

Data sheet for construction planning

for the electric equipment of 2-axle Vulcan EVO MD - 4WD 2x300/2x600 kW
(total power 400 / 750 kW)

+5°C to +45°C

Customer : **FORD USA**
Horiba order no : **S-2100680618-000010**

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1 Survey of electric assemblies

1.1 Place of installation, designation of location

Place of installation:

BR	= Operator room
PZ	= Test cell
MaR	= Machine room
SR	= Plant room

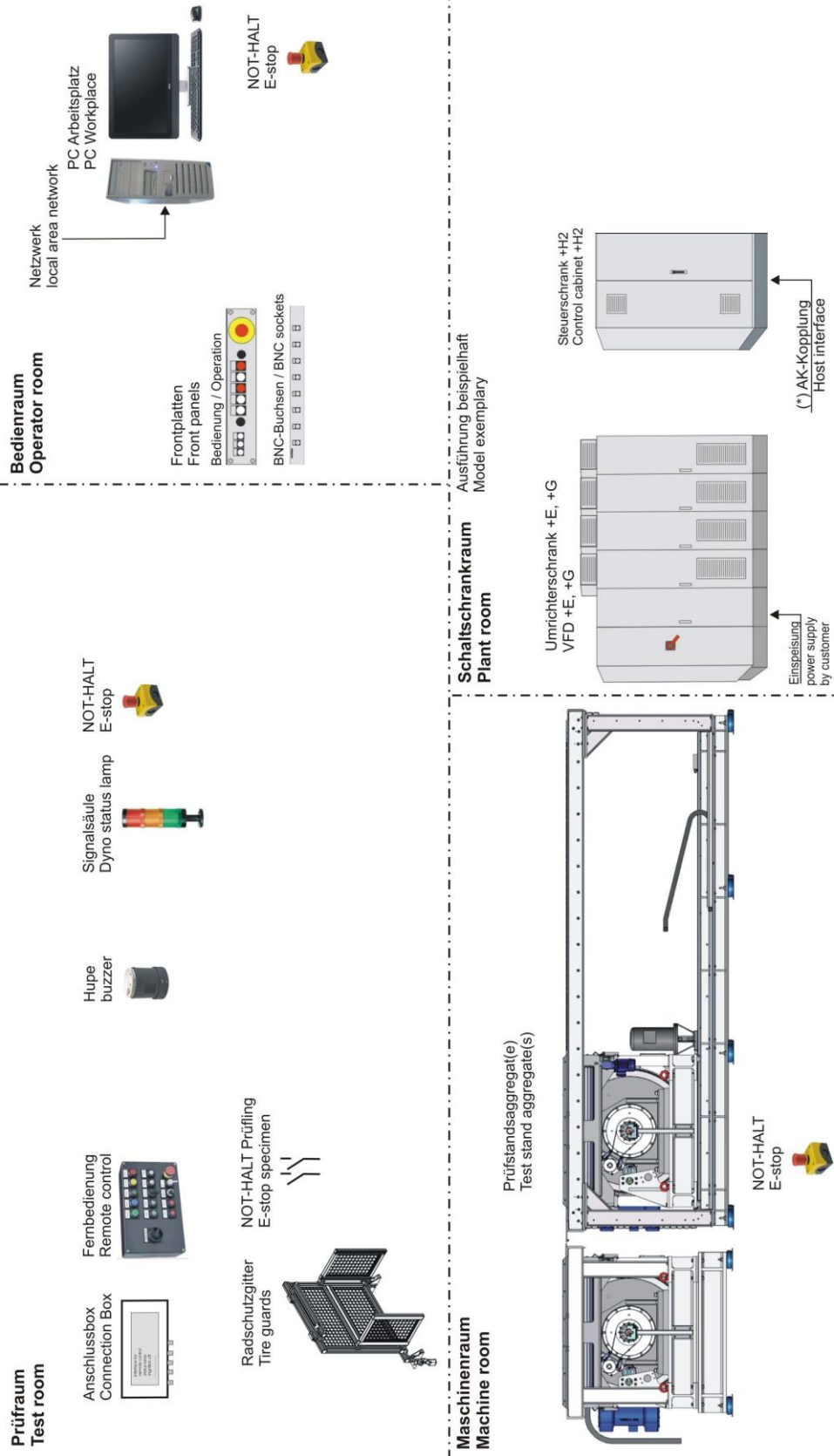
Designation of location:

+E..., +G..., +H...	= Cabinets in Equipment room
+R...	= Test stand assemblies in machine room
+W...	= Equipment in test cell
+Z...	= Equipment in operator room

Item no. code	Denomination	Place of installation
+E1, +G1, , +G12	Converter cabinets for drives	SR
+H2	Control cabinet	SR
+R1	Test stand assembly fixed axle (AC-machine and drum-set)	MaR
+R2	Test stand assembly movable axle (AC-machine and drum-set)	MaR
+X1	Emergency stop button in the pit	MaR
+W1	Safety circuit vehicle Remote control Tire guards Warning beacon or Dyno status unit Connection Box Extra emergency stop button Motorized roller covers	PZ
+Z1	PC, keyboard, mouse and monitor operating test stand. Front panel operation Emergency stop button (on the operator desk) Front panel 8x BNC sockets	BR

Layout of the 2-axle chassis dyno VULCAN EVO MD – 4WD

Anlagenübersicht Fahrzeugprüfstand System layout chassis dyno

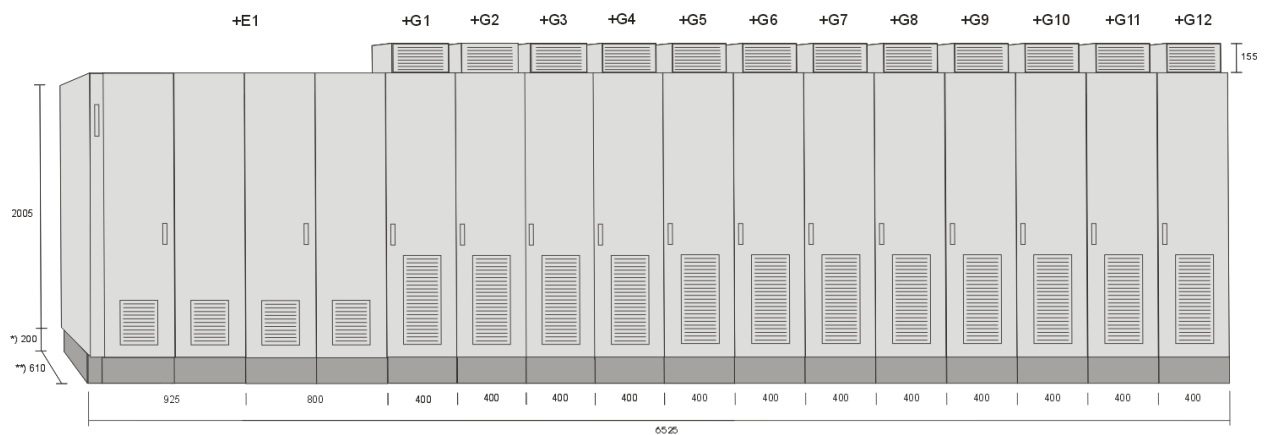


2 Data and ambient conditions for the cabinets

2.1 Drive cabinets +E1, +G1, ..., +G12

Converter cabinets for main drives

Dimensions:



Total dimensions (H x W x D): 2360 x 6525 x 610 [mm]

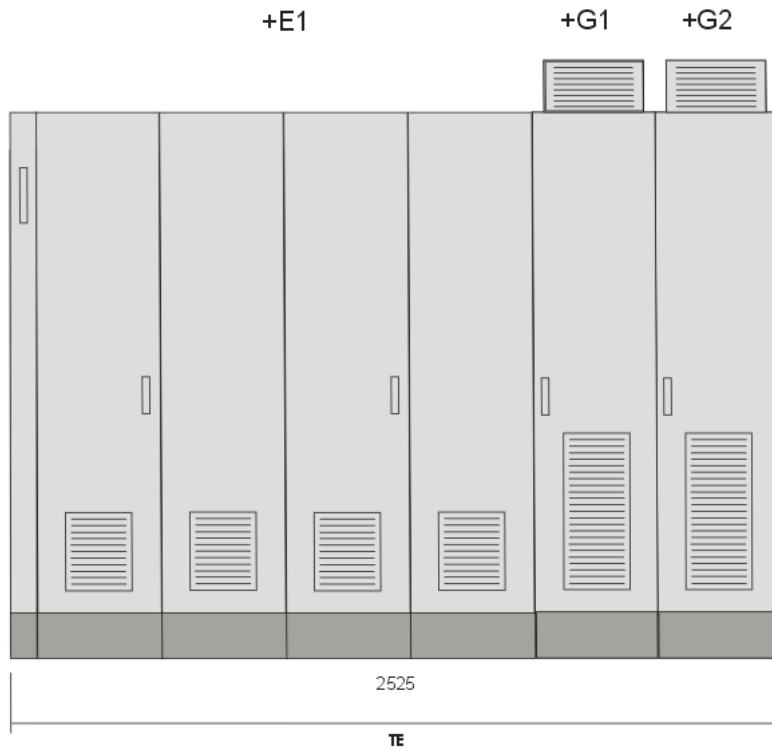
TE = transport unit

*) pedestal

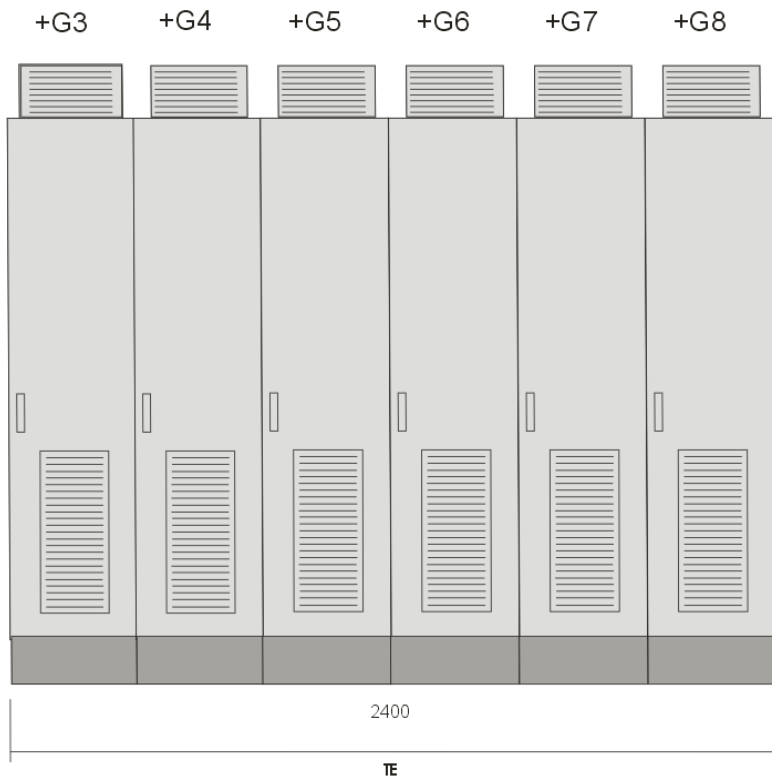
**) without handle, fan grill etc.

Transport units:

Transport unit 1



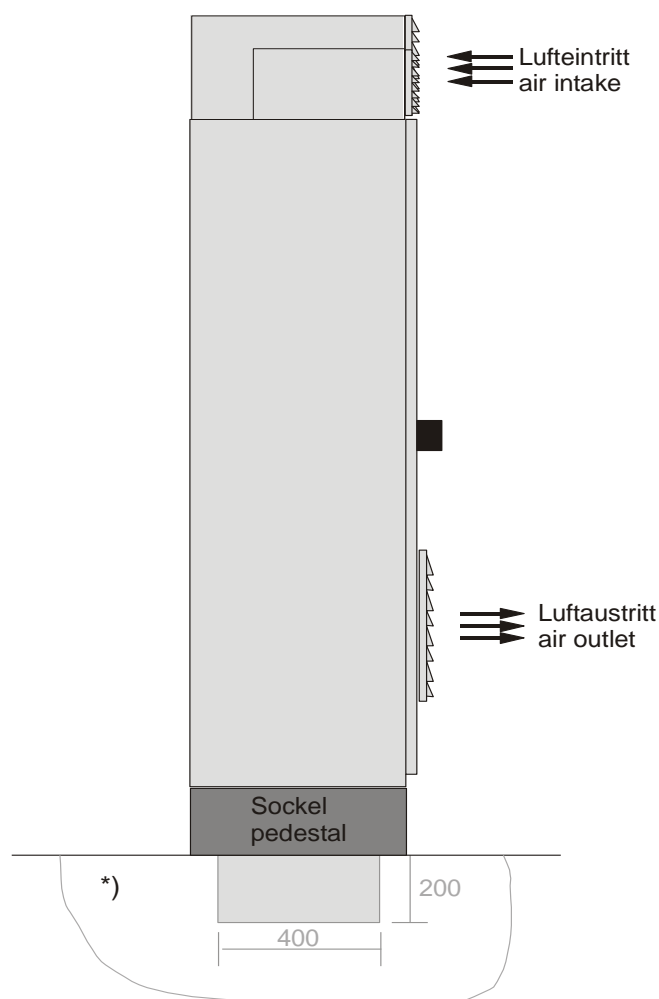
Transport unit 2



Transport unit 3



Installation:



*) If no pedestal is used, the cable duct should be provided in the floor.

Technical data:

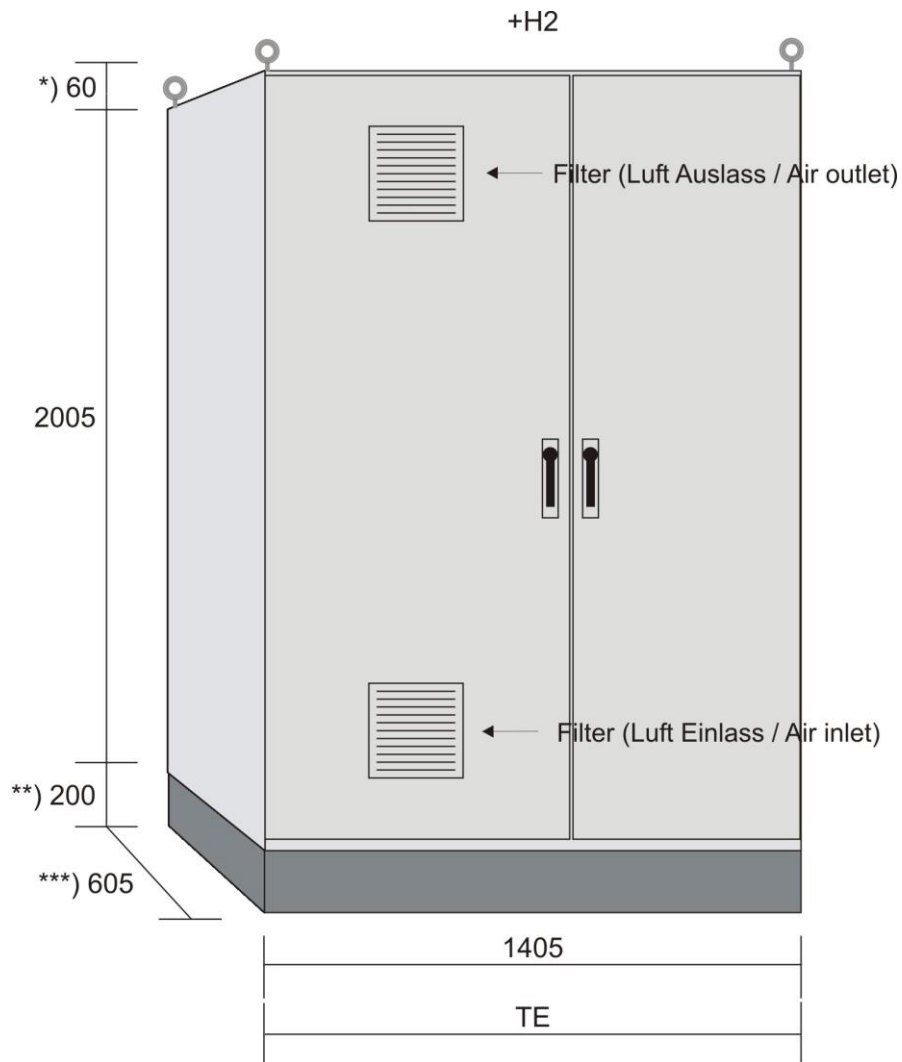
Heat dissipation at nominal power; total approx.	22 kW
Max. ambient temperature	+5 ... +40 °C
Relative air humidity max. (non-condensing)	95 %
Noise level approx.	≤ 75 dB(A)
Type of protection	IP21
Weight +E1,+G1, ,+G12 approx.	2000 kg
Painting	RAL7035

Cabinets can be placed directly in front of the wall.

Cable entry from the bottom or bottom back side or bottom left side.

2.2 Control cabinet +H2

Dimensions:



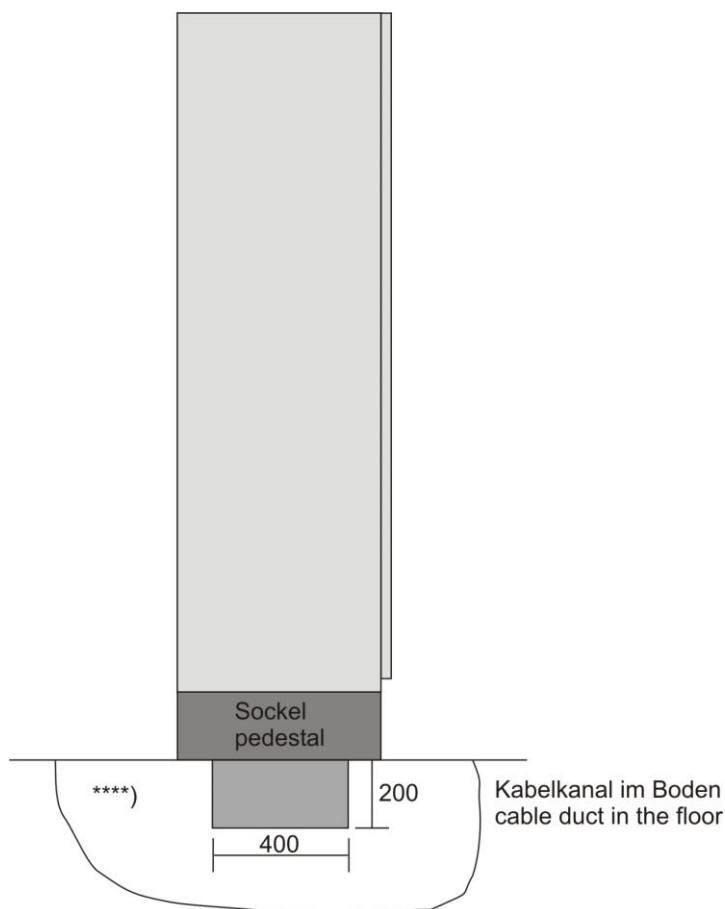
TE = transport unit

*) eyebolts resp. lifting bar can be unscrewed

**) pedestal

***) without handle, fan grill etc.

Installation:



****) If no pedestal is used, the cable duct should be provided in the floor.

Technical data:

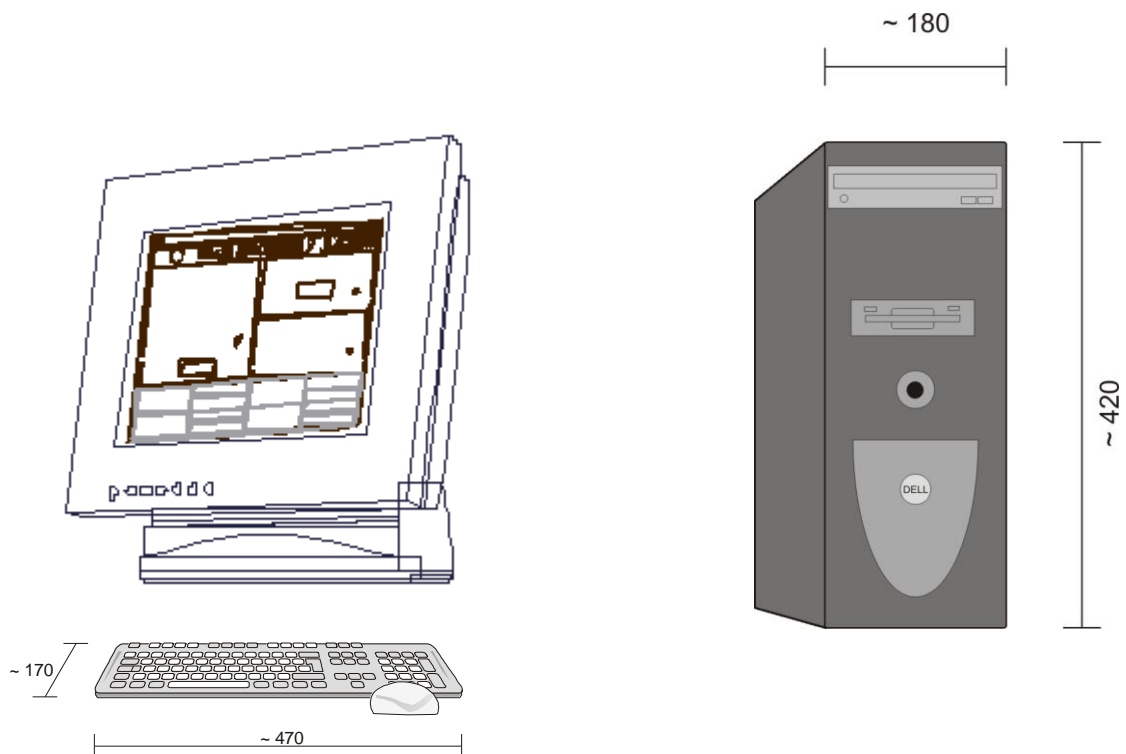
Heat dissipation approx.	1 kW
Max. ambient temperature	+5 ... +40 °C
Relative air humidity max. (non-condensing)	85 %
Type of protection	IP54
Weight +H2 approx.	400 kg
Painting	RAL7035

Cabinet can be placed directly in front of the wall (right side from the drive cabinets).
Cable entry from the bottom or bottom back side or bottom left side.

3 Operating of test stand

Operating of the test stand is enabled by a PC. A control desk has to be provided by customer, that features enough space for placing the following equipment:

- Operating-PC
- Keyboard
- Mouse
- Monitor



- Emergency stop button on the operator desk
Outer dimensions: 71,5 x 80 x 100 mm (WxHxD - red button included)



4 Desk console

for installation of 19" panels on top of a desk

Typically used for installation of an operation panel and optional panels e.g BNC analogue outputs

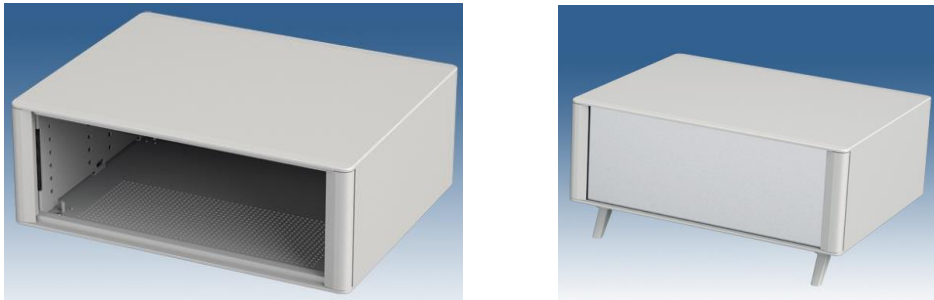


Figure 1: desk console w/o panels

Total dimensions (H x W x D): approx. 198 x 511 x 275 [mm]

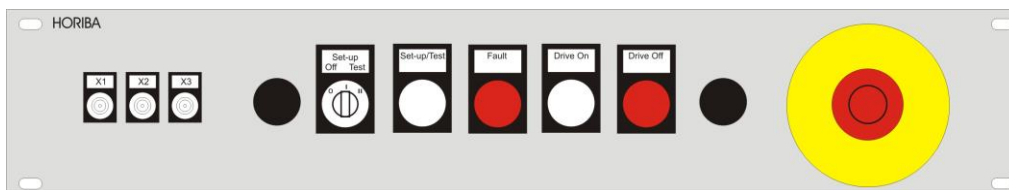


Figure 2: operator panel (2U)



Figure 3: BNC panel analogue out (1U)

5 Remote control

Installed at the support of the customer's driver's aid system in the test room



Figure 4: wall console w/o controls

Total dimensions (H x W x D): approx. 104 x 300 x 200 [mm]

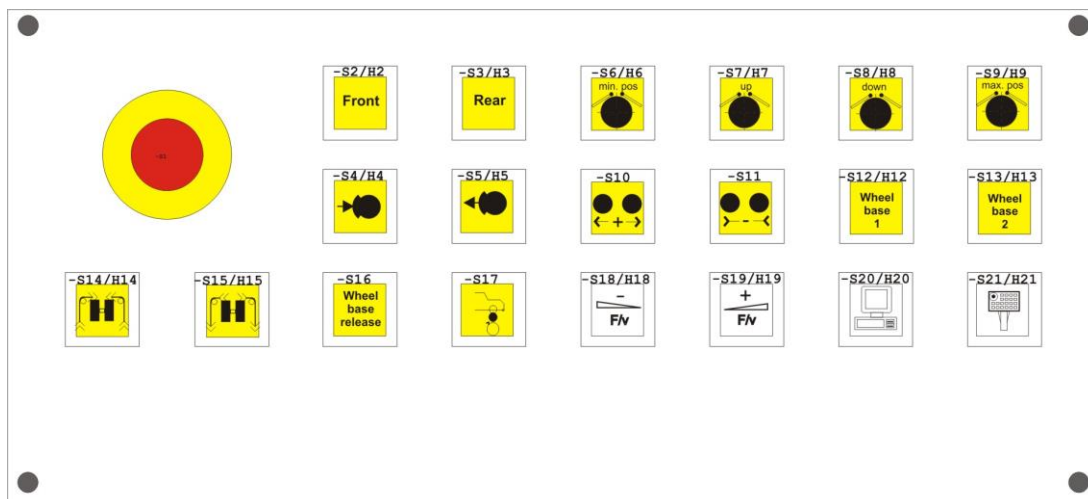
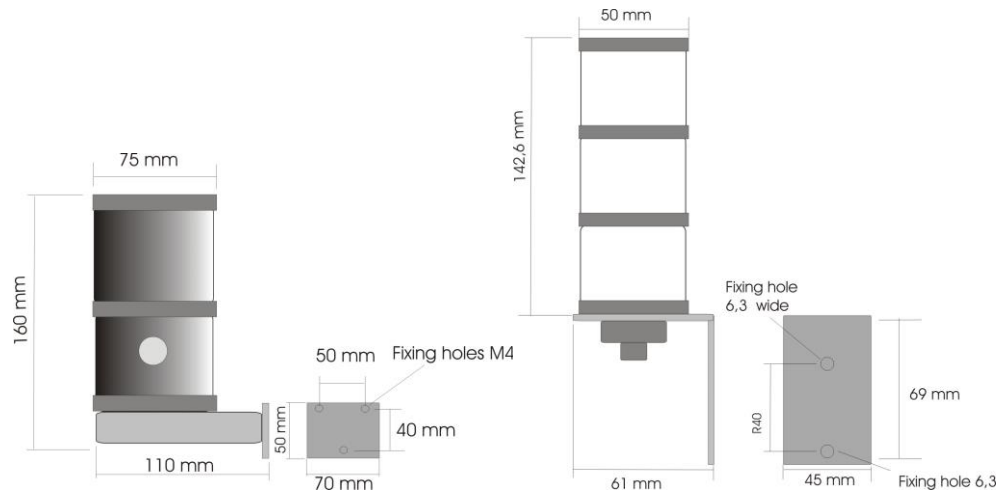


Figure 5: controls in panel

6 Buzzer and dyno status unit

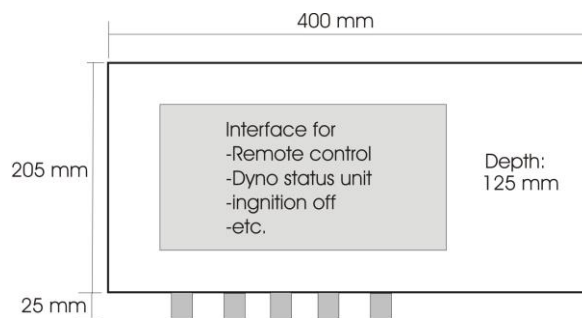
Installed in the test room.



7 Connection Box

Installed in the test room, mounted at the wall near the remote control.

Ambient temperature -20°C ... +45°C.



8 Emergency stop button in the test room

Installed with 10m cable in the test room. The emergency stop can be used in set-up mode all over the test room. In test mode it has to be taken into the vehicle.

Outer dimensions: 71,5 x 80 x 100 mm (WxHxD - red button included)



9 Emergency stop button in the pit

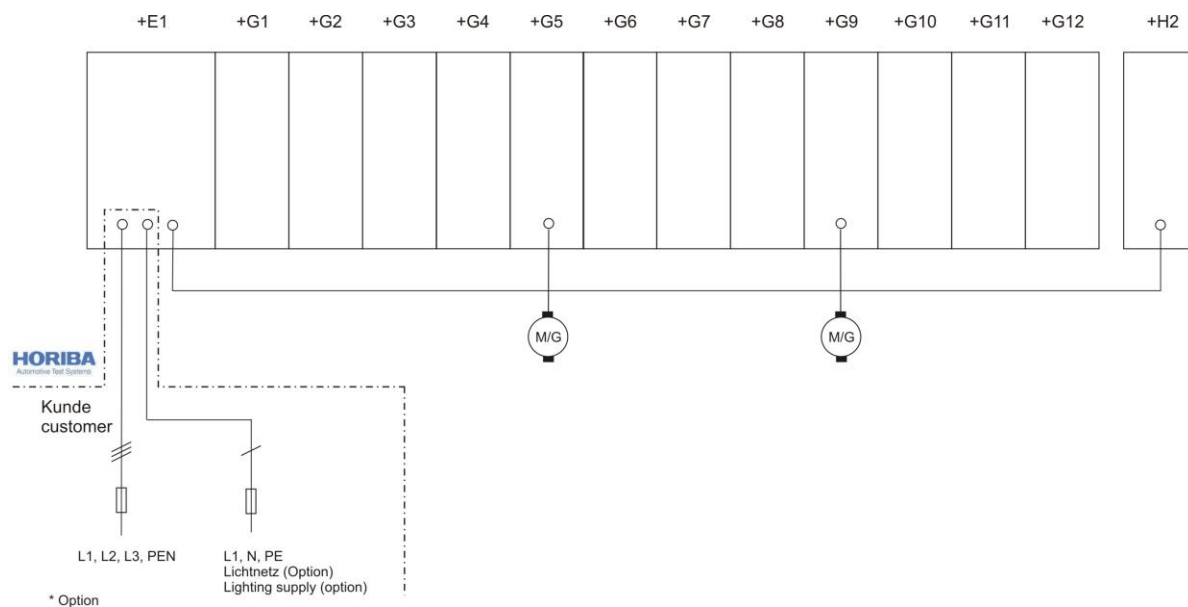
Installed in the pit.

Outer dimensions: 71,5 x 80 x 100 mm (WxHxD - red button included)



10 Mains supply data

10.1 Overview



10.2 Mains supply requirements, notes

Mains perturbation is significantly reduced by the line filter which is incorporated in the inverter. This eases designing of the network.

During installation and commissioning, the following must be paid attention to:

- The frequency inverter must be connected to an industrial mains meeting the requirements according to EN 61800-3 (VDE 0160) as well as to IEC 1000-2-4 (ambient class 3).
- At point of coupling (PC) an efficiency ratio of

$$R_{SCe} = \frac{S_{SC}}{S_N} = \frac{I_{SC}}{I_N} \geq 40$$

is required.

- In case further frequency converters shall be operated at the point of coupling, all converters have to be equipped with a power filter.
- The operation of one-phase consuming, especially measuring devices or switching power supply units, is not permissible.

We recommend to check back with Horiba ATS while network planning.
All the more if:

- the above mentioned conditions cannot be kept
- power converters or capacitor batteries shall be operated at the same point of coupling

The operation of other, non switching (i.e. no IGBT's or thyristors at mains side) three-phase consuming devices, for example directly connected ac-dynos for pumps or blowers, is possible.

S_{SC}	=	short circuit power at point of coupling, determined by mains impedance
S_N	=	total connected power (fundamental oscillation) of a single frequency converter
I_{SC}	=	short circuit current at point of coupling, determined by mains impedance
I_N	=	rated current (fundamental oscillation) of a single frequency converter
PC	=	Point of Coupling

Protective conductor cross section:

Machines and systems manufactured and delivered by Horiba ATS are operated with current-limiting effect which could result in permanent fault current. The customer/user/operator is therefore responsible for provision of a protective conductor with minimum cross section complying with the phase conductor, i.e. capacity/thickness of protective and phase conductors must be identical. Taking this measure prevents risk of dangerous electrical contact and fire hazard causing serious personal and/or material damage.

In Germany the operator of a facility using inverter and / or rectifier is legally obligated to these measures ("Maschinenrichtlinie", subject to regulation EN 50178 / VDE 0160).

Attention:

The ac-machine will be used as motor and also as generator. Therefore, power will be consumed and also be feedback in the power system by the rectifier. The customer should consult his power supplier for confirmation.

Power supply:

The mains connection (power supply) is made by the customer, since the cross-section of the connection depends on the company responsible for the electrical supply. The necessary auxiliary means (e.g. cable shoes) are provided by the customer. Voltage drop from connection point of the transformer to the point of delivery of the drive cabinet must not exceed 4%.

Residual current protective device:

If a residual current device cannot be dispensed with, universal current residual current devices (type B), also referred to as RCDs, must be used under all circumstances. These reliably detect even DC fault currents, pulsating DC fault currents and AC fault currents.

The mains filters and the capacitance of the motor cable and/or the motor winding generate a high leakage current, therefore a residual current protection device with increased trip current (e.g. 300 or 500 mA depending on national regulations) must be provided.

Maximum specific earth resistance:

In a system which conforms to relevant standards and is "safe" for humans, the protective device must trip as soon as the fault voltage in the system reaches a value which may potentially be hazardous for humans.

The permissible residual current devices do not operate until the fault current to earth reaches 300 or 500 mA, depending on national regulations. To ensure the safety of persons and property, the machine earthing system must have a resistance of less than 50 Ohm, i.e. $R_{\text{earth}} < 50 \text{ Ohm}$

From the point of view of electromagnetic compatibility (EMC), the specific earth resistance of the machine should be R_{earth} **less than 1 Ohm**. This will enable specified limits for electromagnetic compatibility to be observed and a high signal quality to be achieved.

To realise „good earthing“, the type of earthing device, type and resistance of the ground (specific earth resistance) and the resistance of the earth conductor must be taken into account.

Please note that the earth resistance (specific earth resistance) depends significantly on the properties of the ground, humidity and temperature (earth resistance increases in case of frost or under dry conditions).

Connection regulations:

According to the national regulations resp. the regulations of the electrical supplier.

10.3 Power supply S_N

Power supply data of the converter cabinet

Connected load S_N for the roller drives

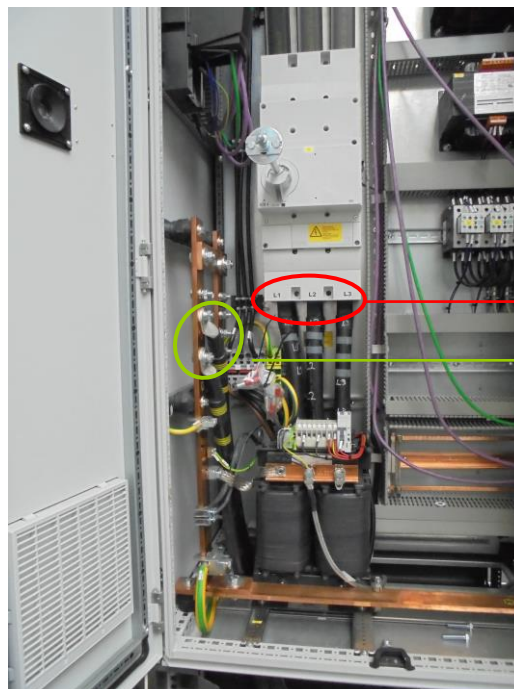
Mains voltage U_{Netz}	3/PEN/480 V AC
Max. mains voltage deviation	+ / - 10 %
Mains frequency f_{Netz}	60 Hz
Max. mains frequency deviation	± 1 %
Connected load S_N approx.	486 kVA
Overload 30/270s	885 kVA
Nominal current approx.	584 A
Overload current approx.	1064 A
Mains short circuit power S_K nominal	12,1 MVA
Mains short circuit power S_K overload	22,1 MVA
Backup fuse for overload operation	2 x (3 x 400) A (delay action)
Place of connection	Feed-bay +E1
Cable entry	From the bottom or bottom back side or bottom left side
Bolts for cable connection L1, L2, L3, PE each	2 x M16
Recommended cross section for supply cable	2 cables 4x240 mm ²
Min. cross section for PE-cable	2 cables 1x240 mm ²

10.4 Connection points in drive cabinet

Feed bay +E1 with open door:



Feed bay +E1 with open door. Connections for power-cable at main switch (top, L1, L2, L3) and PE-rail (bottom, PEN) are visible:



L1, L2, L3

PE

11 Asynchronous machine

11.1 Data / design

Asynchronous machine with external ventilator

Type of protection	IP 23
Braking effort on the shaft (nominal) approx.	each 300 kW
Braking effort on the shaft (overload) approx.	each 600 kW
Noise level (with blower) approx.	≤ 75 dB(A)
Max. ambient temperature	+5 ... +50 °C
Relative air humidity max. (non-condensing)	98 %
Company	VUES

11.2 Cooling

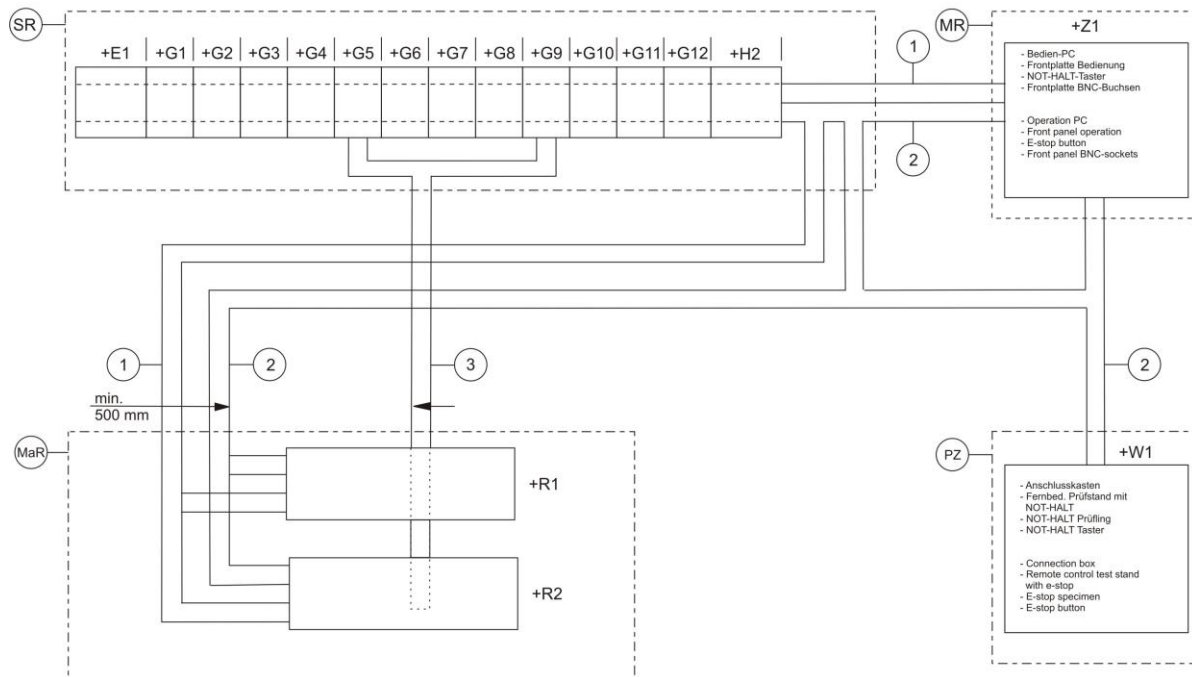
Air exchange in the installation room is to be provided by the customer.

Air amount	each motor approx. 1,27	m ³ /s
Air intake temperature	+5 ... +40	°C
Air quality	max. 4 mg non-conductive material per m ³ air. Air humidity 6..12 g water per m ³ air.	

12 Cable ducts, laying of cables

12.1 Cable duct diagram

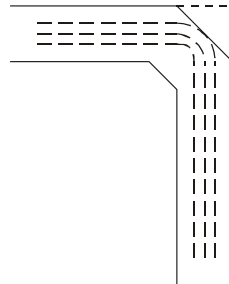
Kabelkanalschema Fahrzeugprüfstand
Cable duct diagram vehicle test stand



12.2 Minimum dimensions for cable duct or tray

	Width	Depth	
①	150 mm	x 50 mm	Power cable, supply voltage > 24 V, cable duct "P"
②	200 mm	x 50 mm	Measurement, supply voltage ≤ 24 V, cable duct "M"
③	1000 mm	x 50 mm	Converter cable, cable duct "C"

**Kanal- /Pritschenbogen
channel- / tray curve**



Cable ducts must be from metal.

Cables from cable duct ① and ② can be laid into the one cable duct, but „M“ cables and „P“ cables must be separated by metallic barrier (plate).

Crossing of cables (cable ducts) has no influence on function of the test stand.

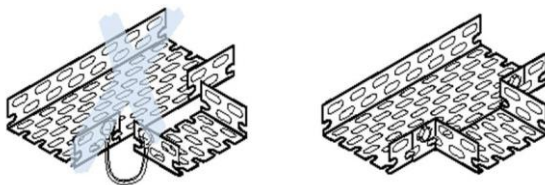
All cable ducts must be covered by metallic cover.

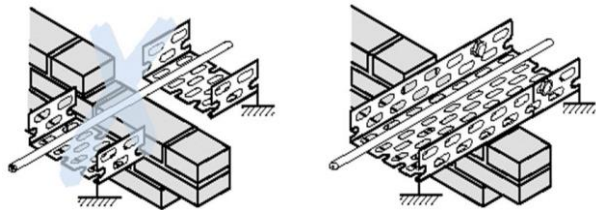
12.3 Annotation

The connection cables are loosely laid into cable channels or cable trays, which have to be supplied and installed by the customer.

The cable channels or cable trays should be made out of sheet-steel. They can be used for equipotential bonding, if they are fully closed metal cable ducts. The individual components must be connected extensively (generally bolted together) over their whole length and earthed at the cabinets / dyno frames on both ends with the required copper connection (flat copper strip, for moving parts flat copper fabric). Discontinuities must be closed with copper straps.

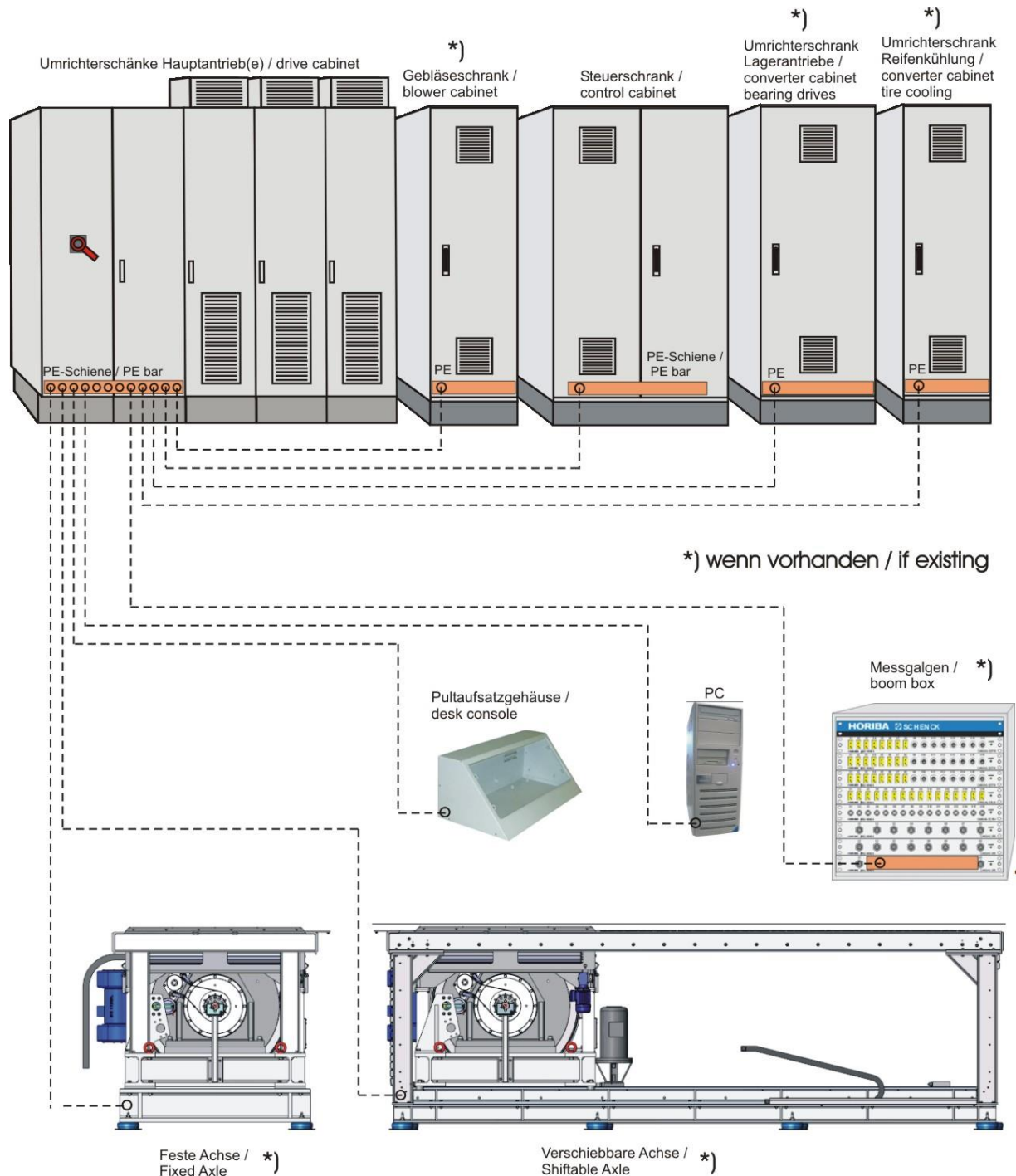
To insure the best EMC-characteristics, separate cable channels or cable trays must be provided for power, control and measurement cables. Power cables have to be strictly separated from control and measurement cables. With sheet-steel cable trays a steel separator (no plastics) has to be used for separating power- and control cables.





12.4 Equipotential bonding

Equipotential bonding has to be carried out as follows:



----- Flachbandkupfer (im Falle von beweglichen Teile ist flexibles Kupfergewebeband notwendig) / flat copper strip (in case of moving parts flexible flat copper fabric is mandatory)

13 Safety devices on the test stand (emergency-stop)

Standard emergency-stop buttons for deenergizing the test stand in case of danger for the staff or damage to the machine are available in the following places:

1. Operator panel in front panel +Z1
2. Emergency-stop button on the operator desk
3. Emergency-stop button, mounted in the test room (remote control)
4. Emergency stop button in the test room
5. Emergency stop button in the pit

If required additional emergency-stop buttons can be installed by the customer and connected in the control cabinet +H2.

The specimen must be shut off in the case of emergency stop. The supplied cable from HORIBA for stopping the engine of the specimen is connected to the safety circuit of the test stand (two channels ensure Performance Level d). The connection of the specimen is mandatory in test mode. The appropriate connection at the vehicle is in the responsibility of the operator.

14 Data for the definition of necessary ventilation

Summary of max. power dissipation in the individual rooms

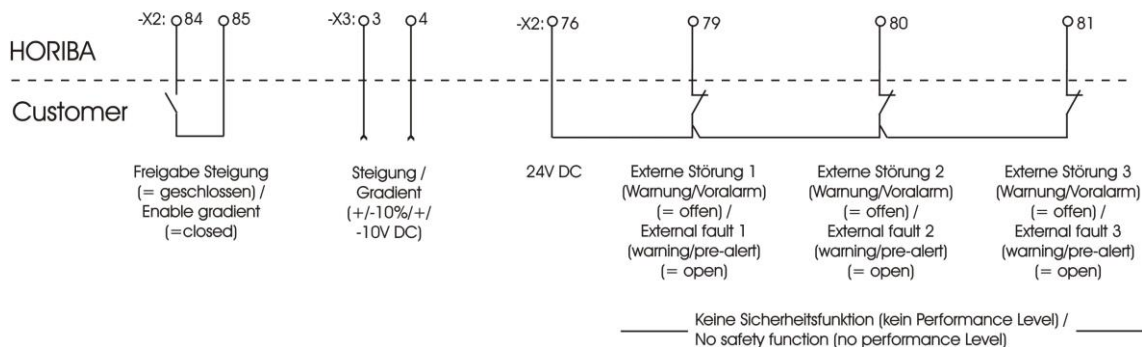
Plant room approx.	23 kW
Machine room approx.	17 kW
Measuring room approx.	0,2 kW

15 Electrical interface for operator

Steuersignale Prüfstand (Eingänge) im Steuerschrank = H2+H2 /

Control signals dyno (inputs) in control cabinet = H2+H2

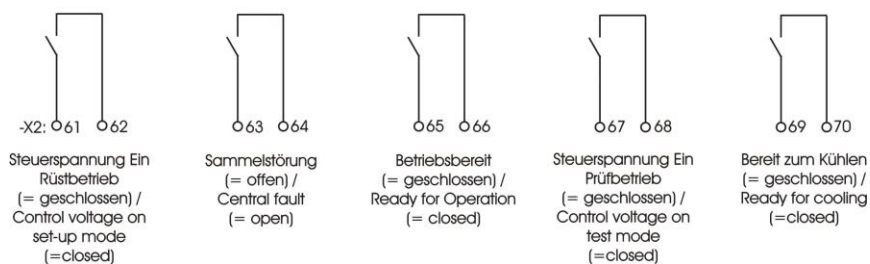
Digitalausgänge / Digital output: 24V DC



Steuersignale Prüfstand (Ausgänge) im Steuerschrank = H2+H2 /

Control signals dyno (outputs) in control cabinet = H2+H2

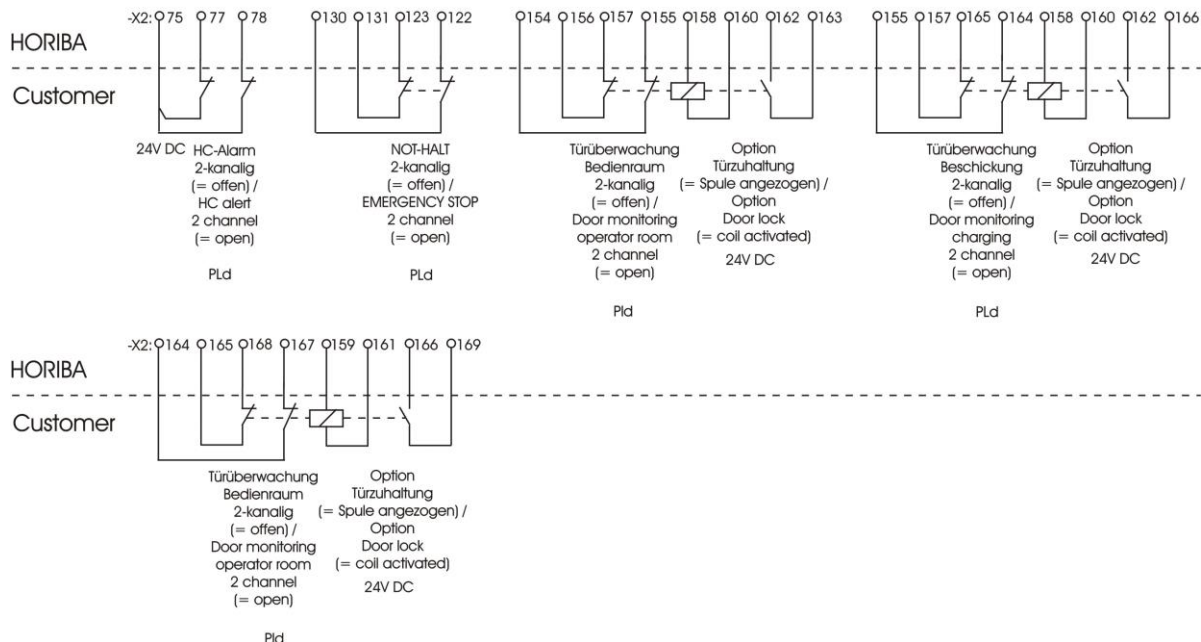
Kontaktbelastung / contact rating: 5...250V AC/DC; 10mA (5V)...6A



Signale Sicherheitsfunktion (Eingänge) Prüfstand im Steuerschrank =H2+H2 / Signals safety functions dyno (inputs) in control cabinet =H2+H2

Alle Sicherheitsfunktionen bis Performance Level c (PLc) können 1-kanalig ausgeführt werden. Ab PLd muss 2-kanalig realisiert werden /
All safety functions up to Performance Level c (PLc) can be executed on 1 channel, from PLd it must be realised on 2 channels.

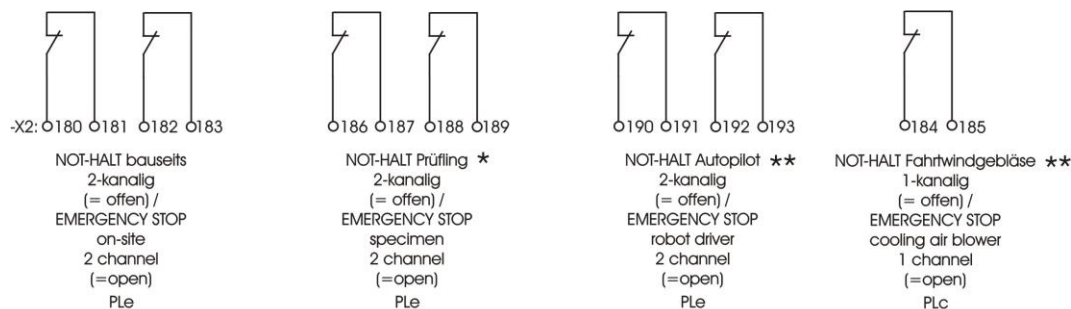
Spannung im Sicherheitskreis / Voltage in safety circuit: 24V DC



Signale Sicherheitsfunktion (Eingänge) Prüfstand im Steuerschrank =H2+H2 / Signals safety functions dyno (inputs) in control cabinet =H2+H2

Alle Sicherheitsfunktionen bis Performance Level c (PLc) können 1-kanalig ausgeführt werden. Ab PLd muss 2-kanalig realisiert werden /
All safety functions up to Performance Level c (PLc) can be executed on 1 channel, from PLd it must be realised on 2 channels.

Kontaktbelastung / contact rating: AC1: 240V; 6A; 1440VA / DC15: 24V; 6A; 144W
AC15: 230V; 3A; 690W / DC13: 3A; 72W



* 5-adriges Kabel (5x0,75mm²) wird bis in den Testraum bereitgestellt /
5 wire cable (5x0,75mm²) is provided into the test room

** Nur verfügbar, wenn nicht durch entsprechende HORIBA-eigene Ausrüstung belegt /
Only available, if not occupied with appropriate HORIBA equipment

Further project specific interfaces for connection of customer's components on special request.