetric structure and securing mechanisms.

Automatic self-check of detector electronics.

Alarming secured by emergency redundancy.

Full function of all detectors at wire break and short-circuit by isolators in each element.

PC-supported start-up, parameterization and diagnosis

Remote diagnosis for error prophylaxis and high availability.

Automatic addressing of all loop elements for quick and safe start-up.

Electronics completely in detector, not in socket.

Simple exchange by turn-lock fastener.

Incl. detector socket and detector sign.

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Complete delivery, installation, connection ready to operate incl. all connection work.

**19.1.60. Smoke detector, optical as air duct detector**  
same as above, however, for monitoring in ventilation ducts

complete delivery and installation.

**19.1.70. Heat detector**  
For monitoring of rooms and systems where a quick temperature rise is to be expected at fire.

The detector measures the ambient temperature and temperature in detector casing. A quick temperature rise independently from start temperature can be differentially evaluated exactly.

The detector can be parameterized as thermal differential detector acc. to EN 54/5 class 1 or as high temperature thermal maximum detector.

Exact maximum temperature release at 80°C.

Automatic adjustment to changing surrounding conditions.

Safe alarm location interpretation and simple operation by freely assignable, organizational detector numbers.

Completely capsuled measuring sensor.

High failure resistance of digital data transmission by symmetric structure and securing mechanisms.

Automatic self-check of detector electronics.

Alarming secured by emergency redundancy.

Full function of all detectors at wire break and short-circuit by isolators in each element.

PC-supported start-up, parameterization and diagnosis

Remote diagnosis for error prophylaxis and high availability.

Automatic addressing of all loop elements.

Electronics completely in detector, not in socket.

Exchangeable by turn-lock fastener.



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Incl. detector socket, detector sign, bracket.

Complete delivery, installation, connection ready to operate incl. all connection work.

**19.1.80. Flame detector**

Fraud alarm safe measurement acc. to UV and IR principle.  
Evaluation of surface frequency and optical fiber length, above all fraud-proof in use at machines with turning spindles.

Automatic adjustment to changing surrounding conditions.

Safe alarm location interpretation and simple operation by freely assignable, organizational detector numbers.

Completely capsuled measuring sensor.

High failure resistance of digital data transmission by symmetric structure and securing mechanisms.

Automatic self-check of detector electronics.

Alarming secured by emergency redundancy.

Full function of all detectors at wire break and short-circuit by isolators in each element.

PC-supported start-up, parameterization and diagnosis

Remote diagnosis for error prophylaxis and high availability.

Automatic addressing of all loop elements.

Electronics completely in detector, not in socket.

Exchangeable by turn-lock fastener.

Incl. detector socket, detector sign, bracket.

Complete delivery, installation, connection ready to operate incl. all connection work.

**19.1.90. Detector display**

External detector display for connection to all fire detectors.

The external detector display will illuminate as soon as the assigned fire detector alarms. Also at service alarm.

The assignment is freely programmable via detector exit.

The display will be connected to next located detector.

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Plastic casing for surface mounted installation in dry and wet rooms.

Built-in fiber-optic conductor for good recognition also laterally.

Red circle on front side.

Complete delivery, installation, connection ready to operate incl. all connection work.

**19.1.100. Transponder / coupler**

Input/output component for connection of limit detectors, connection of special detectors and contacts to ring bus.

Monitored / not monitored controls of operation agents via ring bus, alarms of "RLÜ" center and special monitoring building (leakage detectors)

with monitored inputs/outputs.

The inputs/outputs are usable in any combination.

The control of outputs is free programmable; also bus comprehensive.

Quick and safe start-up by automatic addressing.

High failure resistance of digital data transmission by symmetric structure and securing mechanisms.

Automatic self-check of electronics.

Complete delivery, installation, connection ready to operate incl. all connection work.

**19.1.110. Warning sound siren**

Electronical warning sound siren in red plastic casing and completely grouted electronics, with 26 different sound frequencies, incl. sound acc. to EN 457 and ISO 8201 and base for wall and ceiling installation, for use in rooms and outside and rough surrounding.

Individual adjustment of loudness.

The siren can be synchronized for the use of several sirens in intermitting operation, incl. siren bottom part with PG screw connections at surface mounted cabling.

Complete delivery, installation, connection ready to operate incl. all connection work.

**19.1.120. Flash lamp**

Flash lamp for connection to hazard alarm systems, with red acrylic glass hood and long-life flash tube with high luminosity, suitable for wall and ceiling installation and use under rough surrounding.

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The impact resistant ABS plastic casing is prepared for the surface or flush mounted cable insertion.

Operation voltage: 18 up to 30 VDC  
Flash energy: 5 J  
Color: casing light gray RAL 7035,  
hood red  
Cable insertion: PG 11  
Air humidity, relative: 90 %  
Protective type: IP 55  
Power consumption: 230 mA  
Ambient temperature: -30° up to +55°C

Complete delivery, installation, connection ready to operate incl. all connection work.

**19.1.130. Detector identification**

with alarm line and detector number, Formica sign, round or square, base red, lettering white, fastening by gluing in the vicinity of detectors, visible installation to wall or ceiling at invisible detectors in appropriate location.

Selected size: 25 mm

Complete delivery and installation

**19.1.140. Initial operation**

Initial operation and inspection of fire alarm system incl. instruction of operation personnel and Fire Department. Fill in of hazard alarm sheets per detector group and obtaining of all required signatures.

**19.1.150. Subdistributor with 100 separation clamps**

consisting of:  
distributor boxes for surface mounted installation, sheet steel casing enameled (red), with sign "F", swiveling door (removal in open position)

- with installation panel and sheet steel profile rail TS 32, equipped with "WAGO" separation clamps LSA-PLUS

- with flange openings to all sides (acc. to requirement with blind flanges and cable insertion flanges incl. PG-screw connections)

- distributor with 100 separation clamps

- connection strips with pluggable identification strips

Protective type: IP 55

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completely with all accessories, delivery, installation, connection,  
identification of connections and distributors same as above.

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**19.2. Special services**

**19.2.10. Documentation**

1 set installation certificate, in duplicate, in approved shape, incl. all technical documents required for inspection  
1 set complete operation instruction, one of it installed well visible in fire alarm center acc. to regulation  
1 set installation drawings acc. to standard of system manufacturer with clear representation of system, accomplishment as paper copy, in triplicate, as blueprint, single  
switch drawings in EPLAN  
1 ea report portfolio, bound, for report keeping concerning weekly, monthly, quarterly, semi-yearly and all-year tests with appropriate check list sheets

complete submission and/or placing in fire alarm center.

**19.2.20. Maintenance contract fire alarm system**

A maintenance of the entire system shall be accomplished for the duration of guarantee. All material, maintenance hours, provision of scaffolds etc. required and anticipated for the guarantee duration shall be included in the costs.

**19.2.30. Inspection**

The system shall be inspected prior to connection



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Incl. integrated horn with release as soon as any channel reaches the 2nd limit value.

Visual (LED) indication for each measuring channel as soon as the 1st and/or 2nd limit value is exceeded. 1 acknowledgement module for horn shut-off with new value indication display deletion only if the limit values are under-run.

Modular extendability of the system to at least 60 channels must be ensured.

Mains and battery power supply with automatic change-over, failure alarm, charger, etc., battery level with emergency battery 24V DC to supply emergency power for a period of 4 hours.

Delivery and installation of the AMC as complete unit ready for use for installation inside the building.

**20.1.20. 4-fold change-over contact completely wired**  
increased or decreased price in case of installation into the Air Monitoring Central Station.

**20.1.30. Actuating element alarm plain text display**  
contact outputs have to be combined per alerting area and transmitted potential-free to the building automation and control system for activation of the alarm plain text display above the access doors. Differentiation between H2 / CH / CO acc. to the respective area.

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**20.2. Sensors, alarming and monitoring elements**

**20.2.1. Fees for legal experts and other inspections**

are demanded acc. to official and other requirements, incl. required function measurements and if not specified in the single items.

Discipline: Air Monitoring System

**20.2.10. \*\*\* Item N/A**

**20.2.20. CO-detector**

completely with mounting material incl. all required accessories.

Measuring range 0 - 200 ppm CO

**20.2.40. H2-detector, explosion-protected**

acc. to the diffusion principle completely with mounting material incl. all required accessories.

With ATEX-approval

Delivery and installation ready for use.

Measuring range 0 - 100 % UEG

**20.2.60. Electric horn 24 VDC**

for surface-mounted installation, bottom section made of die-cast aluminum, top section made of impact-resistant thermoplastics. Incl. fastening material for wall mounting, complete delivery and installation, with continuous tone or siren tone.

Sound pressure level: approx. 110 dB(A) at 1 m distance

Operation voltage: 24 VDC

**20.2.70. Horn Ex**

electric horn as described above, however, to be used in Zone 1 with ATEX-approval.

**20.2.90. Alarm flash light for CO/HC**

in the monitoring areas, for surface-mounted installation, in dry or moist rooms, sealed metal casing with attached colored spherical cap of impact-resistant thermoplastics, weather-resistant enameling, completely with fastening material.



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Operation voltage: 24 V-DC  
Flash frequency: 60/min  
Flash energy: 5 WS

**20.2.100. Alarm flash light Ex**  
as item above, however, for Zone 1 with ATEX-approval.

**20.2.110. Subdistributor with 25 isolating terminals**  
consisting of:  
Power panels for surface-mounted installation, enameled sheet steel casing (red), with sign "F", revolving door (removable in open position)

- with mounting plate and sheet steel profile rail TS 32, equipped with WAGO isolating terminals LSA-PLUS
- with flanged openings on all sides (if necessary with blind flanges and cable insertion flanges incl. PG-unions)
- distributor with 25 isolating terminals
- connection blocks with plug-type labeling strips

Protective type: IP 55  
Dimensions  
(W x H x D): 400 x 200 x 120

Complete delivery, installation and connection with all accessories, identification of connections and distributors as described above.

**20.2.120. Floor distributor with 100 isolating terminals**  
otherwise as item above.

**20.2.130. Commissioning of the complete system, Air Monitoring System**  
of the switch function extensions, training of the operation and maintenance personnel.

**20.2.140. Wiring of the system**  
Complete wiring between sensor, horn, flash lamps etc. and the AMC must be offered as a lump sum subject to the system standard. The supply line to the AMC will be provided on site acc. to the contractor's directions.

### **Raceway made of rigid PVC,**

for routing of lines on walls and ceilings. Completely with all required fittings, covers, incl. fastening material, color gray. The raceway must be labeled with "Air Monitoring System" at intervals of max. 3 m.

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**20.2.150.** Raceway - H/W = 20/20 mm

**20.2.160.** Raceway - H/W = 40/40 mm

**20.2.170. Documentation**

- 1 set of installation test, in duplicate, with all technical documents required for inspection
- 1 set of complete operation instructions, one mounted at an easily visible place in the AMC
- 1 set of installation drawings acc. to the standard of the system manufacturer with clear presentation of the system, provision as paper print in triplicate, one-fold as ST-print
- 1 ea report portfolio DIN A4, bound, for report keeping of weekly, monthly, quarterly, semi-annual or annual inspections with the appropriate check lists

Complete submittal and/or mounting in the AMC.

**20.2.180. Inspection fees**

demand acc. to official and other requirements, incl. required function measurements and if not specified in the single items.

**20.2.190. Expert inspection**

The system must be inspected by an expert prior to commissioning. For this purpose, the contractor has to arrange dates in coordination with the supervision that the system can be put into operation at the planned point of time.

The contractor has to assign skilled personnel for supervision during inspection.