OPERATING INSTRUCTIONS AND MAINTENANCE NOTES ON LIQUID TRANSFORMERS

MAN_08247

Client : PRESSCONTROL
Order n°: AF08.20.065.001
Transformer : 6000 kVA
30000±2x3.33% -
20000±2x2.5%/15000V, 50Hz
Dyn5
Serial N° : 66581
Type : TOE/36
Cooling : ONAN

I.LORA	D.FRIGO	I.LORA	27/11/08	First Issue	00
DRAW	VERIFIED	APPROVED	DATE	REV. DESCRIPTION	REV.

Ocrev srl
Via dell'Industria 28 - 36070 Castelgomberto VI – ITALY

CONTENTS:

1. TRANSPORT

The transformer is prepared by the manufacturer ready for operation, except for cases where some components like HV/LV cable box, cooling elements (radiators) and oil storage tanks, are disassembled to obtain the dimensions suitable for transport.
The components, disassembled for the aforesaid reasons, must be reassembled at the installation site, by very carefully following the instructions set out by the manufacturer.

2. LIFTING

Lifting can be done by using the appropriate eyebolts, remembering to use long enough cables so that H (see Fig. 1) is never less than L.
Always use all the existing rings and not only some of them.

Short lifting may also be done with hydraulic jacks, by applying suitable supporting plates under the crate.

In some cases a forklift may be used.

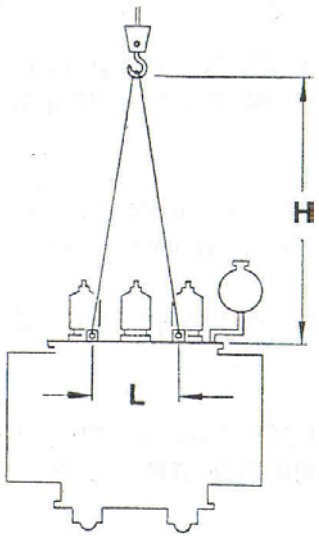

Fig. 1. An example of lifting

3. STORAGE

If the transformer is not installed after a reasonably short time, care must be taken. Before applying energy, carefully clean the transformer, by removing dust and other foreign particles and objects that may have deposited on the bushings or other parts of the cover because of the long storage period.

4. ACCESSORIES (see DRGW N° TL 4145 and TL 1405SC)

The transformer is usually fitted with the following accessories:
- bushings placed on the primary side,
- bushings placed on the secondary side,
- bi-directional rollers,
- lifting lugs,
- off-load tap changer for adjusting the transformer ratio and Voltage, (DO NOT OPERATE UNDER VOLTAGE)
- thermometer pockets,
- oil conservator,
- oil level indicator,
- Buchholz relay,
- silicagel breather,
- oil filling hole and plug,
- oil drain valve,
- earthing terminals,
- rating plate.

Depending on the client's requests the transformer may be fitted with particular accessories, each of which supplied with its specific description of operation attached to the accessory itself.

5. INSTALLATION AND START-UP

If not otherwise requested, the characteristics indicated on the rating plate of the transformer refer to installations of up to a maximum height of 1.000 m above sea level.

For correct thermal dispersal of the leaks, due to self-consumption of the transformer, there must be a minimum distance of 30 cm from the wall, between the cooling surfaces and the room walls, and 60 cm between one transformer and another, if there are more than one.
The room must be dimensioned to permit air circulation of 4÷5 m^3/min. for each kW of losses. If this condition is not met there would be an anomalous increase in temperature compared to that calculated.
A normal environment may be considered as one where the temperature comes within the following values:

* minimum temperature	-25°C
* average annual temperature	20°C
* average daily temperature	30°C
* **maximum temperature**	**40°C**

The transformer is designed to work at a maximum ambient temperature of 40°C, with an oil temperature rise of 60 K and a winding temperature rise of 65 K. Accordingly, the transformer oil temperature must never go over 100°C, being this the maximum temperature value allowed by Standards for mineral oil or other dielectric-fluid transformer with Class A insulation. It is equipped with contact.
Temperatures differing from those indicated will have to be studied to establish the causes.

1) 1) After the HV/LV cables have been connected, carried out: by verify the tightness connections/earthings bolts according DIN267 8.8(5.6) bolts approximate values: M10 50(21.6)Nm; M12 87.3(38.2)Nm; M14 138(60.8)Nm; M16 211(93.2)Nm), keeping count of the respective phase sequence, make sure, before applying energy, that the tap-changer is set to the desired transformer ratio (Terminal board connections must be properly tight to prevent overheating of the joint); and the cables and, of course, all the connections, must be at safe distance from live parts (see table on this subject);

Insulation class (kV)	Shock peak (kV)	Minimum distance (mm) according to IEC 60076-3
3.6	40	60
7.2	60	90
12	75	110
17.5	95	170
24	125	210
36	170	280

2) Make sure that the silicagel breather has been mounted according to the following modalities:

- verify the colour of silicagel salt accordingly to the indication of label;
- remove the hexagon plug from the pipe of conservator
- let any oil that has entered into the pipe during transport drip out;
- remove the upper plastic cap and screw on the silicagel on the conservator pipe;
- Remove the lower basin, remove the bottom plastic cup than fill the lower basin with a little quantity of dry oil up to the mark (see arrow in the label);
- Carefully assembling again the lower basin to the silicagel.

(be careful not to open the drain plug of the oil conservator); install the breather in its place, after prior removing the plug from the air hole.

3) Check that the oil level in the oil conservator is set to 20°C and verify the external bolts and sealing capacity of the gaskets;

4) Make a physical check of control circuit wiring and alarm devices (Verify the set-up on Oil Thermometer: alarm 90°C, trip 95°C; on Winding Temperature Indicator: alarm 95°C, trip 100°C. Regarding the relay Buchholz, unscrew the cap of the signalling devices button, remove from inside it the spacer inserted for blocking the signalling device and eventually by the valve leak out the air from the Buchholz relay).

5) Refinish all paint scratches **(RAL 7031).**

6) For parallel operation with other transformers, the transformer must respect the following conditions:

a) It must belong to the same vector group as the transformers to be used in parallel, according to the following table:

Three-phase transformer connections

0	Yy0	Dd0	Dz0
1	Yd1	Dy1	Yz1
5	Yd5	Dy5	Yz5
6	Yy6	Dd6	Dz6
11	Yd11	Dy11	Yz11
2		Dd2	Dz2
4		Dd4	Dz4
7	Yd7	Dy7	Yz7
8		Dd8	Dz8
10		Dd10	Dz10

b) Identical value of 'Short-Circuit Current', with only the tolerance foreseen by the Standards, of the other transformers meant for parallel connection.

7) Make sure that all the disconnecting valves of radiators and relay Buchholz are on the open position, accordingly to the valves label.

8) Make sure that all tools or other object used in installation are accounted for and removed from the transformer.When the inspection and tests listed in paragraphs are completed and any required repairs have been made, the transformer may be energised.

6. MAINTENANCE

Generally the transformer needs no particular expedients for maintenance. However, to ensure safe and reliable operation, it is best to check periodically, the frequency of which depends on the environmental and operation conditions:

a) Check the oil level;
b) Check the oil temperature, which must never exceed environmental temperature by **60 K, considering an environmental temperature of 40°C;**
c) After about a year's operation it is advisable to take a sample of oil and make it undergo a dielectric test;
The sample must be taken from the discharge valve at the bottom of the transformer, unless it is fitted with a special sampling valve.
d) General cleaning from dust and other dirt that may have collected there, paying special attention to the bushings;
e) verify the silicagel salt colour accordingly to the indication of label
f) Check the sealing capacity of the gaskets

***** THE ABOVE-MENTIONED OPERATIONS MUST BE CARRIED OUT WITH THE TRANSFORMER CONNECTED TO GROUND AND NOT ENERGISED *****

6.1. Maintenance Schedule

Table 3. Recommended Maintenance Schedule

	Check Period	Just prior to Energising	One month after Energising	Once a Year
1.	Oil Level Indicator readings	X	X	X
2.	Verify the silicagel salt colour accordingly to the indication of label (orange "dry-properly condition"; green "wet-not working condition")	X	X	X
3.	Bolted Connections	X		X
4.	Tank Leaks	X		X
5.	Control Wiring & Circuits(thermometer-Buchholz)	X		X
6.	Paint Finish	X		X
7.	Surface Temperature with Infrared Scanner or oil thermometer Reading		X	X
8.	Liquid Dielectric Test (IEC 60296 and IEC 60422 min.values 40kV)	X		X
9.	Tap changer operation (make 6 operation cycle)	X		X

7. **ANOMALIES**

ANOMALY	CAUSE	SOLUTION
High noise level	Undistributed load	Contact the manufacturer
Overheating	Overloading	Take the load back to the nominal values
	Insufficient air circulation	Check that the values found under the chapter "Installation and Start-up "

BETRIEBSANLEITUNG UND WARTUNGSHINWEISE FÜR

FLÜSSIGKEITSTRANSFORMATOREN

MAN_08247

Transformator typ :	TOE/36 phasen 3
Nennleistung:	6000 kVA
Mittel/Niederspannung:	30000±2x3.33% - 20000±2X2.5%/15000V, 50Hz.
Schaltgruppe :	Dyn5
Trafo nummer:	66581

Kunde :	PRESSCONTROL.(GMBH)
Auftrag:	AF08.20.065.001

I.LORA	A.COSTA	I.LORA	26/07/05	Ausgegeben	00
Ausführung	Kontrolle	Bewährt	Datum	Aenderung	Rev.

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INHALTSVERZEICHNIS:

8. TRANSPORT

Der Transformator wird im Allgemeinen vom Erzeuger betriebsbereit fertiggestellt. In einigen fällen kann es jedoch aus Transportgründen erforderlich sein, einige Teile, wie zum Beispiel Schutzkästen, Kühlteile (Kühler) und Ölkonservatoren, abzumontieren.
Diese Teile müssen dann unter genauer Beachtung der vom Erzeuger mitgegebenen Anleitungen vor Ort wieder montiert werden.

9. HEBEN

Beim Heben sind die eigens vorgesehenen Transportösen und ausreichend lange Seile zu verwenden. Dabei darf H (siehe Abb. 1) niemals kürzer als L sein.
Niemals nur einige der vorgesehenen Ringe verwenden, sondern immer alle.

Für kleine Hebungen kann man auch einen hydraulischen Hebebock verwenden, wobei geeignete Unterlegplatten unter die Kiste geschoben werden müssen.

In einigen Fällen kann man auch einen Hubwagen verwenden.

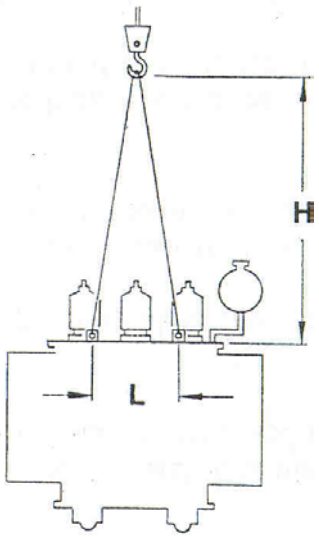


Abb. 1 Beispiel für Heben

10. LAGERUNG

Sollte der Transformator nicht innerhalb kurzer Zeit installiert werden, ist vor der Erregung eine sorgfältige Reinigung durchzuführen. Dabei müssen Staubpartikel und Fremdkörper, die sich infolge der langen Lagerung auf die Isolatoren oder auf andere Teile der Abdeckung abgelegt haben sollten, beseitigt werden.

11. ZUBEHÖRTEILE

Im Allgemeinen ist der Transformator mit folgenden Zubehörteilen bestückt:
- Isolatoren auf der Primärseite,
- Isolatoren auf der Sekundärseite,
- Orientierbare Transporträder,
- Hebeösen,
- Kommutator für die Einstellung des Übersetzungsverhältnisses,
- Thermometergefäße,
- Ölkonservator (*),
- Ölstandanzeiger,
- Buchholz-Relais (*),
- Silicagel-Lufttrockner (*),
- Zuführungs- und Belüftungsvorrichtung (*),
- Ölablassventil,
- Erdungsklemmen,
- Typenschild.

(*) nur für absaugende Ausführung

Nach Anfrage des Kunden kann der Transformator mit besonderen Zubehörteilen bestückt sein. Für jeden Zubehörteil wird eine eigene Funktionsanleitung mitgeliefert.

12. INSTALLATION UND INBETRIEBNAHME

Falls vom Kunden nicht anderweitig gewünscht, beziehen sich die auf dem mitgelieferten Typenschild angegebenen Eigenschaften auf Installationen bis zu maximal 1.000 m ü.d.M.

Zwecks einer korrekten Beseitigung des Wärmeverlustes durch den Eigenverbrauchs des Transformators, sind folgende Mindestabstände einzuhalten: 30 cm zwischen den Kühlflächen und den Raumwänden; 60 cm zwischen den einzelnen Transformatoren, wenn mehr als einer davon vorhanden sind.
Der Raum muss ausreichend groß sein, um eine Luftzirkulation von 4÷5 qm/min. pro kW Verlust zu ermöglichen. Wird diese Erfordernis nicht beachtet, steigt die Temperatur verglichen zur berechneten Temperatur übermäßig an.

Als normal ist ein Raum anzusehen, in dem die Temperatur folgende Werte aufweist:
* Minimaltemperatur -25°C
* Jahresdurchschnittstemperatur 20°C
* Tagesdurchschnittstemperatur 30°C
* Höchsttemperatur **40°C**

Sollten Temperaturen festgestellt werden, die von den angegebenen abweichen, ist nach der Ursache dafür nachzuforschen.

1) Nachdem unter Beachtung der entsprechenden Phasenfolge der Anschluss der Mittelspannungs- und Niederspannungs-Leiter durchgeführt worden ist, muss man sich noch vor der Erregung vergewissern, dass sich der Kommutator für das gewünschte Übersetzungsverhältnis richtig eingestellt ist;

2) Sich vergewissern, dass der Silicagel-Lufttrockner nach folgender Vorgangsweise montiert wurde:
- konstatieren der Silicagel-Lufttrockner salze farbe
- den 6-eckigen Nutverschluss abnehmen
- das eventuell während des Transports in das Rohr eingetretene Öl abtropfen lassen
- den Trockner festschrauben

(darauf achten, dass der Feder-Ablasspropfen des Ölkonservators nicht geöffnet wird);

3) Überprüfen, dass der Ölstand im Konservator auf 20°C eingestellt ist; der zeigerthermometer kalibriert zu 95°C für alarme unt zu 100°C für ausloesung unt entfernen Sie aus es heraus die Distanzscheibe, die für das Blockieren der signalisierenden Vorrichtung eingesetzt wird und laufen Sie schließlich aus dem Buchholz Relais aus.

4) Für den Parallellauf mit anderen Transformatoren muss der Transformator folgende Bedingungen erfüllen:

a) Er muss der gleichen Vektorialgruppe der anderen Transformatoren angehören, die für den Parallellauf bestimmt sind, und zwar nach folgender Tabelle:

Verbindungen der Drehstromtransformatoren

0	Yy0	Dd0	Dz0
1	Yd1	Dy1	Yz1
5	Yd5	Dy5	Yz5
6	Yy6	Dd6	Dz6
11	Yd11	Dy11	Yz11
2		Dd2	Dz2
4		Dd4	Dz4
7	Yd7	Dy7	Yz7
8		Dd8	Dz8
10		Dd10	Dz10

b) Der 'Vcc'-Wert muss - mit der einzigen von den Bestimmungen vorgesehenen Toleranz – mit jenem der anderen für den Parallellauf bestimmten Transformatoren identisch sein.

ANSTRICHFARBE RAL 7031

13. WARTUNG

Im Allgemeinen bedarf der Transformator keiner besonderen Wartung. Um, jedoch, einen zuverlässigen und sicheren betrieb zu gewährleisten, soll je nach den Raum- und Betriesbedingungen in regelmäßigen Zeitabständen eine Reihe von Überprüfungen durchgeführt werden:

a) Den Ölstand überprüfen

b) Die Öltemperatur überprüfen. Diese darf nicht um **60°C** die Raumtemperatur übersteigen, wobei man von einer Raumtemperatur von **40°C** ausgeht.

c) Nach ca. 1 Jahr Betrieb ist es ratsam, eine Ölprobe zu entnehmen und diese einem dielektrischen Test zu unterziehen.
Das Öl ist aus dem am Ende des Transformators befindlichen Ventil zu entnehmen, es sei denn es ist ein eigens für die Ölentnahme vorgesehenes Ventil vorhanden.

d) Allgemeine Reinigung von Staub und anderen Ablagerungen, vor allem auf den Isolatoren.
e) konstatieren der Silicagel-Lufttrockner salze farbe;
e) Die Dichtungen auf Dichtheit überprüfen.

***** DIE OBEN GENANNTEN EINGRIFFE SIND BEI NICHT ERREGTEM UND BEI VORSCHRIFTSMÄSSIG GEERDETEM TRANSFORMATOR DURCHZUFÜHREN *****

6.1. Wartungstabellen

Table 3. Empfohlenen Wartungstabelle

	Prüfaktivität	Vor Inbetriebnahme	30 Tage nach Inbetriebnahme	1-mal pro Jahr
1.	Ölstand	X	X	X
2.	konstatieren der Silicagel-Lufttrockner salze farbe	X	X	X
3.	Anschlussbolzen	X		X
4.	Kesseloelaustritt	X		X
5.	Hilfstromkreisen (thermometer-Buchholz)	X		X
6.	Lackierung	X		X
7.	Flachtemperatur mit Infrarot Scanner oder Öltermometer Messung		X	X
8.	Öldurchschlagsfestigkeit (IEC 60296 and IEC 60422 min.values 40kV)	X		X
9.	Umsteller-benützung (6-fach volldrehen)	X		X

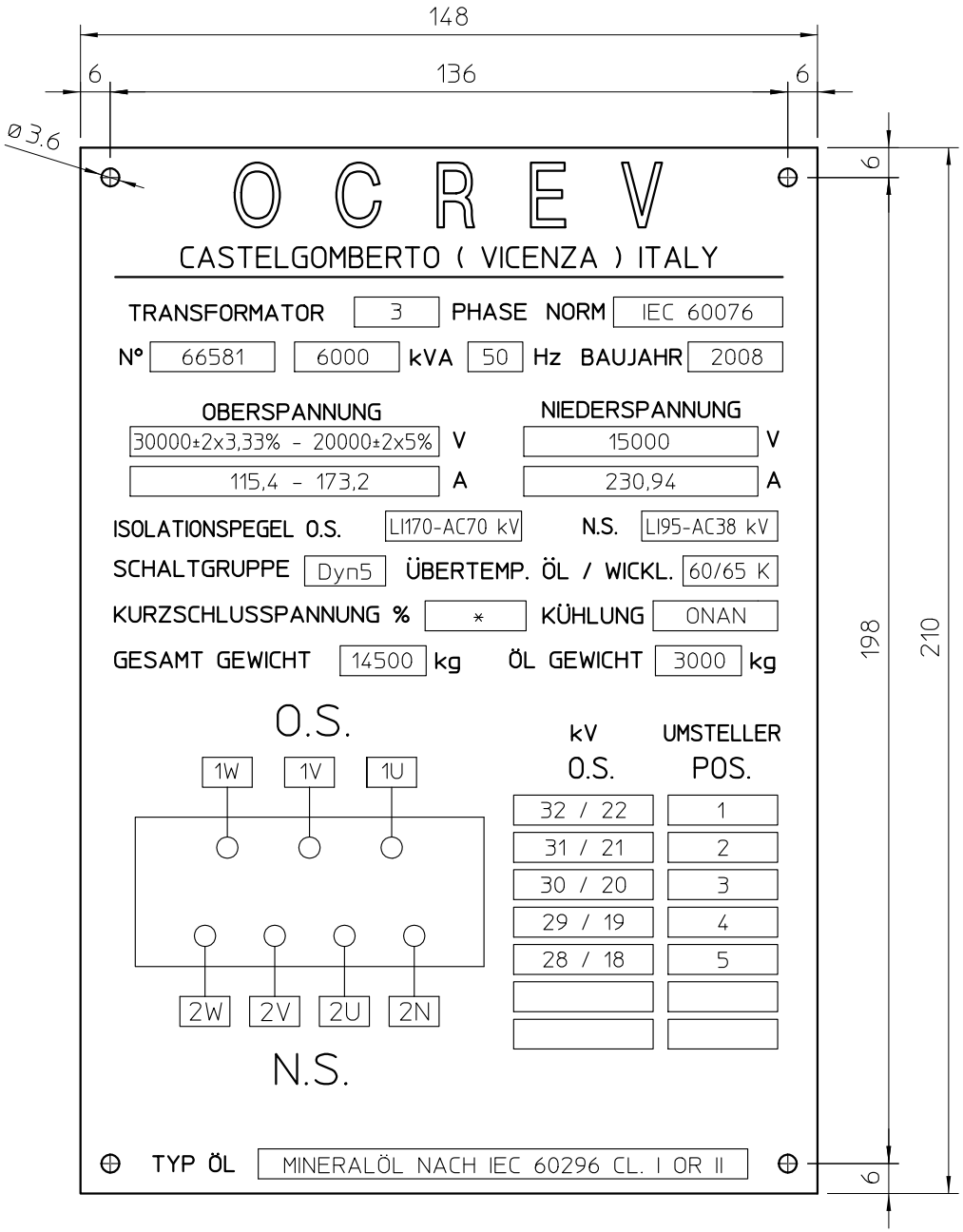
Anschlussbolzen: DIN267 8.8(5.6)Nm : M10 50(21.6)Nm; M12 87.3(38.2)Nm; M14 138(60.8)Nm; M16 211(93.2)Nm),

14. STÖRUNGEN

STÖRUNG	URSACHE	ABHILFE
Außerordentliches Geräusch	Verformte Last	Den Erzeuger befragen
Überhitzung	Überlastung	Die Last wieder auf die Nennwerte bringen
	Unzureichende Luftzirkulation	Überprüfen, ob die im Kapitel „Installation und Inbetriebnahme“ angegebenen Werte eingehalten wurden

15. DRAWINGS / ZEICHNUNG

-	RATING PLATE TYPENSCHILD UND SCHALTBILD	DRWG. N° TL 1732TR
-	OVERALL DIMENSIONS MASSZEICHNUNG	DRWG. N° TL 4145
-	AUXILIARY CIRCUITS WIRING DIAGRAM SCHALTBILD	DRWG. N° TL 1405SC



* DIESE WERT WIRD NACH DEN TEST ANGEGEBEN

Die ziffern sind mit folgenden toleranzen zu berucksichtigen mit ausnahme deren die direkt in der zeichnung angegeben sind	
Bis 100 mm	± 5 mm
Von 100 mm bis 300 mm	± 10 mm
Von 300 mm bis 1000 mm	± 20 mm
Von 1000 mm bis 2000 mm	± 40 mm
Ueber 2000 mm	± 1 mm
Bohrungen	± 0,5 mm
Gewinden	± 1
winkel	

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CASTELGOMBERTO (VICENZA)
ITALY

KUNDE *PRESSCONTROL*

TECHN. DATEN

LEISTUNGSSCHILD
N° 1 OEL TRAFO 3 PHASE Typ TOE
6000 kVA - 30±2x3,33%-20±2x5% / 15 kV - 50 Hz - Dy
Trafo nummer 66581

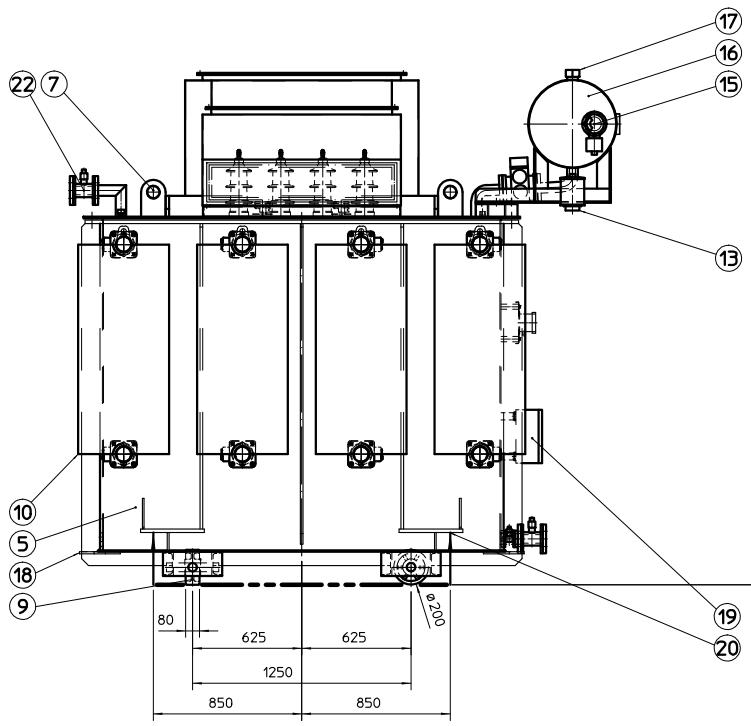
SCALE *1 : 1*

AUFTRAG N° AF08.20.065.001
COMM. N° 247.08
ZEICHNUNG NR. TL 1732TR

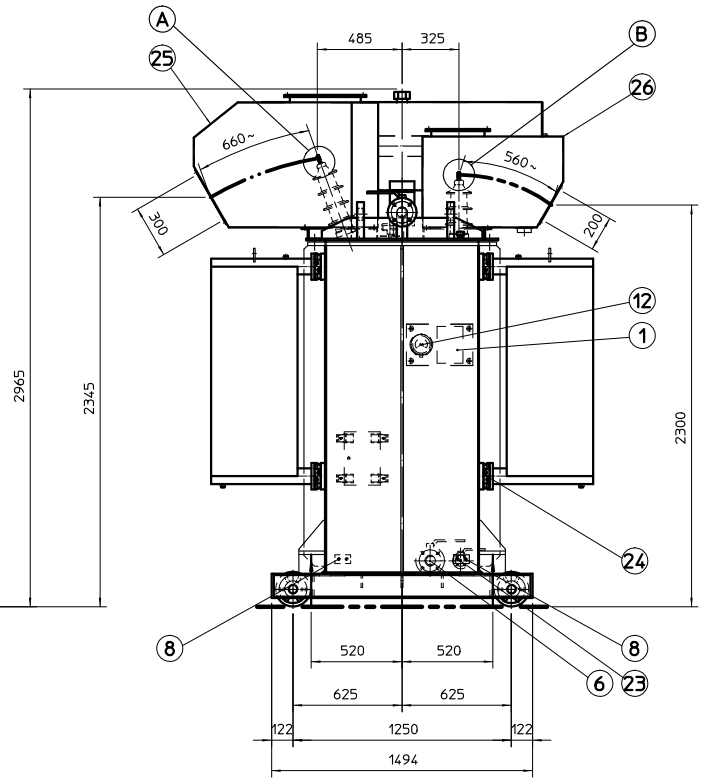
AENDERUNG		DATUM	GEZ.	KONTROLLE	GEPR.
0	*Ausgegeben*	*02/09/2008*	*PM*	*PM*	*FZ*
1	*Endzeichnung*	*25/11/2008*	*PM*	*PM*	*FZ*
2					
3					

Cad-File N° *TL6000GFE66581*

FRONT TRANSFORMER
FRONTSEITE TRANSFORMATOR

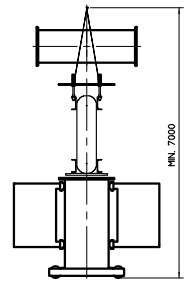


SIDE
SEITE



LIFTING OF WOUND CORE AND WINDINGS
WEIGHT 8700 Kg

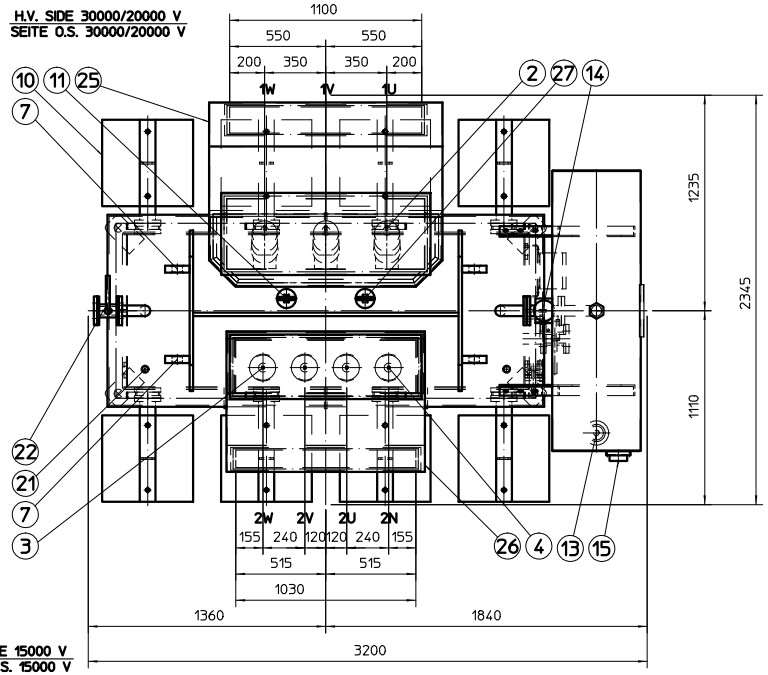
KERN UND WICKLUNGEN
GEWICHT 8700 Kg



TOTAL WEIGHT TRANSFORMER - 14500 Kg
GESAMTGEWICHT
TOTAL WEIGHT OIL - 3000 Kg
TRANSFORMATOR OELGEWICHT
COLOURS OF VARNISHING - RAL 7031
ANSTRICHFARBE

PLAN

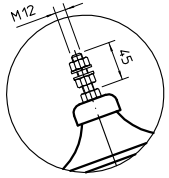
H.V. SIDE 30000/20000 V
SEITE O.S. 30000/20000 V



M.V. SIDE 15000 V
SEITE M.S. 15000 V

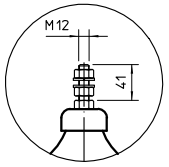
DETAIL "A"
H.V. BUSHINGS
Scale 5 : 1

DETAIL "A"
O.S. DURCHFUHRUNG
Scale 5 : 1



DETAIL "B"
M.V. TERMINALS
Scale 5 : 1

DETAIL "B"
M.S. KLEMME
Scale 5 : 1



POS.	LEGEND BENENNUNG	TYPE TYP	N°
27	OFF-LOAD TAP CHANGER 20 / 30 kV *UMSTELLER 20 / 30 kV*		1
26	M.V. CABLE BOX *M.S. ABDECKHAUBE*	IP55	1
25	H.V. CABLE BOX *O.S. ABDECKHAUBE*	IP55	1
24	RADIATOR DISCONNECTING VALVES *RADIATORABSPERRVENTIL*		16
23	OIL SAMPLING VALVE *OEL PROBEENTNAHME*	DN15-PN10	1
22	FILTER VALVE *FILTER-VENTIL*	DN50-PN10	1
21	FREE THERMOMETER POCKET *THERMOMETERTASCHE*	Ø3/4"	1
20	JACKING PADS *SPANNHEBEL*		4
19	AUXILIARY TERMINAL BOX *SCHALTKASTEN*		1
18	DRAWN HOOKS *TRANSPORTOESEN*		4
17	OIL FILLING HOLE AND PLUG *OEL EINFUELLSTUTZEN*	Ø2"	1
16	OIL CONSERVATOR *AUSDEHNUNGSGEFASS*		1
15	OIL LEVEL INDICATOR *OELSTANDANDZEIGER*		1
14	BUCHHOLZ RELAY *BUCHHOLZRELAIS*		1
13	CONSERVATOR SILICAGEL BREATHER *LUFTENTFEUCHTER*		1
12	OIL THERMOMETER *ZEIGERTHERMOMETER*		1
11	OFF-LOAD TAP CHANGER *UMSTELLER*		1
10	COOLING RADIATORS *RADIATOREN*		8
9	BIDIRECTIONAL ROLLERS *FAHRWERK MIT UNSETZBAREN ROLLEN*	Ø200x80	4
8	EARTHING TERMINALS *ANSCHLUSSTUECK ERDUNG*	M16	2
7	TRANSFORMER LIFTING LUGS *ANHAENGEVORRICHTUNG*		4
6	OIL DRAIN VALVE *OELABLASSVORRICHTUNG*	DN50-PN10	1
5	TRANSFORMER TANK *TRANSFORMATOR KESSEL*		1
4	NEUTRAL M.V. BUSHING (2N) *M.S. NEUTRAL DURCHFUHRUNG*	20kV/250A	1
3	M.V. BUSHINGS (2U - 2V - 2W) *M.S. DURCHFUHRUNG*	20kV/250A	3
2	H.V. BUSHINGS (1U - 1V - 1W) *O.S. DURCHFUHRUNG*	30kV/250A	3
1	RATING PLATE *LEISTUNGSSCHILD*	ZEICHNUNG NR TL1732TR	1

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CASTELGOMBERTO (VICENZA)
ITALY

KUNDE *PRESSCONTROL*
AUFTRAG N° AF08.20.065.001
COPIA N° 247.08

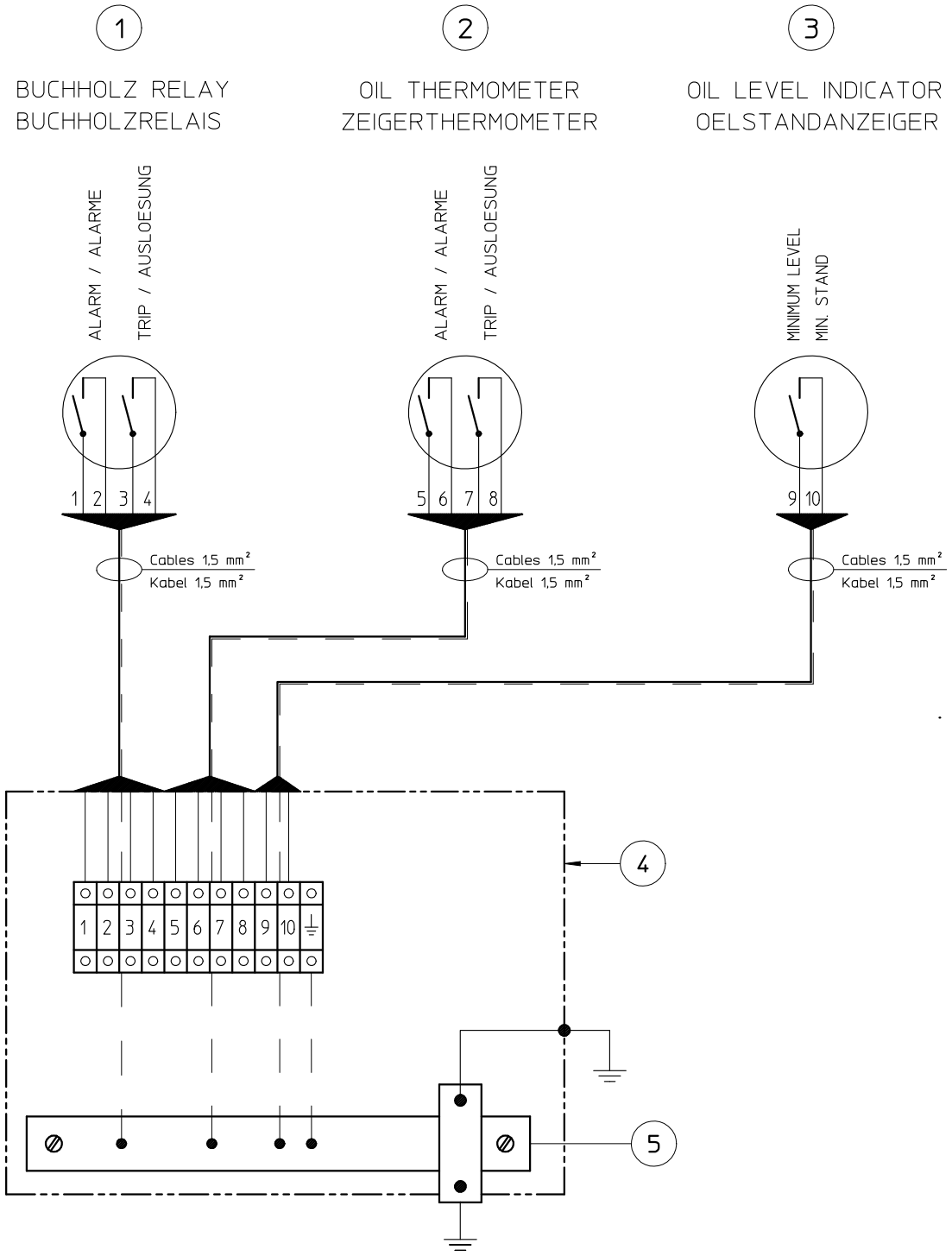
TECHN DATEN
MASSZEICHNUNG
N° 1 OEL TRAFO 3 PHASEN Typ TOE
6000 kVA - 30000+2x3.33%-20000+2x5% / 15000 V - 50 Hz -
Dyn5 - Trafo number 66581

ZEICHNUNG NR
TL 4145

SCALE 1 : 1

ÄNDERUNG		DATUM	GEZ.	KONTROLLE	GEPR.
0	Ausgegeben	02/09/2008	AF	FM	FZ
1	Endzeichnung	21/11/2008	AF	FM	FZ
2					
3					

Cad-File N° DL6000GFE66581



POS	LEGEND *BENNENUNG*	TERM.	N°
5	EARTHING BAR *ERDUNGSSCHIENE*	Cu 10x3mm²	1
4	AUXILIARY TERMINAL BOX *SCHALTKASTEN*		1
3	OIL LEVEL INDICATOR *OELSTANDANZEIGER*	9 - 10	1
2	OIL THERMOMETER *ZEIGERTHERMOMETER*	5 - 6 7 - 8	1
1	BUCHHOLZ RELAY *BUCHHOLZRELAIS*	1 - 2 3 - 4	1

OCREV
CASTELGOMBERTO (VICENZA)
ITALY

KUNDE *PRESSCONTROL*

AUFTRAG N° AF08.20.065.001

COMM. N° 247.08

TECHN. DATEN

SCHALTBILD
N° 1 OELTRAFO 3 PHASEN Typ TOE
6000 kVA - 30±2x3,33%-20±2x5% / 15 kV - 50 Hz - Dyn5
Trafo nummer 66581

ZEICHNUNG NR.
TL 1405SC

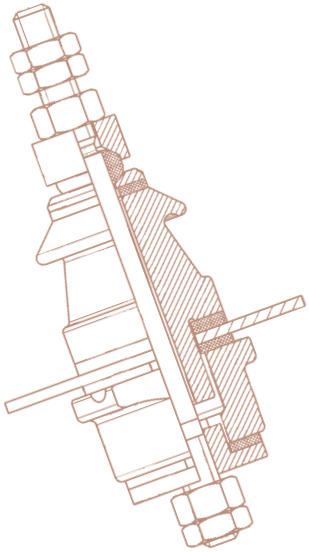
SCALE / : /

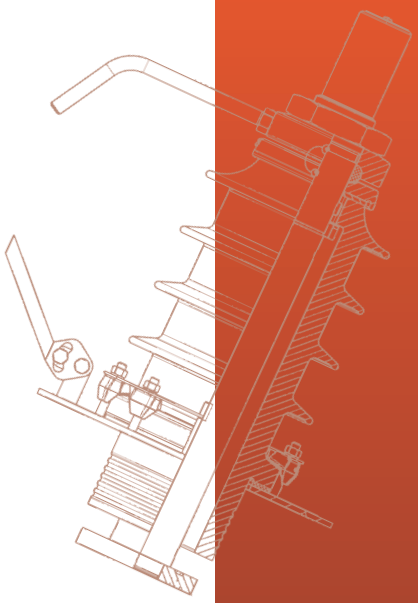
AENDERUNG			DATUM	GEZ.	KONTROLLE	GEPR.
	0	*Ausgegeben*	*02/09/2008*	*AM*	*AM*	*FL*
	1					
	2					
	3					

Cad-File N° *SL6000GFE66581*

16. ANNEX.

- H.V. BUSHING 30KV SIDE: COMEM TYPE 30 / 250
- L.V. BUSHING 15KV SIDE: COMEM TYPE 20 / 250
- ESSICAGEL BREATHER FOR TRANSFORMER: COMEM TYPE EM2DB
- OIL LEVEL INDICATOR FOR TRANSFORMER: COMEM TYPE L 14K
- BUCHHOLZ RELAY FOR TRANSFORMER: COMEM TYPE BR50 DIAGRAM A
- OIL THERMOMETER: TERMAN TYPE TERMAN 1187/S 100





CERAMIC BUSHING INSULATORS

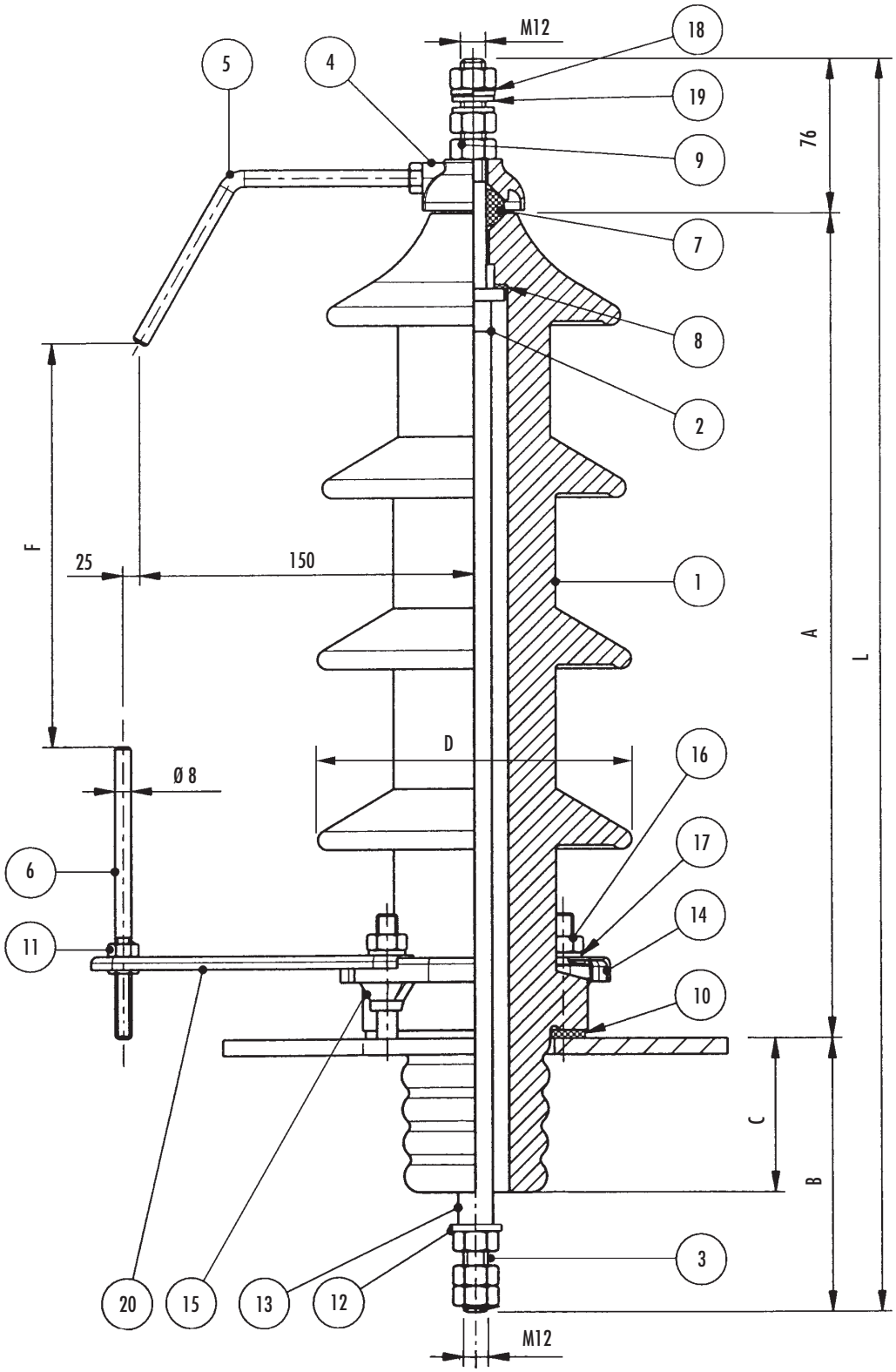
FOR OIL-INSULATED TRANSFORMERS

comem®

12÷36 kV

UNEL 38144-74

250 A



Dettagli per il fissaggio e il montaggio dell'isolatore vedi pag. 58 - Tipo A • *Insulator installation and fastening details: see page 58 - Type A*

TYPE	A	B	L	C	D(Max)	F	N° of sheds	Tank Hole	Weight
12 kV/250 A	234	120	430	61	Ø 140	70	2	Ø 78	4.6 kg
24 kV/250 A	309	135	520	76	Ø 155	100	3	Ø 78	6.3 kg
36 kV/250 A	409	135	620	76	Ø 155	200	4	Ø 78	7.6 kg

UNEL 38144-74

12÷36 kV

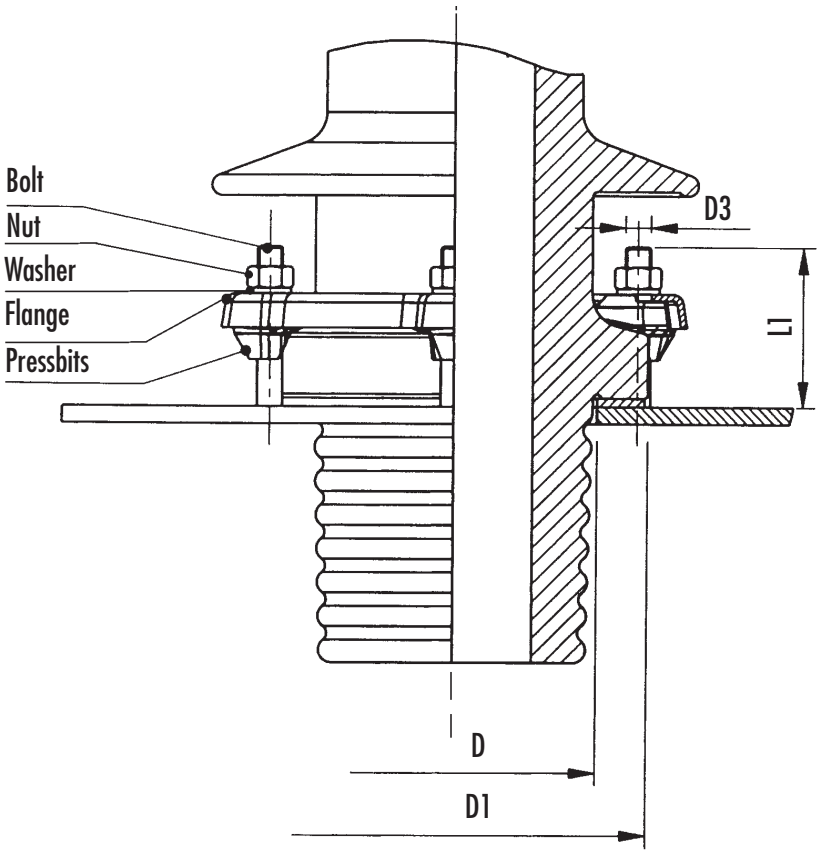
B3

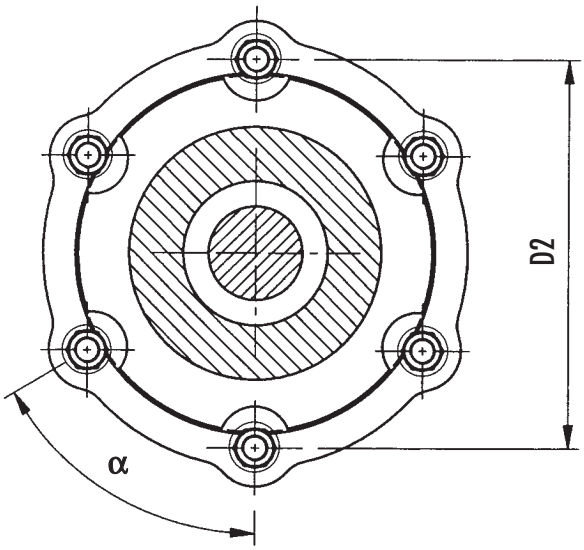
250 A

ITEM	DESCRIPTION	Q.TY
1	PORCELAIN	1
2	UPPER BOLT	1
3	LOWER BOLT	1
4	CAP	1
5	UPPER HORN	1
6	LOWER HORN	1
7	GASKET	1
8	GASKET	1
9	NUT DIN 934	6
10	GASKET	1
11	NUT DIN 934	3
12	GASKET	1
13	INSULATING TUBE	1
14	FLANGE	1
15	PRESSBITS	4
16	NUT DIN 934	4
17	WASHER DIN 125 A	4
18	WASHER	1
19	WASHER DIN 125 A	2
20	SUPPORT	1

IDENTIFICATION			VOLTAGE TIGHTNESS					
ACCORDING TO STANDARD	RATED VOLTAGE (kV)	RATED CURRENT (A)	LIGHTING IMPULSE (kV)	POWER FREQUENCY (kV)		CREEPAGE DISTANCE MIN. (mm)	ARCING DISTANCE MIN. (mm)	LEE PROTECTED LINE MIN. (mm)
				DRY	WET			
UNEL 38144-74	12	250	75	28	—	305	235	165
UNEL 38144-74	24	250	125	50	—	450	310	212
UNEL 38144-74	36	250	170	70	—	607	408	288

FIXING INSTRUCTION



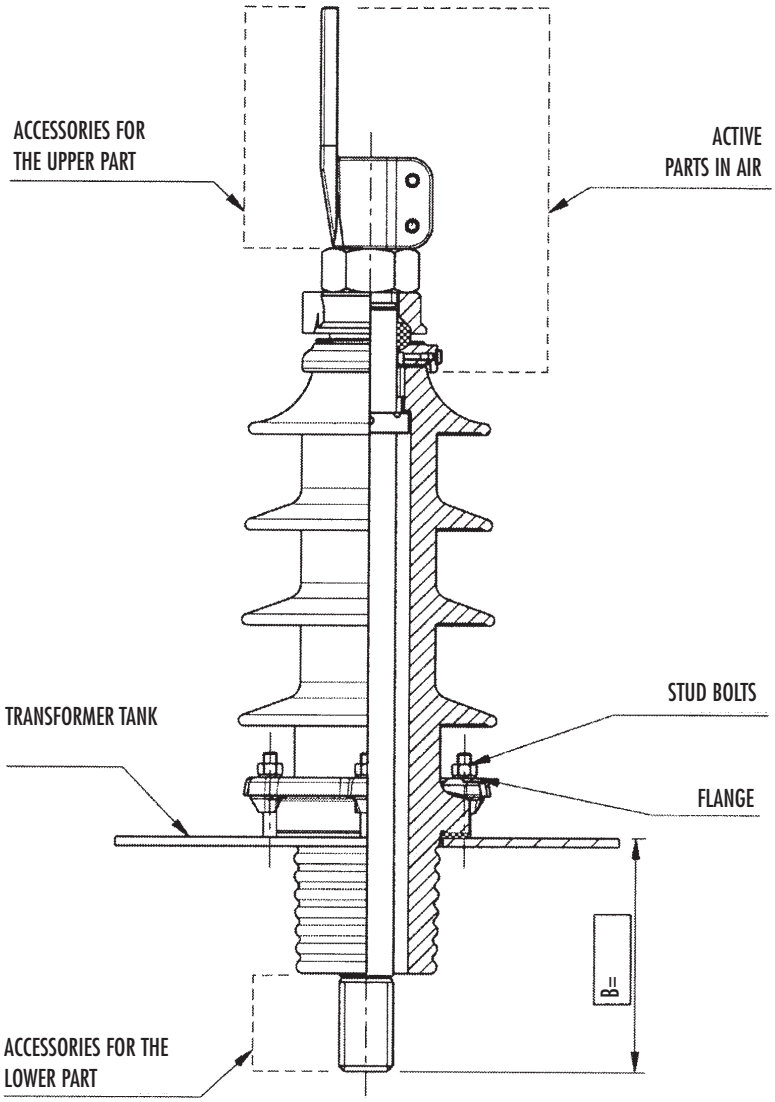


FIXING	TYPE OF BUSHING	α	N° of bolt	D±1	D1	D2	D3	L1
A	12kV-36kV / 250A DIN - UNEL	90°	4	Ø 78	Ø 111	Ø 123	M10	55
B	12kV-36kV / 360A DIN - UNEL	60°	6	Ø 90	Ø 128	Ø 140	M10	55
C	12kV-36kV / 1000A DIN - UNEL	60°	6	Ø 110	Ø 163	Ø 180	M12	65
D	12kV-36kV / 2000A - 3150A DIN - UNEL	60°	6	Ø 135	Ø 183	Ø 200	M12	65
E	52kV / 1000A - 3150A DIN - UNEL	60°	6	Ø 135	Ø 184	Ø 200	M12	70
F	24kV - 36kV / 5000A - 8000A DIN	36°	10	Ø 200	Ø 255	Ø 280	M12	75
G	12kV – 36kV / 1000A CENELEC	60°	6	Ø 110	Ø 165	Ø 185	M12	60
H	12kV - 36kV / 2000A - 3150A CENELEC	60°	6	Ø 135	Ø 185	Ø 205	M12	60
I	24kV - 6300A COMEM	60°	6	Ø 176	Ø 223	Ø 240	M12	75

ORDER SHEET

B16

WARNING: Fill out the sheet only if it is different from the specific relevant standard



B= (specify only if different from standard)

- **VOLTAGE (kV):** .....
- **CURRENT (A):** .....
- **RELEVANT STANDARD:**
  - ❑ DIN
  - ❑ UNEL Catalogue page: .....
  - ❑ Other: .....
- **ACTIVE PARTS IN AIR:**
  - ❑ Tinned 10 µm
  - ❑ Silver-plated 3 µm
  - ❑ Other: .....
- **FIXING COMPONENTS:**
  - ❑ Galvanized steel
  - ❑ Stainless steel
- **FLANGE:**
  - ❑ Aluminum
  - ❑ Galvanized steel
  - ❑ Stainless steel
- **GASKETS:**
  - ❑ NBR (-25 °C/+115 °C)
  - ❑ NBR (-40 °C/+115 °C)
  - ❑ VITON (-10 °C/+150 °C)
  - ❑ Special type: .....
- **ARCING HORNS:** ❑ YES ❑ NO

- **CONSTRUCTION DETAILS ACCORDING TO CUSTOMER SPECIFICATIONS:** .....

.....

- **ACCESSORIES FOR THE UPPER PART:**

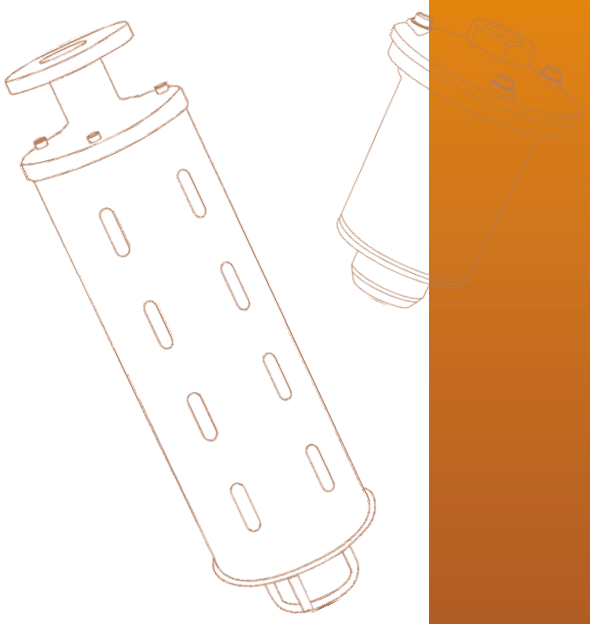
Flag: ❑ Type: ..... ❑ Customer drawing: .....

- **ACCESSORIES FOR THE LOWER PART:**

Flag: ❑ Type: ..... ❑ Customer drawing: .....

Nuts: ❑ Type: .....

- **NOTES:** .....



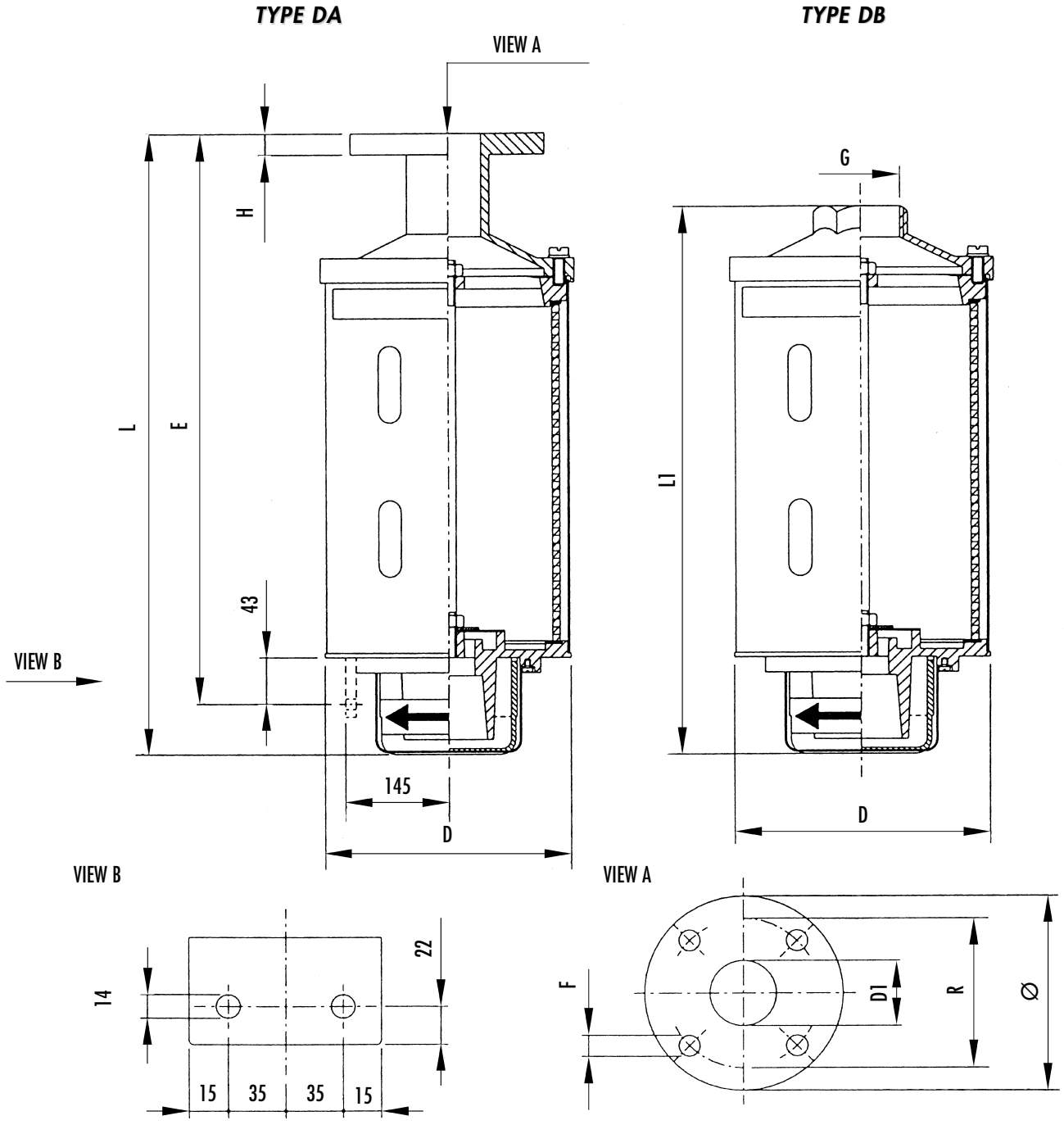
AIR DEHUMIDIFIERS

comem®

HYDRAULIC DEHUMIDIFIERS WITH FLANGE

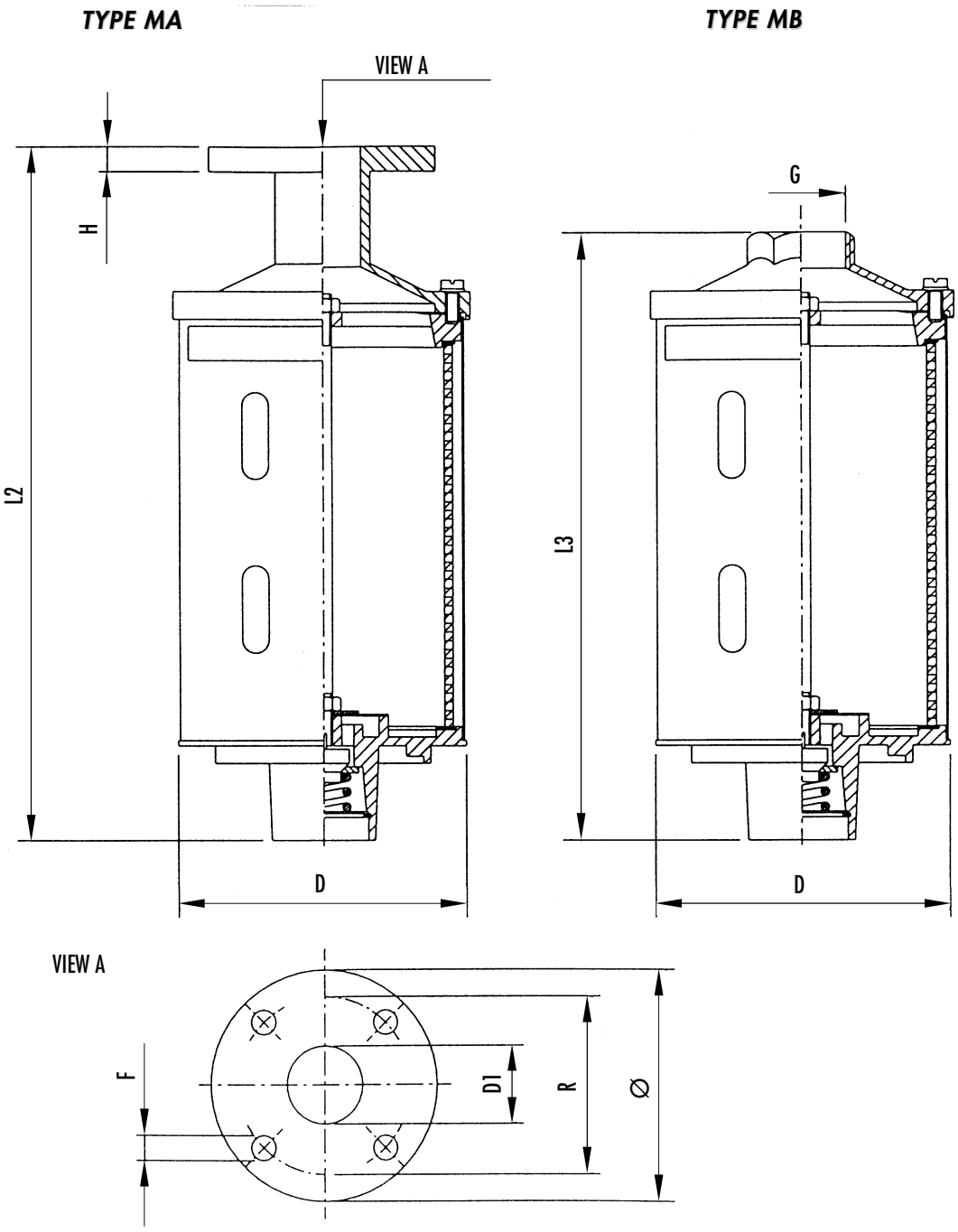
MECHANICAL DEHUMIDIFIER WITH FEMALE THREAD

SUMMARY TABLE FOR TYPE DA-DB DEHUMIDIFIERS



Type	L Toll. ± 5	L1 Toll. ± 5	D1	H	Ø	R	F	G UNI-ISO 228	E	D Toll. ± 5	*Weight* *Type* **DA** kg	*Weight* *Type* **DB** kg
2	265	210	30	12	100	75	12	G 1″	-	140	3	2.7
3	360	310	44	14	130	100	14	G 1″½	-	175	5.4	4.95
4	610	560	44	14	130	100	14	G 1″½	-	175	9.35	8.75
5	675	625	57	15	140	110	14	G 2″	-	220	16.7	16.5
6	895	845	57	15	140	110	14	G 2″	-	220	22.5	22.2
7	840	-	57	15	140	110	14	-	728	330	40,6	-
8	1225	-	57	15	140	110	14	-	1113	330	65,3	-

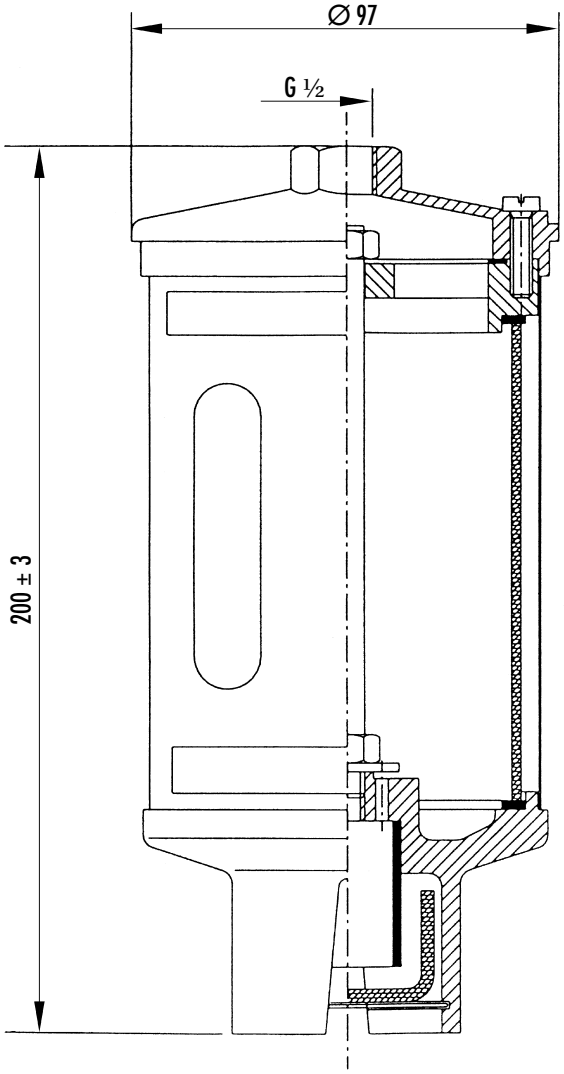
SUMMARY TABLE FOR TYPE MA-MB DEHUMIDIFIERS



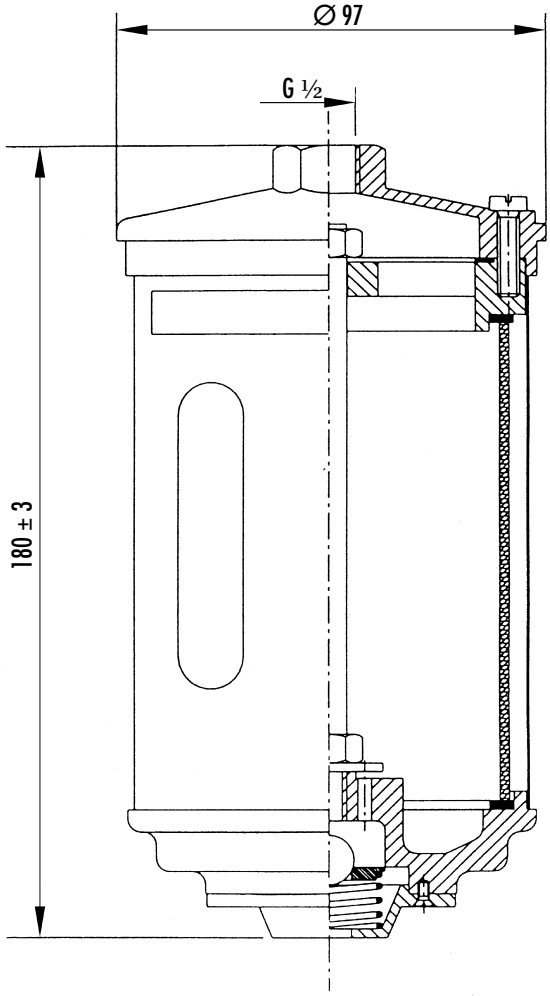
Type	L2 Toll. ± 5	L3 Toll. ± 5	D1	H	Ø	R	F	G UNI-ISO 228	D Toll. ± 5	*Weight* *Type* **MA** kg	*Type* **MB** kg
2	260	210	30	12	100	75	12	G 1″	140	2.7	2.5
3	350	300	44	14	130	100	14	G 1″½	175	5.2	5
4	600	550	44	14	130	100	14	G 1″½	175	8	7.8
5	660	615	57	15	140	110	14	G 2″	220	16.5	16.2
6	880	835	57	15	140	110	14	G 2″	220	22.5	22.2

SUMMARY TABLE FOR TYPE 1 DB-MB DEHUMIDIFIERS

TYPE 1DB



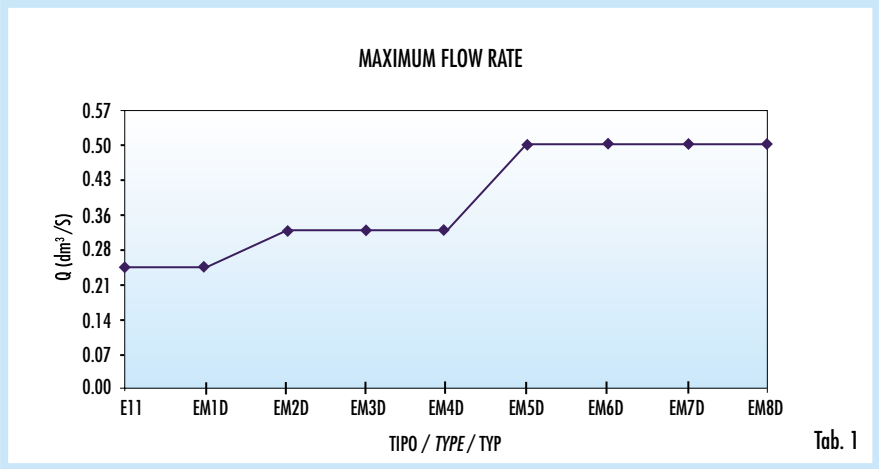
TYPE 1MB



COD.	*Type*	SILICA GEL dm^3	Weight kg
1EM01DB000	EM1DB	0.5	1.15
1EM01MB000	EM1MB	0.5	1.15
1EC01DB000	EC1DB	0.5	1.3
1EC01MB000	EC1MB	0.5	1.3

AIR DEHUMIDIFIERS FOR TRANSFORMERS

Air dehumidifiers are transparent jars that contain salts of chemically pure silicon oxide (called silica gel) with coloured indicator.
The air sucked inside the transformer passes through these jars, due to the thermal contraction of the oil mass.
Silica gel absorbs air humidity and prevents oil contamination.
The colour variations are shown on the dehumidifier label.
At this point, the salt contained in the dehumidifier must be replaced with new salts or regenerated (see "maintenance instructions").
A special characteristic of silica gel is its capacity to absorb atmospheric humidity.
To choose the correct type of dehumidifier, refer to table 3.



Tab. 1

TECHNICAL FEATURES

The upper (3) and lower (7) (see fig. 2) parts consist of compact, corrosion-proof aluminium alloy castings. The transparent tube (6) containing the salts (5) is made of polycarbonate that resists transformer oils, UV light, slightly corrosive atmospheres and tropical and marine climates. On request this tube can be furnished in tempered glass that is particularly suited for desert-site installations (where sandstorms may take place or strongly acid atmospheres). This tube is protected by a stainless steel cylinder (4) against accidental blows, with opening to allow for visual inspection of the salts.
A closing system in the lower part (7) prevents continued air contact with salts. This closing system can be mechanical (2) or hydraulic (7), and it allows for air passage in both directions (inlet and outlet) only when there is a different pressure inside and outside the transformer. Pressure load loss values of the air when passing through dehumidifiers are as follows: 0,003 kg/cm^2 for inlet air, and 0,005 kg/cm^2 for outlet air.
Between the salts and the closing system there is a labyrinth system. This has the double purpose of diffusing inlet air uniformly, and to avoid that any salt dust may damage the closing system. Dehumidifiers in size from 1 up to 6 are available with mechanical and hydraulic closing whereas 7 and 8 are only available with hydraulic closing system.
The graph in fig. 1 shows dehumidifier flow capacities in dm^3/s (indicative).

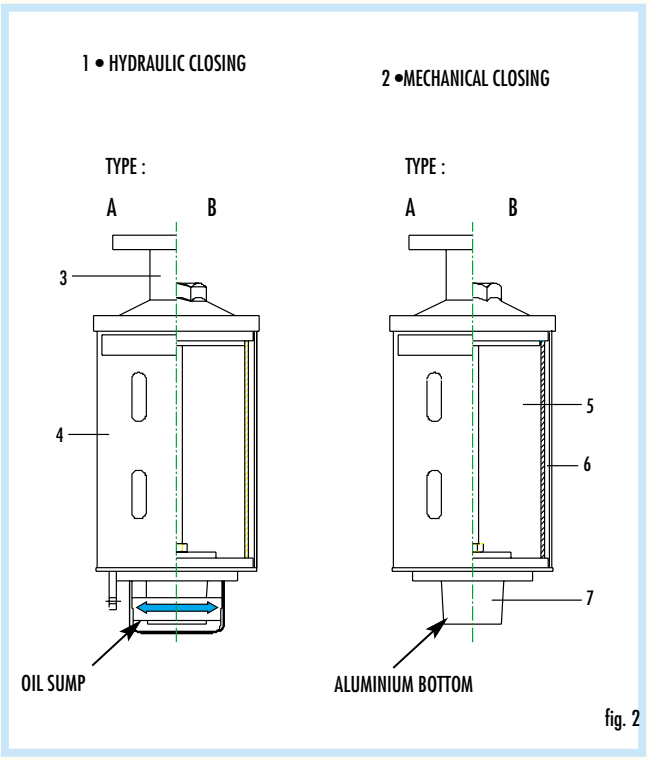


fig. 2

ORDER CODE

Insert the appropriate letters to complete the code:

1	E		0				0	0	0

Type of assembling system: A = with flange
B = with female thread assembling unit

Type of closing: D = hydraulic
M = mechanical

Insert the number that identifies the size: from 1 to 8

Type of installation environment:
- desert climates or highly acid atmospheres: letter C
- slightly corrosive atmospheres, tropical or marine climates: letter M
(the letter M corresponds to the COMEM standard for normal installations).

ASSEMBLING DIRECTIONS

The top of the units is made with two assembling systems:
• with PN 6 UNI 2276-67 flange, indicated by the letter A (version not available for sizes 1, E11, E1S);
• with female thread, indicated by the letter B (version not available for following sizes 7 and 8).
Table 4 shows the absorption characteristics of the salt which, together with the capacities given in table 1, make it possible to select the most suitable dehumidifier. When they are assembled, it is recommended to remove the plugs and the hydraulic seal must be activated pouring mineral oil in up to the mark on the jar (the oil level, once the sump is mounted on the bottom, must correspond with the mark in the sump). Install connection pipelines from the conservator to the dehumidifier with nominal air passage diameters that are the same as the size of the flange or threaded connection to avoid choking off the flow of inlet or outlet air).

PROTECTION OF OUTER SURFACES

(according to COMEM NT-03 technical standards)
Outer surfaces in aluminium alloy are first sandblasted and degreased and then covered with a double coat of highly protective paint that protects against all harmful weather conditions, and that resists both high and low temperatures. External hardware is made entirely out of AISI 304 stainless steel.

SPECIAL DESIGNS

We recommend, for desert installations or in the presence of sandstorms and highly acid atmospheres (with high concentrations of sulfur dioxide H_2S), replacing both the sump and the polycarbonate tube with tempered glass units and applying the special paint process which employs a double coat of epoxy primer before proceeding with standard finish.

IDENTIFICATION MARKS

The sign identifying the unit consists of:
1• Letter E = Air dehumidifier
2• Letter M = Polycarbonate tube and sump
Letter C = Tempered glass tube and sump
3• Number = from 1 to 8 to identify the size
4• Letter D = Hydraulic closing
Letter M = Mechanical closing
5• Letter A = Flange assembling system
Letter B = Female thread assembling system

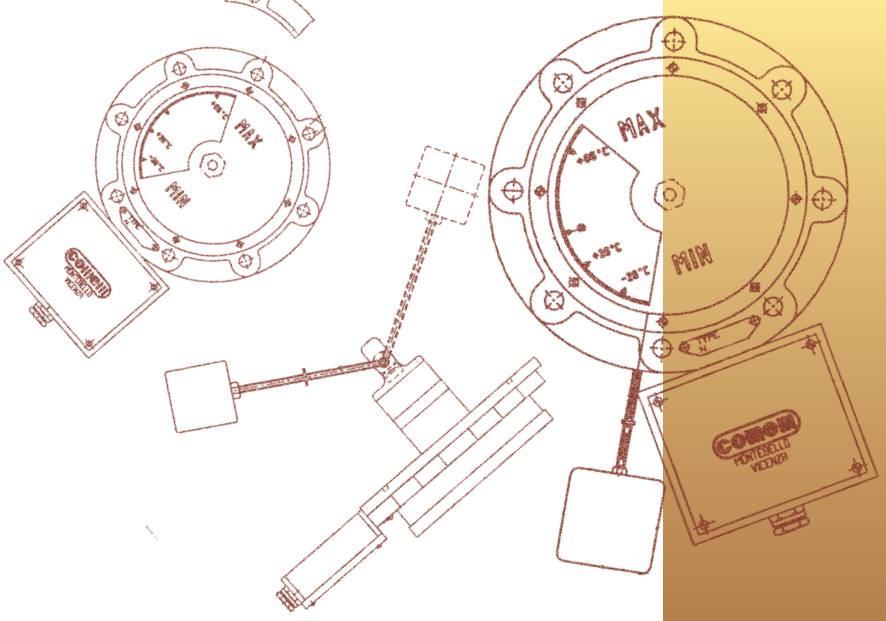
Example: **EM 3 DB** = Air dehumidifier with polycarbonate tube and sump - size 3 - hydraulic closing - female thread assembling system.

TAB. 3

Type	SILICA GEL dm³	*Weight* kg
1	0,46	0,37
2	0,95	0,76
3	2,75	2,2
4	6,50	5,2
5	13,3	10,5
6	19	15,2
7	32	25,6
8	58	46,3

TAB. 4

Equilibrium capacity for water vapour at 25 °C and given relative humidity	
10% R.H.	6.4 w.t.%
20% R.H.	10.7 w.t.%
40% R.H.	22.7 w.t.%
60% R.H.	33.3 w.t.%
80% R.H.	36.3 w.t.%



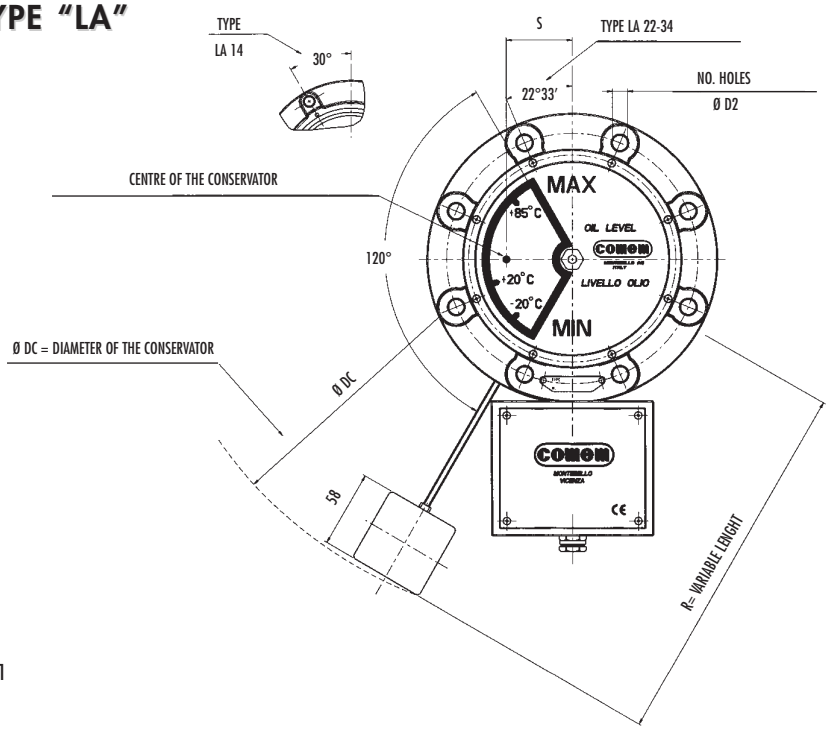
LEVEL GAUGES WITH MAGNETIC JOINT

L 14 - L 22 - L 34

comem®

LEVEL GAUGES WITH MAGNETIC JOINT
SIZE Ø 140/220/340

TYPE "LA"



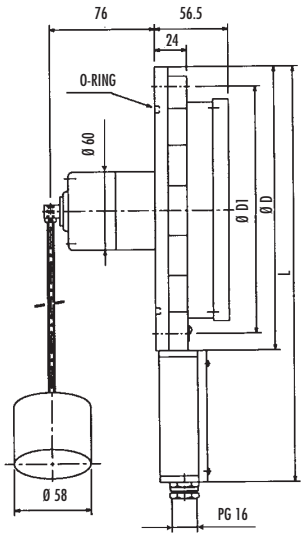


fig. 1

R = (DC/2 - 10) x 1.15 S = (DC/2-40) x 0.577

TYPE "LB"

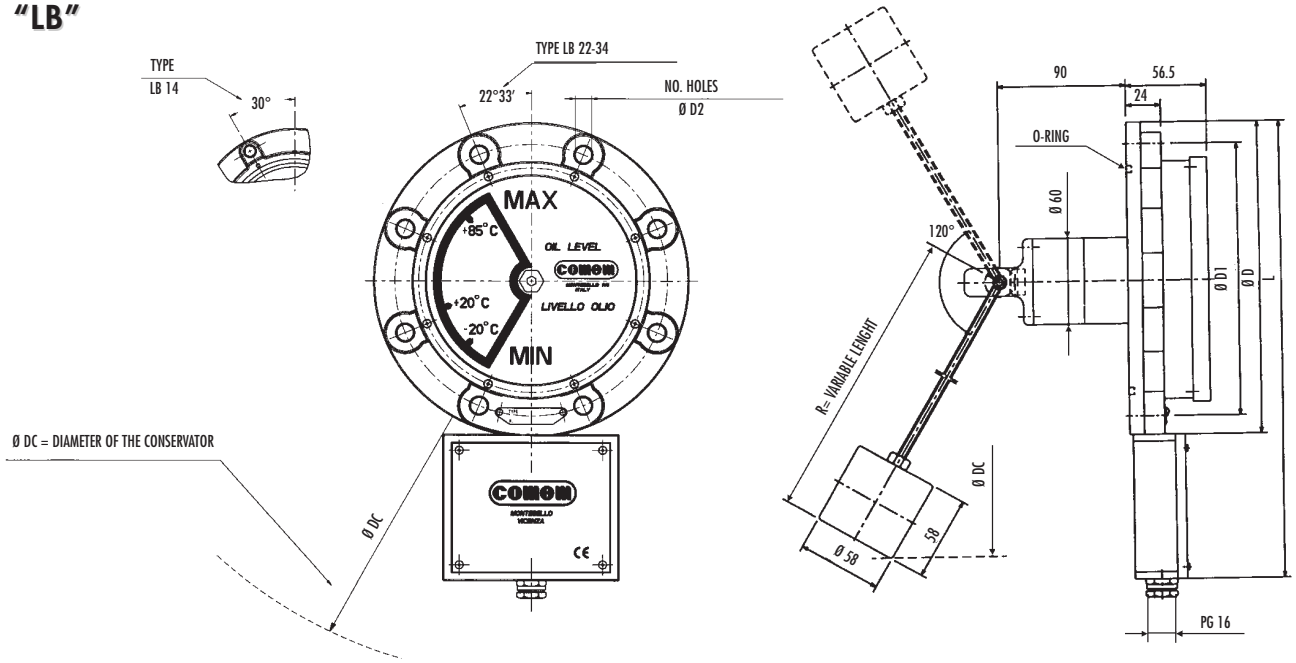


fig. 2

R = (DC/2 - 10) x 1.15

TYPE OF GAUGE	Ø D	Ø D1	Ø D2	NO. HOLES	L	O.RING TYPE	WEIGHT kg	R STANDARD
LA14	140	125	7	6	245	O.R. 186 (6362)	1.40	max. 370
LA22	220	190	11.5	8	325	O.R. 221	2.30	max. 550
LA34	340	305	18	8	445	O.R. 248 (81000)	6.00	max. 710
LB14	140	125	7	6	245	O.R. 186 (6362)	1.70	max. 370
LB22	220	190	11.5	8	325	O.R. 221	3.60	max. 550
LB34	340	305	18	8	445	O.R. 248 (81000)	6.30	max. 710

DIMENSIONS IN MILLIMETERS

LEVEL GAUGES WITH MAGNETIC JOINT

The level gauges with a magnetic joint are composed of a sturdy watertight body of aluminium alloy painted against corrosion. The movement of the float rod and the gauge disk takes place by means of magnetic coupling through an angle of 120°. In this way, for every variation in the level of the liquid there is a corresponding rotation of the magnet with consequent variation of the indication on the dial of the gauge. The gauge disk is coloured white and red. The system is closed with a screen-printed polycarbonate disk with reference marks corresponding to the levels that the oil should reach at the following temperatures in degrees Centigrade: -20°C, +20°C, +85°C. **Note**: special dials may be made on request.

READING THE INDICATIONS OF THE VARIOUS LIQUID LEVELS

- **Minimum level**: when the dial shows all red.
- **Maximum level**: when the dial shows all white.
- Intermediate indications between **MAX** and **MIN**: the dial shows part white and part red. Remember that the amount of red shown indicates, in proportion, the part of the conservator left without liquid.

FLOAT MOVEMENT

This may be in the radial direction of the conservator (type "LA") or in the axial direction (type "LB"), as shown in the drawing (Fig. 1 and 2).

FLOAT ROD

This is completely threaded. If the length is not specified (distance R in the drawing, fig. 1 and 2), the standard size indicated on the table is supplied.

ELECTRIC INDICATION

These level gauges are fitted with microswitches for indicating the minimum and maximum oil level.

ELECTRIC CHARACTERISTICS

- Power supply:	24 to 220 V a.c. or d.c.
- Interruption power:	3 A 125/250 V ac (resistive)
	0.5 A 125 V dc for inductive load L/R = 40 ms
	0.25 A 250 V dc for inductive load L/R = 40 ms

INDICATING INTERVENTION

The electric microswitches intervene with an advance angle of 5° with respect to the indications of the minimum or maximum oil level in the conservator. When there is a double contact on MIN and/or MAX, the second contact intervenes about 5° after the first contact. After installation of the gauges it is possible to check the correct operation of the microswitches and, in general, good operation of all the internal parts of the gauge by proceeding as follows:

- Remove the cap situated in the centre of the dial on the front of the level gauge, unscrewing it in an anticlockwise direction.
- Insert a screwdriver in the slot provided and turn the gauge disk until the electric circuit connected to it switches on or off.
- Close the cap again, being particularly careful to position the O-ring (O.R.) correctly under the cap and to screw the cap on quite firmly.

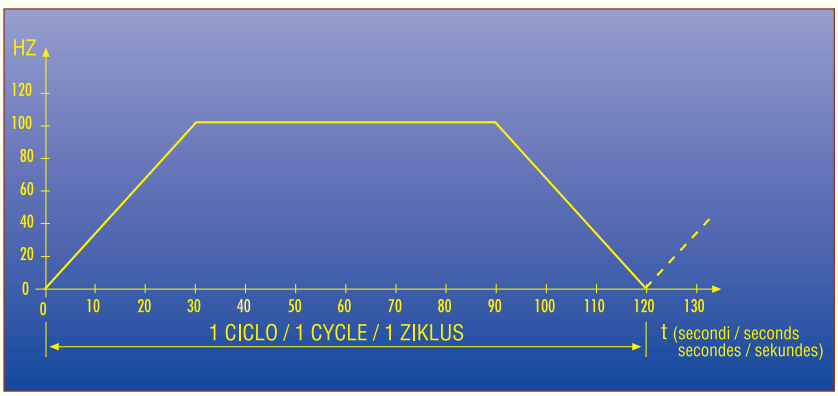
RESISTANCE TO VIBRATIONS ON THE ELECTRIC CONTACTS

Tests have been carried out according to the procedures illustrated below in graph (10 cycles), with an amplitude of oscillation of 2 mm and in normal working conditions. No contacts gave any sign of closing or opening.

NOTES

External nuts and bolts made of stainless steel.
External painting in grey RAL 7001.
Degree of protection: IP 54.
Working temperature. All the level gauges are suitable for working with:

- Oil temperature between:	-25°C and +120°C
- Environment temperature between:	-25°C and +60°C



INDICATIONS FOR ASSEMBLY

The level gauges which have float movement in the radial direction of the container (type "LA") must be fitted offset with respect to the horizontal axis of the conservator (distance "S" fig. 1) so as to have an exact indication of the minimum and maximum oil level.
Those with movement in the axial direction (type "LB") must be fitted in the centre of the conservator. The measurements of the movements (distance "S") and the length of the rod (distance "R") are obtained from the formulae given under fig. 1 and 2. It is good practice to check operation of the gauge after having fitted it on the conservator.For further and more detailed information, see the technical information card supplied.

TESTS AND INSPECTIONS

The level gauges are subjected to insulation test towards earth as follows: 2.5 kV AC 50/60 Hz for 72 seconds. The bodies of the level gauges, after having passed the dimensional inspection and without their internal parts, are tested for watertightness so as to eliminate those that have leaks. Final testing is carried out when the level gauge is completely assembled. The sensitivity of all the signalling movements and the accuracy of their assembly are scrupulously checked.

IDENTIFICATION MARKS

The mark that completely identifies the type of level gauge is composed of a series of letters and numbers according to the following pattern:

1 (letter)	**L**	Level gauge
2 (letter)	**A**	Movement of the radial float (fig. 1) (letter)
	B	Movement of the axial float (fig. 2)
3 & 4 (cifra)	**14**	Size of the level gauge = Ø 140 mm
	22	Size of the level gauge = Ø 220 mm
	34	Size of the level gauge = Ø 340 mm
5 (lettera	**K**	Wiring diagram with 1 contact on min.
	Y	Wiring diagram with 2 contacts on min.
	X	Wiring diagram with 1 contact on min. + 1 contact on max.
	W	Wiring diagram with 2 contacts on min + 2 contacts on max.
6 (lettera)	**O**	Ordinary paint
	S	Paint for corrosive environments
7 (lettera)	**N**	COMEM standard level gauge
	S	Specific level gauge for customer

Example : **LA14XON**
Level gauge with radial movement, diameter 140 mm, wiring diagram with 1 contact on minimum and 1 contact on maximum, painted for normal environments and with standard COMEM dial and rod length.

WIRING DIAGRAMS

DIAGRAM TYPE "K"

1 CONTACT ON MINIMUM LEVEL

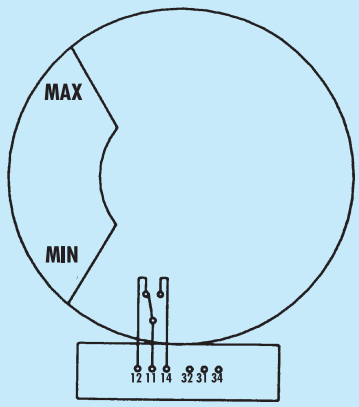


DIAGRAM TYPE "Y"

2 CONTACTS ON MINIMUM LEVEL

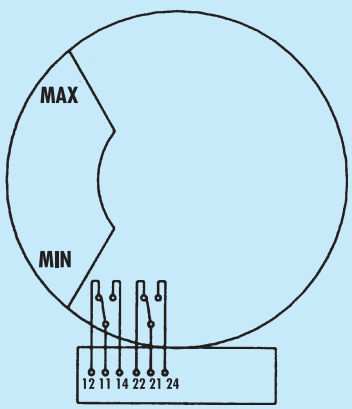


DIAGRAM TYPE "X"

1 CONTACT ON MIN. LEVEL +
1 CONTACT ON MAX. LEVEL

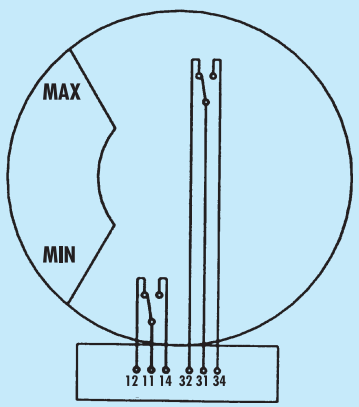
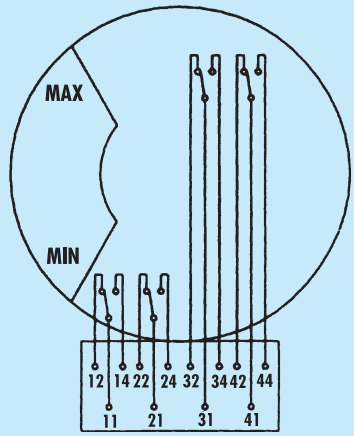
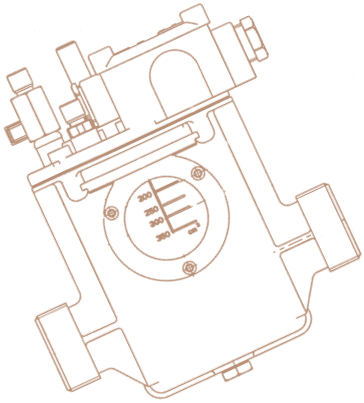
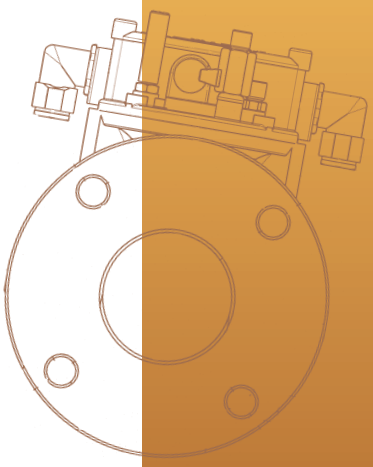


DIAGRAM TYPE "W"

2 CONTACTS ON MIN. LEVEL +
2 CONTACTS ON MAX. LEVEL



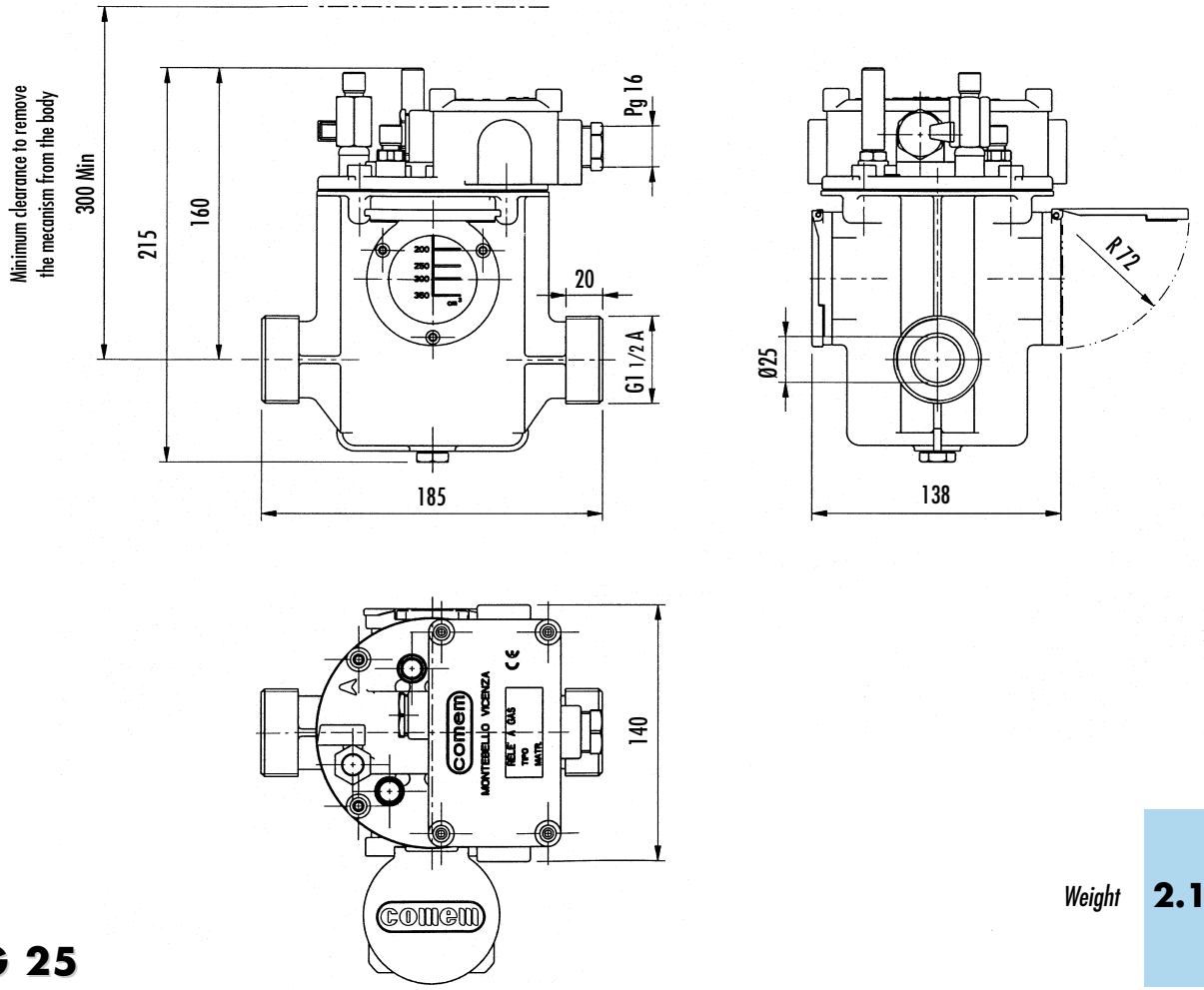




GAS-ACTUATED RELAYS
BUCHHOLZ TYPE
AND
GAS SAMPLING DEVICE

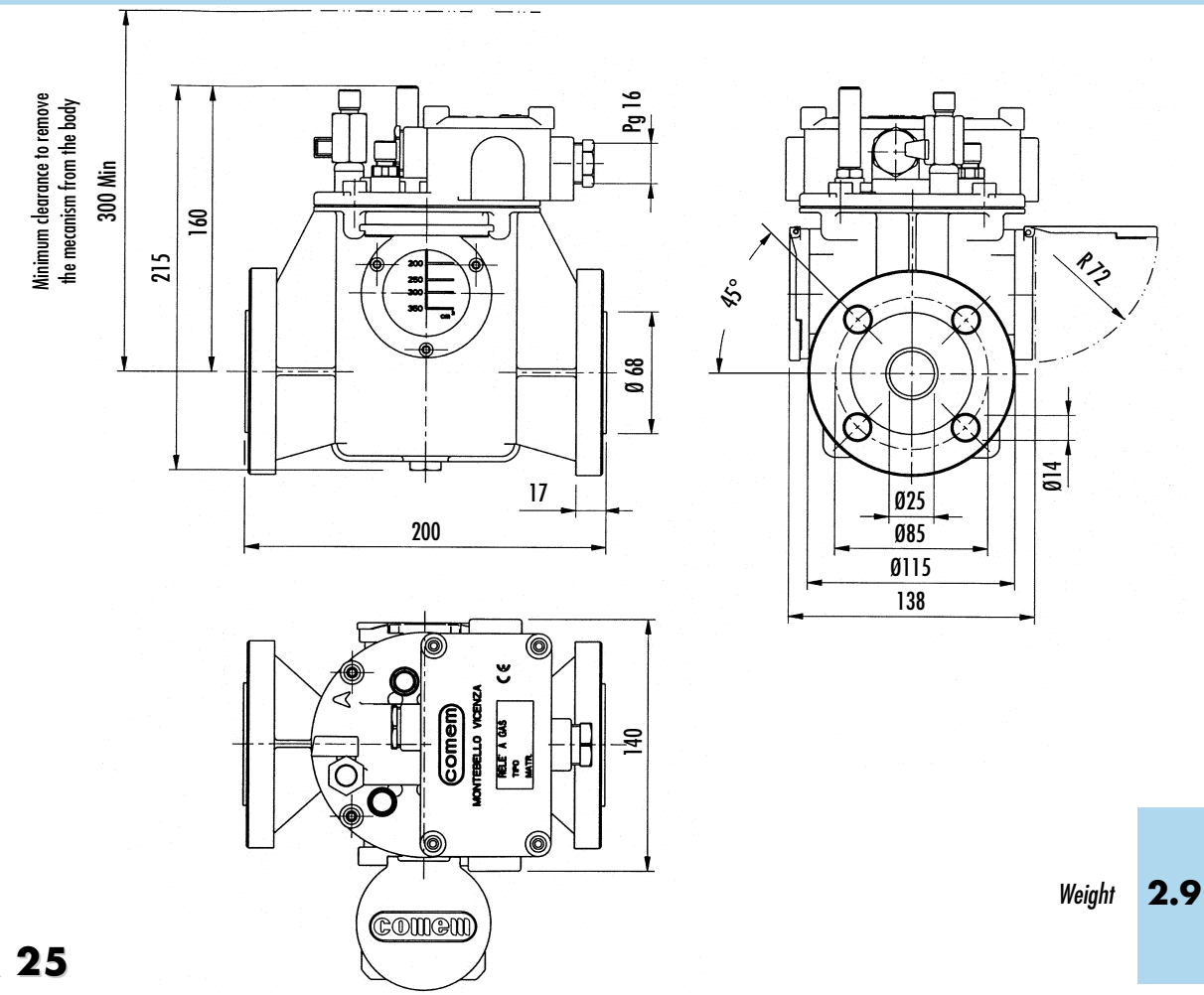
comem®

GAS-ACTUATED RELAYS BUCHHOLZ TYPE



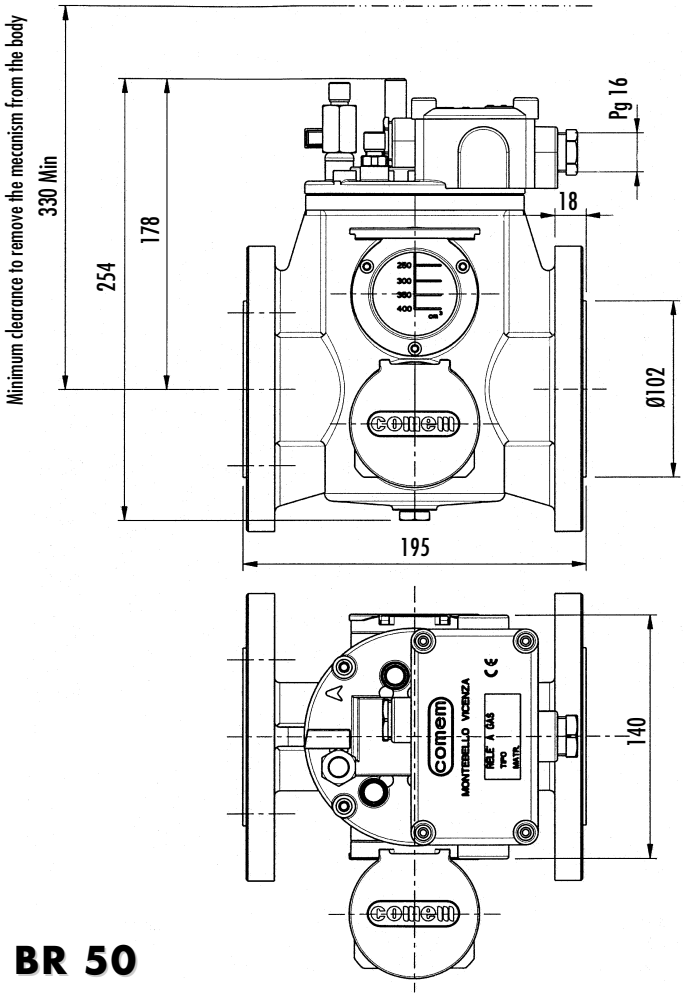
BG 25

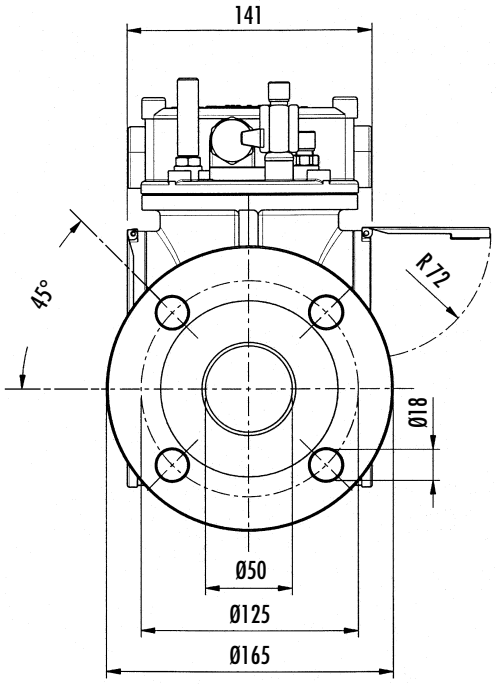
Weight **2.1 kg**



BR 25

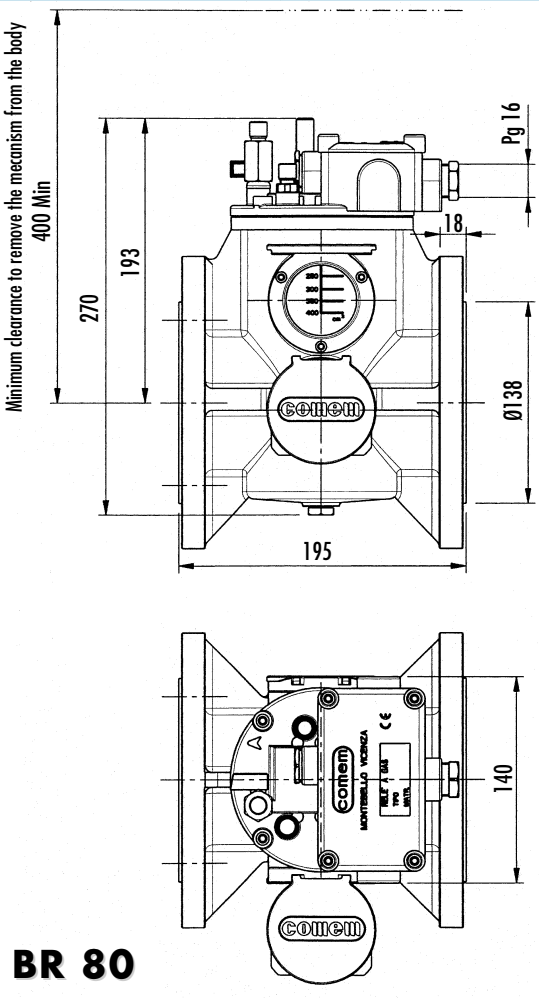
Weight **2.9 kg**

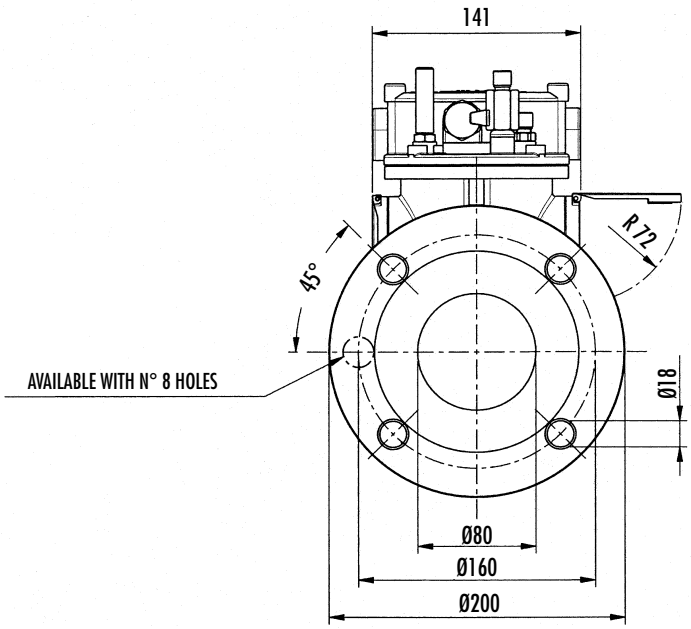




BR 50

Weight **4.9 kg**





BR 80

Weight **5.8 kg**

BUCHHOLZ GAS-ACTUATED RELAY
to CENELEC Pr EN 50216-2 standard

The generation of gas in an oil filled trasformer is a clear indication of a problem. The gas may be a result of the following:

• Decomposition/degradation of solid, or liquid insulation inside the transformer due to overheating, or arcing.

• From the outside tawards the pipeline.

• From the oil itself due to unsatisfactory de-gassing prior to filling.

Rapid oil movement in the pipeline towards the conservator is caused by an internal arc, short circuit, or hot spot which must be correctely addressed.

Oil leaks from the transformer are environmentally unacceptable and a fire hazard will lead to transformer failure.

To indicate any of the above mal functions Comem has developed a new "Buchholz" relay to comply fully whit the latest CENELEC pr EN 50216-1 and 2 standards. The new relay incorporates the very latest technology in its construction and is the result of Comems 40 years experience with these products.

PRINCIPLE OF OPERATION

The Buchholz relay is sited in the pipework between the transformer and its conservator and is filled with oil during normal transformer operation. When gas is generated in the transformer it rises towards the conservator and collects in the upper chamber of the relay.

The oil level drops and the top float triggers alarm switch.

If gas continues to be generated then the second float operates the second switch wich is normally used to isolate the tranformer.

Also connected to the second switch is the rapid oil movement vein. The operation of this vein can be adjusted to suit the transformer design and the speed of the oil.

In the event of an oil leak the Buchholz relay will only operate after the conservator has exhausted all of its oil. In order to check this eventuality it is recommended that an RDR Mk II automatic shutter valve is fitted between the Buchholz and the conservator.

Specific information on this product is available on request.

CONSTRUCTION

The new Comem Buchholz relay is an assembly of two machined aluminium alloy castings that effect a perfect oil seal.

1) The main body of the relay is fitted with tempered glass inspection windows with graduated scale markings in cubic centimetres to indicate the internal volume. The oil drain plug is located at the bottom of the main body.

2) The top cover carries the frame which contains the moving parts of the relay. These comprise the two floats and their associated switches encapsulated in glass bulbs, one calibrated flow valve and two permanent magnets.

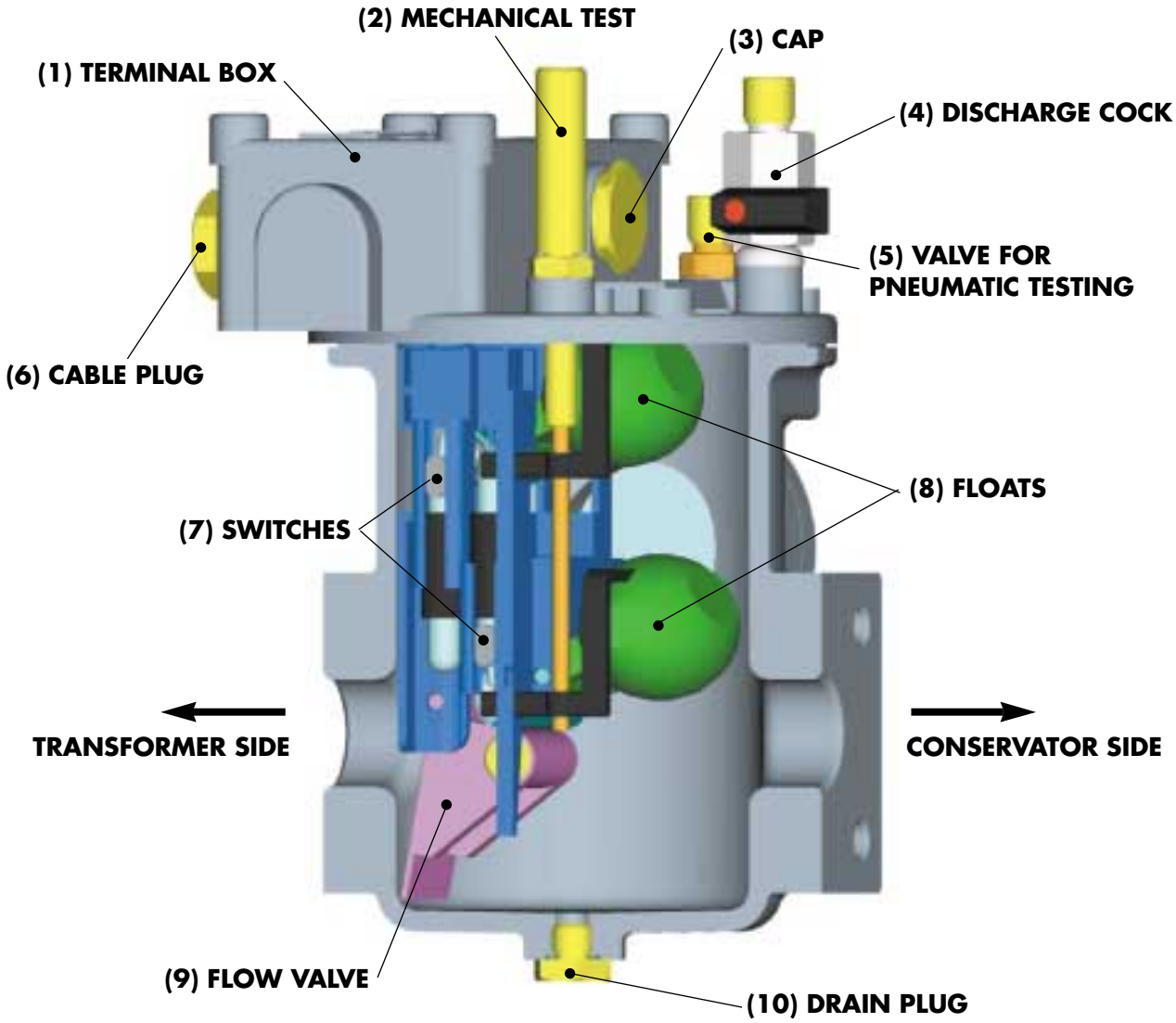
The cover also carries:

(4) a gas discharge valve with G1/8 in male thread with protective cap.

(5) A valve for pneumatically testing the alarm and isolation circuits, with protective cap.

(2) A push rod for mechanically tripping the alarm and the isolation circuits, with protective cap.

A terminal box which as standard contains 4 numbered M6 terminals and one earth terminal.



EXTERNAL COATING AND PROTECTION

To the external aluminium alloy parts is given a phosphate treatment prior to applying one coat of vinyl enamel, colour RAL7001.
This treatment has proved more than satisfactory over the years for the majority of applications including desert and tropical situations.
Hawever, in particularly severe applications (>500h saline mist) such as shipboard applications and/or applications in corrosive atmospheres (acids) a suitable epoxy primer is recommended. (This should be discussed at the time of selection).
All external brass fittings are plated and all nuts are stainless steel.

RELAY SELECTION

The size and Type of relay to be used will depend on the transformer rating and oil volume. DIN standard recommendations are given in the following table but the final choice is often as a result of the transformer manufacturers experience.

MVA TRANSFORMER POWER	NOMINAL DIAMETER
Up to 5	25
From 5 up to 20	50
From 20 up to 50	80
Over 50	100

tab. 1

TECHNICAL DATA

- The relay pipework is typically mounted at 2,5 degrees to the horizontal. Installation is possible with a maximum inclination of 9 degrees. Special calibration of the relay is necessary at this extreme.
- Operating pressure - 1 bar, tested to 2,5 bar for 2 minutes @ 115 deg C.
- Gas volume to trip alarm:

BUCHHOLZ RELAY TYPE	ALARM VOLUME NECESSARY TO TRIP THE ALARM
BG 25, BR 25, BS 25, NF 25, C 01 , C 1	125 cm^3
NF 50, NF 80	125 cm^3
BR 50 , BS 50 , BR 80, BS 80, C 4	235 cm^3

tab. 2

- Rate of oil flow in m/s to trip isolation. In the following table standard values are highlighted with an '**O**' available on request with an '**X**' and not available with a '//'.

INSIDE PIPE DIAMETER	1,0 m/s	1,5 m/s	2,0 m/s
25	**O**	**X**	//
50	**O**	**X**	//
80	**O**	**X**	**X**
100	//	**O**	**X**

tab. 3

- The relay operates within 0,5 seconds.
- Oil temperature between -25 and +115 deg C.
- Ambient temperature between -25 and +60 deg C.
- Degree of Protection IP55 to EN 60529.

SWITCH ELECTRICAL DATA

Rated switch current is **2 A r.m.s**. with max. **10 A r.m.s.** as short term 30 ms current value.
Breaking power is specified in the following table:

VOLTAGE	CURRENT	BREAKING POWER	
48 - 127 V d.c.	2 A	250 W	L/R < 40 ms
230 V a.c.	2 A	400 VA	cos φ > 0,5

Minimum switch life 1000 maneuvers..

tab. 4

Dielectric contact voltage as specified in the following table:

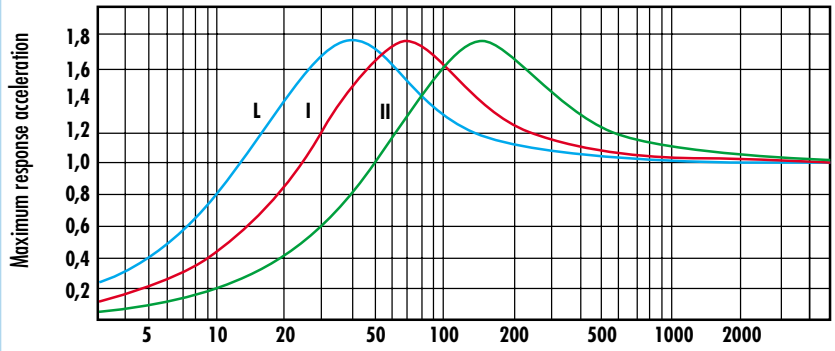
	SHORT TERM INDUSTRIAL FREQUENCY LEAKAGE TEST kV/1 min. (r.m.s)	RESISTANCE VOLTAGE PER PULSE kV (peak)
Between circuits and ground	2.5	5
Across open contacts	1	3

tab. 5

TESTING

The following Type Tests have been performed on the relay.

- Measurement of the volume of gas necessary to trip the alarm.
- 500 hr saline mist test (Ref EN 60721-3-4)
- Electromagnetic Field Test. Relay does not trip in field strength up to **25 mT** (ref pr EN 50216-2).
- Stationary sinusoidal mechanical vibrations. Tests according to EN 60721-3-4 standards have been performed.
  a) class **4M4** vibration test applied in sites where vibrations are transmitted from machinery and vehicles. Not suitable for machines exposed to high vibration and shock levels. Three-axis movement was impressed to the relay using special equipment with stationary sinusoidal vibrations from **2** to **200 Hz.** Movement had a constant **3 mm** (6 mm peak-peak) amplitude in the range from **2** to **9 Hz** whereas above this frequency it had constant **10 m/s²** acceleration. The alarm and release switches did not trip.
  b) non-stationary vibration tests with vertical shock with **250 m/s²** acceleration with type I spectrum (duration 11 ms) as shown in the graph below. Alarm and release contacts did not trip.



Example duration of a sinusoidal half pulse:

Type L spectrum: 22 ms duration

Type I spectrum: 11 ms duration

Type II spectrum: 6 ms duration

- A seismic test was also performed according to PR EN 50216-1 standards that refers to EN 60068 class 0, level 2 standards.
  The test consists of application of a **9 m/s²** horizontal acceleration and a **4.5 m/s²** vertical acceleration, increasing frequency one octave per minute. No activation of alarm or release switches was encountered.
- Pressure Withstand Test 2.5 bar for 2 minutes with oil at 100 deg C.
- Vacuum Withstand Test of 2500 Pa for 24 hrs.
- Rate of oil flow test to operate trip contcts, (as shown in table 3).
- Test to show the relay is insensitive to oil flow from conservator to transformer.
- Electrical tests per table 5.

ROUTINE TESTS

The following Routine Tests are applied to all relays.

- Hydraulic seal test in mineral oil at 90 deg C and 100 kpa pressure for 30 minutes.
- Contact operation via mechanical push rod.
- Contact operation by lowering the oil.
- Rate of oil flow to trip contacts.
- Electrical resistance test between contacts (as table 5).
- Electrical resistance test between contacts and earth (as table 5).

An individual routine Test Report is shipped with each relay

RELAY OPERATING TEST

The following Site Tests can be performed when the relay is installed on the transformer
The Alarm and Trip contacts can be tested either manually by the push rod (2) - mechanical test, or by the introduction of air into the relay through valve (5) - pneumatic test.
A bicycle pump can be utilised for this test or a kit article n° **5400806002** is available from Comem.
To effectively test the rate of flow of oil is a complex test requiring specialised equipment. Should this test be required other than as a type test then Comem can perform this on request at the time of the order.

INSTALLATION INSTRUCTIONS

The following installation procedures must be observed for proper relay operation:

- The red arrow on the relay must point towards the conservator.
- The relay must always be full of oil, which means that the minimun oil level in the conservator must be higher than the relays breather valve.
- The recommended inclination of the relay pipework is 2.5 degrees from the horizontal. The maximum angle is 9 degrees.
- The pipe from the transformer to the relay must exit the transformer at the highest point.
- The pipeline upstream from the relay has to be straight and with a length equal to **5-10 times** the pipeline diameter, at least.
  Down stream from the relay, pipeline length has to be **3 times** the pipeline diameter, only. It must rise up towards the conservator.

RELAY ORDER FORM

Chosen size and model (see drawings and table 1):

BG 25	BR 25	BR 50	BR 80	BR 80 8 holes	BS 25	BS 50	BS 80	NF 25	NF 50	NF 80	C 01	C 1	C 4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Electric contact layout (meaning with relay filled with oil and operating):

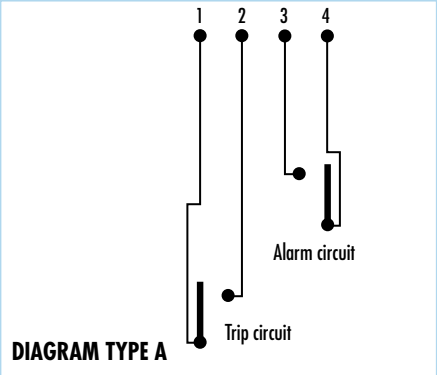


DIAGRAM TYPE A

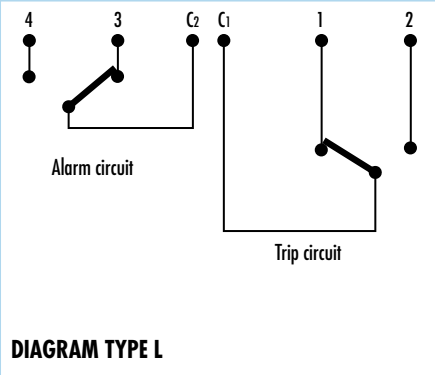


DIAGRAM TYPE L

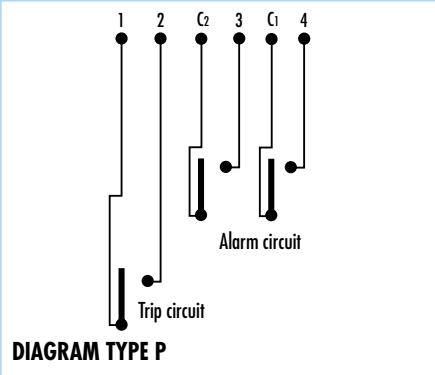


DIAGRAM TYPE P

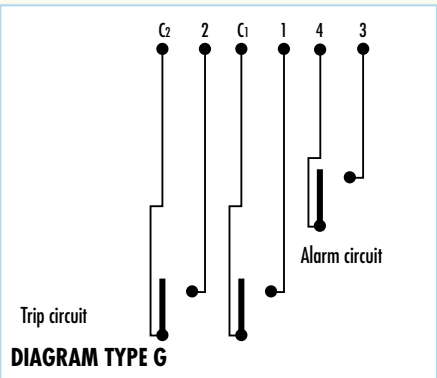


DIAGRAM TYPE G

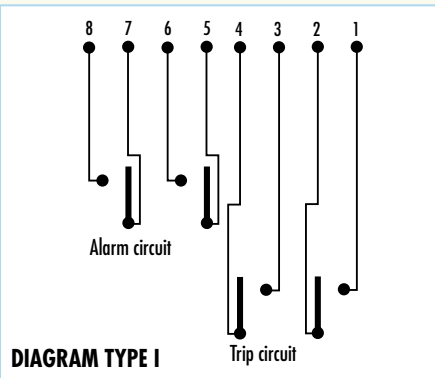


DIAGRAM TYPE I

Special version

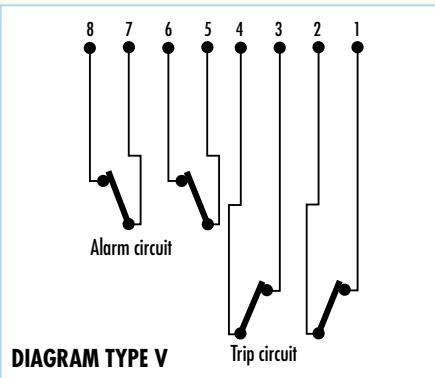


DIAGRAM TYPE V

Special version

A	L	P	G	I	V	Other
☐	☐	☐	☐	☐	☐	☐ _____

Chosen seals:

A	B	C	Other
☐	☐	☐	☐

	TYPE OF DIELECTRIC / AMBIENT TEMPERATURE/OIL		MINERAL	SILICONE	ESTERIZED
A	Ambient -25° ÷ 60° C Oil -25° ÷ 115° C	Standard version	NBR	VITON/NBR	//
B	Ambient -10 ÷ 60° C Oil -10° ÷ 115° C	Special version	//	VITON	VITON
C	Ambient -40° ÷ 60° C Oil -40° ÷ 115° C	Special version	NBR/VITON	NBR/VITON	NBR/VITON

(NBR/VITON: meaning: parts in contact with oil in VITON, parts not in contact with oil in NBR) tab. 6

Paint finish:

Standard	Corrosive environments	Other special finishes
☐	☐	☐ _____

LIQUID FILLED THERMOMETERS

Description and general specification

These instruments are used to detect the temperature in the oil filled transformers and are made for outdoor mounting as well tropical or artical climates (ambient temperature range: -30/+70°C). All components are made of corrosion resistant materials or surface treated materials.

NOMINAL DIAMETER : 100mm. or 150mm.

TEMP. SENSING SYSTEM : expansion type (liquid filled system), compensated for ambient temperature changing by means of a bimetallic spring.

CAPILLARY PROTECTION :
- protective copper tubing
- flexible galvanized iron+PVC tubing
- flexible AISI 304 tubing.

BULB : brass or stainless steel.

CASING : Stainless steel. On request case can be provided with an air breather device.

LOCKING CLEAR WINDOW : glass.

LOCKING RING : cromate brass.

STANDARD MEASURING RANGES :
-20/+130°C 0/+120°C 0/+150°C 0/+200°C

MEASURING ACCURACY : 1,5% of full scale value.

FINISHED PRODUCT QUALITY CONTROL TESTS

THERMOMETERS WITHOUT ELECTRIC CONTACTS for distribution transformers

Instrument calibration : carried out through termostatic baths controlled by a computer system.
The procedure varies according to instruments scale.
The calibration procedure, being the thermometer scale : 0/+120°C :
is made using 5 different baths set at the following temperatures :

bath 1 = 0°C
bath 2 = 20°C
bath 3 = 50°C
bath 4 = 100°C
bath 5 = 115°C

Calibration procedure : Step 1 : a check is carried out to see wheter the temperature taken by the instrument under test differs from that taken through the sample sensor by more than the 70% of the maximum allowed instrument reading tolerance value. This test is performed by sequentially plunging the TEMPERATURE. INDICATOR bulb into successive temperature increasing thermostatic baths : 0°C/+20°C/+50°C/+100°C/+115°C

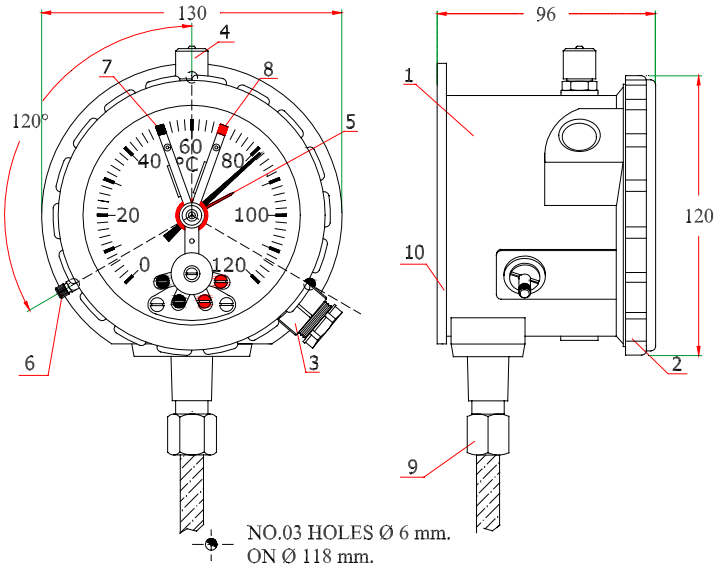
Step 2 : the instrument is heated until the instrument pointer exceeds by 20% the angular full scale value.

Step 3 : step 1 is repeated, but inversely.

Check of instrument mechanical protection degree : IP 55

POS. BENENNUNG
1 GEHAUSE
2 VERSCHLUSSRING
3 KABELVERSCHRUBUNGEN
4 ENLUFTER
5 HOCHTEMPERATURPUNKT
6 HOCHTEMPERATURKNAUF
7 ALARME KONTAKTE
8 ABHANGEN KONTAKTE
9 KAPILLAREN

ALARME 95° C
ABHANGEN 100°C



POS	DESCRIPTION
1	CASE
2	LOCKING GLASS RING
3	CABLE GLAND
4	AIR HOLE
5	MAXIMUM INDICATING POINTER
6	MAX TEMP. RESET SCREW
7	ALARM CONTACT POINTER
8	TRIP CONTACT POINTER
9	CAPILLARY OUTPUT

Thermometer typ 1187/S Ø 100
Temperature Indicator type **1187/S** Ø 100

TER.MAN.'90 Srl – Strum. Ind.le
Bollate – MILAN - ITALY

DRWG. N. 1187/S