



**EC/97/23 - PED - Art. 3.3 (SEP)**

# **BONETTI® GLASS LEVEL GAUGES USE AND MAINTENANCE MANUAL**

## **SAFETY GENERAL INFORMATION**

### **FOREWORD**

To have proper working of Cesare Bonetti S.p.A. products, any installation, start up, control and maintenance must be performed by qualified and duly instructed personnel, following prescription stated by maintenance manual.

To minimize any risk for people, goods and environment, those general instruction must be respected.

Cesare Bonetti S.p.A. is not responsible for damages outcoming from:

- use of product by non qualified personnel;
- incorrect installation;
- incorrect maintenance;
- product alteration or tampering;
- use of spares not original by Bonetti;
- non-performance of instruction stated in maintenance manual;
- extraordinary occurrence.

Any responsibility regarding correct selection of product and its proper material, depending on technical characteristic, application and purchasing standards and rules, belong to the system or plant engineer.

### **PRESSURE**

Before starting maintenance operation be sure that pressure inside product is reduced to atmospheric value and be sure that product connection piping has been correctly isolated.

**Do not trust on the Pressure Gage only to assume that pressure has been discharged.**

### **TEMPERATURE**

To avoid burning, wait until product temperature cools down completely, and use protecting gloves, eye glasses and dressing, if necessary.

### **DISPOSAL**

Product can be recycled. No environment pollution risk occurs if proper procedure has been respected.

Warning: if product contains residue of process fluid, disposal and/or recycling prescribed procedures for such fluid must be respected.

In case PTFE sealing or gaskets is fitted on product, such material must be recycled separately, according to proper and/or prescribed procedures.

### **DANGEROUS GAS OR FLUID INSIDE PIPING**

Be sure that any dangerous or flammable or explosive gas or fluid has been discharged from product and connected piping, to avoid any danger to maintenance people due to contact or inhalation

### **ENVIRONMENT DANGER**

Evaluate carefully: explosion risk, oxygen leakages, dangerous gas leakages, fire risk due to maintenance operation or welding.

### **SEALING GASKETS**

Graphite sealing gaskets to be removed or handled during maintenance, as spares, could contain thin steel layers able to injure, if non handled with care.

### **MAINTENANCE WORK**

Maintenance work must be performed or supervised by qualified, duly instructed and skilled people. Personnel in charge of products maintenance, installation or exercise must be trained to carry out procedures according to use and maintenance manual.

Verify that tools to be used for maintenance are within their scope and that they are in good condition.

If special tools are requested, verify their availability and condition.

### **STORAGE**

If products that are non self-draining are stored in low temperature, be careful to avoid or protect them from inside fluid freezing.

Good condition of stored products must be periodically verified.

### **PRODUCTS SENT BACK TO BONETTI COMPANY**

According to laws and rules for safety, health and environment preservation, if any product is sent back to Cesare Bonetti S.p.A. for maintenance or any other reason, the sender must inform by written notice about risk and warning to be used depending on product mechanical damages, or inside and/or outside product fluid residue and/or contamination, that could be dangerous for health, safety or environment.

Such information must be completed with any useful safety instruction and safety data sheet regarding substances classified as dangerous or potentially dangerous.

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**Shown products are according the current production. Cesare Bonetti S.p.A. reserves to modify product characteristics according technical evolution or customer special request. Verify if manual comply with used product.**

# GENERAL USE AND MAINTENANCE PRESCRIPTION

## 1.0 SCOPE

This manual states safety criteria, check and controls, installation instruction, use and maintenance instruction for glass level gauges shown in Table 1.

**If the level gauge has intercepting valves, this manual must be used together with the specific intercepting valve type manual.**

## 2.0 PRODUCT DESCRIPTION

A glass level gauge is an instrument suitable to give a direct level reading of a fluid contained in a vessel.

Level gauges are reflex type (BR), transparent type (BT) or bicolour type (BC).

Standard materials normally used for pressure containing parts are Carbon Steel, Low Alloy Steel, Austenitic Stainless Steel.

If those materials are not suitable for the fluid, Cesare Bonetti S.p.A. can provide special materials according to Customer specification.

## 3.0 RATING

Max rating condition (pressure and temperature) and group fluid classification is stated by 97/23/CE Directive (PED), annex II, and are shown in following Table 1.

TIPO TYPE		DISEGNO DRAWING	PS (bar)	T. MAX (°C)	FLUIDO FLUID	GRUPPO GROUP
BR 12	Fig. 837		32	236	VAP. ACQUA/ WATER STEAM	2
			64	120	FLUIDI IN GEN./ GENERIC FLUIDS	1,2(*)
BR 14	Fig. 836		20	211	VAP. ACQUA/ WATER STEAM	2
			BR 22	Fig. 838		12
BR 23	Fig. 839		28	38		
			10	300	FLUIDI IN GEN./ GENERIC FLUIDS	1,2(*)
BR 24	Fig. 840		22	216	VAP. ACQUA/ WATER STEAM	2
			105	38		
BR 25	Fig. 841	Ø1 40mm Mod. ≤ 2 x 9 Ø1 50mm Mod ≤ 2 x 5	80	300	FLUIDI IN GEN./ GENERIC FLUIDS	1,2(*)
			BR 28	Fig. 856		200
BT 23	Fig. 843		160	300		
			12	187	VAP. ACQUA/ WATER STEAM	2
BT 24	Fig. 844		51	38	FLUIDI IN GEN./ GENERIC FLUIDS	1,2(*)
			30	300		
BT 25	Fig. 845	Ø1 40mm Mod. ≤ 2 x 9 Ø1 50mm Mod ≤ 2 x 5	20	211	VAP. ACQUA/ WATER STEAM	2
			105	38		
BT 28	Fig. 846		62	300	FLUIDI IN GEN./ GENERIC FLUIDS	1,2(*)
			120	38		
BT 29	Fig. 868		80	300	FLUIDI IN GEN./ GENERIC FLUIDS	1,2(*)
			165	38		
BT 32	Fig. 859		100	300	FLUIDI IN GEN./ GENERIC FLUIDS	1,2(*)
			103	313	VAP. ACQUA/ WATER STEAM	2
BT 33	Fig. 858		90	302	VAP. ACQUA/ WATER STEAM	2
			BTV	Fig. 842		6
BC 23	Fig. 824 BC 23		12	38	FLUIDI IN GEN./ GENERIC FLUIDS	1,2
			12	187	VAP. ACQUA/ WATER STEAM	2
BC 24	Fig. 824 BC 24		20	211	VAP. ACQUA/ WATER STEAM	2
			BC 28	Fig. 824 BC 28		40
BC 32	Fig. 825 BC 32		100	310	VAP. ACQUA/ WATER STEAM	2
			BC 33	Fig. 825 BC 33		90

(\*) NOTE: Pressure and Temperature loads are not applicable with water/steam or fluids corrosive for the glasses.

## 4.0 SAFETY CRITERIA

Proper working of level gauges can be obtained if all steps regarding installation, start up, control and maintenance are managed by duly instructed, qualified and skilled personnel.

Therefore this use and maintenance manual, together with the use and maintenance manual of each intercepting valve type, must be fully considered by such personnel.

If use and/or maintenance instruction are not applied, product may

be damaged or work badly, generating risk of damage to people, plant or environment.

Prescription stated in section "SAFETY GENERAL INFORMATION" must be respected.

## 5.0 INSPECTION AT RECEIPT

When receiving goods, check carefully to verify that no damage has been suffered during transportation.

Check also that level gauge and valve type, rating pressure/temperature as shown on Table 1 and material, as indicated on body, bonnet and/or label, comply with application.

Never exceed limits stated by such rating.

Verify and be sure that level gauge and valve material is suitable for process fluid and surrounding atmosphere.

## WARNING:

**Glass level gauges can not be used for "Lethal service". Lethal service is the use of the instrument with "Lethal Substances" as defined in ASME Section VIII Part UW:**

*By "lethal substances" are meant poisonous gases or liquids of such a nature that very small amount of the gas or of the vapour of the liquid mixed or unmixed with air is dangerous to life when inhaled. For purpose of this Division, this class includes substances of this nature which are stored under pressure or may generate a pressure if stored in a closed vessel.*

## 6.0 STORAGE

Level gauges must be stored protected from weather or contamination arising from dirt, mud and so on. If goods have to be stored for a while, we suggest to maintain them in the original packing. If storage is very long, check goods periodically (not less than twice a year) and verify surface and internal condition, removing any dirt, rust and/or corrosion from inside and outside.

## 7.0 INSTALLATION

Installation must be done by qualified and skilled personnel.

Before installing, to avoid structure deformation or any other damage that could cause leakage or bad working or glass breakage, check carefully to:

- remove protection caps from end connections;
- verify absence of dirt inside level gauge and intercepting valves (if any);
- be sure that upstream and downstream piping is clean and without any dirt coming from drilling or welding (as metal shaving or slag) or corrosion and so on;
- install the level gauge according the proper working sense (look to the upper and lower part);
- install the level gauge so that it does not sustain piping weight, and sustain the level gauge if its weight could stress or danger flanges or piping, also considering vibrations, seismic stress or wind, if any. Cesare Bonetti S.p.A., on request, can provide you technical data to calculate, at your care, such stress
- avoid misalignment between piping and instrument ends. Check if face to face connecting dimension(CC) fits correctly with distance between piping ends.
- avoid instrument or piping thermal expansion able to stress the structure. To minimize thermal expansion effect insert an expansion joint or use other systems able to minimize such deformation.
- for flanged connections check correct position and dimension of gaskets between instrument (or intercepting valve) flange and piping flange, apply the proper bolting torque to stay bolts. For screwed connections verify compatibility between instrument (or intercepting valves) and piping screw thread.
- for connections with welding ends as BW as SW, see par. 15.0
- if possible, always use intercepting and draining valves between piping and level gauge, or, in the sketch assembly, always install systems able to section and interrupt upstream and downstream flow, with a draining system for said sectioned plant parts. Those section and draining systems give also a good help when maintaining instruments in safety conditions.
- using a torque wrench, check level gauge bolting torque as indicated in Fig. 2 and in Table 5.
- check carefully glasses must not have any scratch, corrosion, small etching or other defect. To better check, use a light with a 45° angle to the glass surface. Glass resistance is deeply reduced also by small defects and ratings shown in Table 1 are

no longer applicable. So any damaged glass must be changed immediately.

- any abrasive particle in the fluid can damage glass surface or glass protecting sheets (as mica or other).

### 8.0 START UP AND OPERATION

Level gauge start up must be performed slowly to avoid any thermal shock or mechanical stress due to different temperature in different level gauge items.

Cesare Bonetti level gauges are equipped with borosilicate tempered glasses able to absorb a thermal shock up to  $\Delta T = 255^\circ\text{C}$ . Nevertheless additional stresses, not easily manifest in start up, could reduce such resistance.

To minimise thermal shock in start up, intercepting valves must be slowly and only partially open to allow a slow heating gradient to the instrument. When the instrument temperature reaches the vessel temperature, valves must be regulated in totally open position.

In start up check closed position of vent and drain valves (if any).

In operation intercepting valves must work in totally open position.

To minimise leakage risk, periodically isolate level gauges and, when the gauges temperature drops down to the ambient temperature, check that bolting torque is as indicated in table 5. This check is mandatory if level gauges are used in discontinuous operation or in variable operating condition.

**WARNING:** if intercepting valves are equipped with safety check ball, while in operation valves must be in totally open position to permit the proper automatic ball intervention.

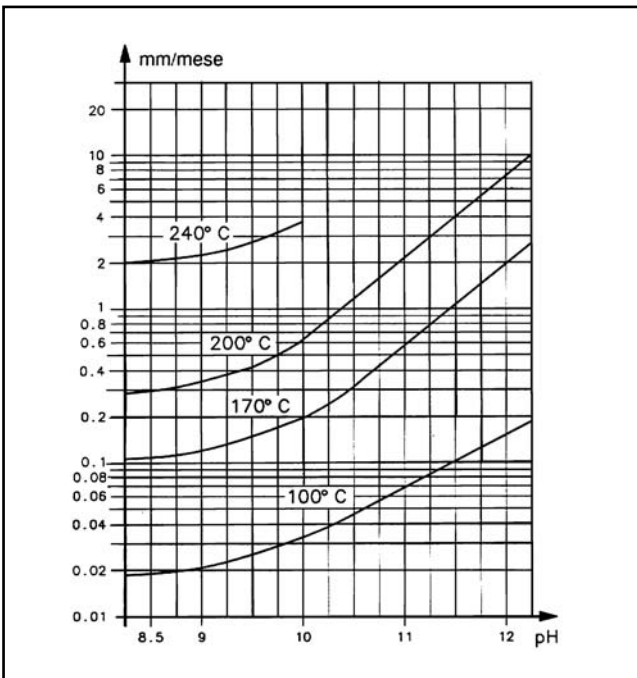
Safety check ball are an automatic safety device, able to interrupt fluid leak to environment in case of glass breakage. Safety check ball are purchased under Customer request, but we strongly suggest such protecting device.

During plant shut down, leave open level gauge valves to allow a slow temperature and pressure decreasing on level gauge an to avoid any fluid trap inside the instrument.

### 8.1 REFLEX LEVEL GAUGES

Reflex level gauges are equipped with reflex glasses. Such glasses, due to their shape, cannot be shielded, therefore they must not be used with corrosive fluid; do not use reflex level gauges with water/steam in operating condition exceeding as indicated in Table 1.

As operating condition in boiler vessels requires water/steam with basic pH, glass is corroded according Fig. 1. Therefore reflex level gauges used with water/steam according operating conditions stated in Table 1 must be periodically and carefully checked and maintained to avoid glass breakage due to glass corrosion.



**Fig. 1** - Corrosion diagram (mm/month) depending on pH and temperature ( $^\circ\text{C}$ ) of boiler water, for a glass without mica shielding.

### 8.2 TRANSPARENT LEVEL GAUGES

Transparent level gauges are equipped with transparent glasses. Transparent glasses (flat on both sides) must be protected, depending on process fluid with mica shields or with Kel-F (PCTFE polychlorotrifluoroethylene), if operating with corrosive fluids able to chemically corrode glasses.

### 9.0 MAINTENANCE

Glass level gauges maintenance must be performed by skilled and qualified people, after complete reading of this maintenance manual.

#### WARNING:

Do not proceed with maintenance service unless:

- level gauge has been properly isolated from the pressurized part of plant;
  - level gauge inside pressure has been totally discharged and safely vented to atmospheric pressure. Do not assume that the system has depressurised even when the pressure gauge indicates zero.
  - level gauge temperature decrease until ambient temperature, to avoid burning. Protective gloves, eyeglasses or other safety devices must be used, if necessary;
- Level gauge maintenance must be performed immediately, isolating the level gauge, when:**
- glass is losing its original transparency, or it looks, also partially, opaque;
  - if any roughness appears on the internal surface of glass, due to erosion or to corrosion;
  - if, on reflex glasses, the original prismatic shape of internal surface is lost and level visibility becomes difficult;
  - if mica shields or Kel-F shields of transparent glasses look damaged and fluid is in contact with glass;
  - if leakages from glass gaskets
  - if leakages from connections between level gauge and intercepting valves
  - if any corrosion is observed inside or outside any part of the level gauge

#### WARNING:

Proper inspection and maintenance schedules must be generated by end user according his plant knowledge and experience.

Such schedules must consider service, operating conditions, fluids and any internal and external media able to influence material used on instrument.

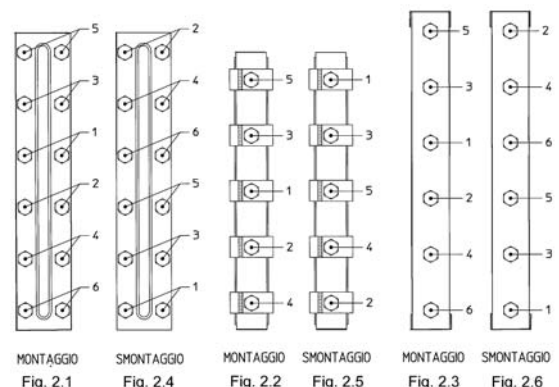
### 9.1 REMOVING

Warning: do not remove level gauge from connecting piping unless all internal pressure has been discharged and safety vented to the atmospheric pressure; wait until the temperature of level gauge falls down to the ambient temperature; carefully check that any process fluid has been discharged and drained out.

### 10.0 DISASSEMBLY

first of all close intercepting valves and isolate level gauge from the vessel pressure; check carefully valve perfect sealing. Then remove the level gauge (leaving intercepting valves on site) and fix it on a workbench to avoid any injury to maintenance people

- Unscrew nuts starting from external ones to central ones of any section as shown in Fig. 2 (2.4, 2.5 o 2.6)
- Remove plates, using a rubber hammer if necessary.



**Fig. 2** - Bolt disassembly and assembly sequence

- Remove stainless steel L bars (if any), cushion gasket, glass, glass mica or Kel-F shield (if any), and sealing gasket.  
**WARNING: Cushion gasket, glass, glass mica or Kel-F shield (if any), and sealing gasket must be destroyed and disposed by approved methods.**  
**Never use again same gaskets: residual deformation can generate leakages or glass breakage.**  
**A used glass can hide defects or stresses due to past use under pressure and temperature: if reassembled on the gauge it could break under pressure, with danger and injury for people or environment.**

**Level gauge sealing surface check:**

- Carefully clean sealing surfaces on glass, on gauge body and on gauge plates. Use a soft metallic scraper (as a brass scraper). Check that any bur, rust and gasket residual has been removed.  
**WARNING: avoid any scrape or damage on sealing surfaces. A bad cleaning or any residual dirty can generate a critical stress point able to break the glass.**
- Check flatness between glass and centre piece and between glass and cover plate. Use a glass mock-up with known flatness. Sealing surface flatness must be less than 0.05 mm. If flatness value is wrong, metallic sealing surfaces must be machined to recover requested value.

**11.0 ASSEMBLING**

Following spares must be available and checked:

- New original BONETTI glasses (check any transportation or handling damage);
- Sealing and cushion joints.
- New protecting shields (mica or Kel-F), if necessary.

The following assembling instruction refer to a single window level gauge. For multiple windows gauges repeat operation steps.

**11.1 REFLEX GLASS GAUGES ASSEMBLING**

**TYPE BR14**

1. Refer to proper level gauge type to identify items (Table 2 and assembling Dwg. Fig. 817 and Fig. 3)
2. Clean tightening bolt thread to remove paint, rust or dirt. Apply some grease on thread.
3. Insert wedge piece (9) inside gauge body (8).

TABLE 2	
N° ITEM	N° ITEM
1 CENTER PIECE	8 GAUGE BODY
2 SEALING JOINT	9 WEDGE PIECE
3 REFLEX GLASS	10 TIGHTENING BOLT
4 CUSHION JOINT	11 BOLT AND NUT
5 COVER PLATE	12 CLAMP
6 "U" STUD BOLT AND NUT	13 ANGULAR PIECE ("L" BAR)
7 "O" STUD BOLT AND NUT	

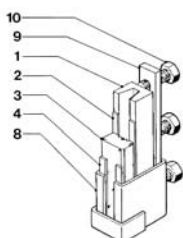


Fig. 817 - BR14

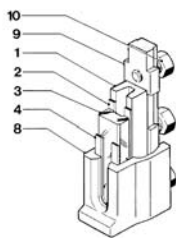


Fig. 816 - BR12

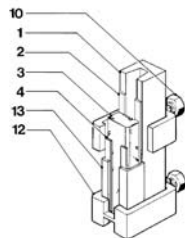


Fig. 760 - BR22

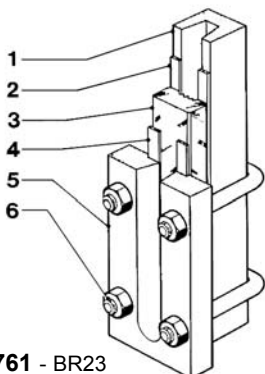


Fig. 761 - BR23

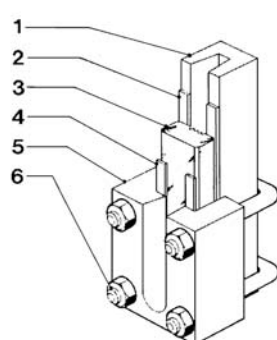


Fig. 762 - BR24

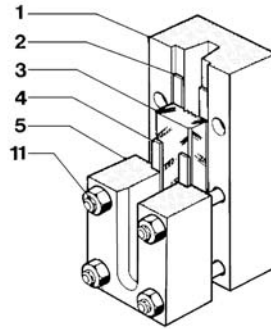


Fig. 819 - BR28

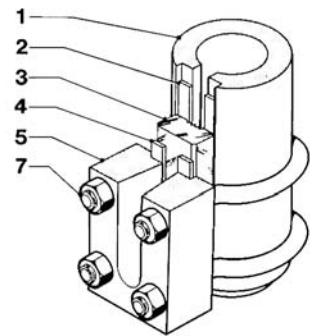


Fig. 763 - BR25

4. Screw tightening bolts (10) on wedge piece (9).
5. Insert centre piece (1) inside gauge body (8).
6. Place sealing joint (2).
7. Insert reflex glass (3) inside gauge body, with prismatic shape surface faced to sealing joint; be careful to avoid contact with metallic items.
8. Place cushion joint (4).
9. Manually screw tightening bolts until the bolts are in contact with the centre piece, following sequence shown in Fig. 2 (2.3). With a torque wrench screw bolts up to 10 Nm, always following same sequence (Fig. 2 - 2.3). Repeat 3 times, increasing the bolting torque until proper torque (as shown in Table 5) has been reached.

**TYPE BR 12**

1. Refer to proper level gauge type to identify items (Table 2 and assembling Dwg. Fig. 816 and Fig. 3)
2. Clean tightening bolt thread to remove paint, rust or dirt. Apply some grease on thread.
3. Place cushion joint (4) inside gauge body (8)
4. Insert reflex glass (3) inside gauge body, with prismatic shape surface faced to upper part (opposed side respect to cushion joint); be careful to avoid contact with metallic items. Screw tightening bolts (10) on wedge piece (9).
5. Place sealing joint (2).
6. Insert centre piece (1) inside gauge body (8), carefully checking that sealing joint stay in the correct position between glass and centre piece.
7. Insert wedge piece (9) on gauge body (8).
8. Manually screw tightening bolts until the bolts are in contact with the centre piece, following sequence shown in Fig. 2 (2.3). With a torque wrench screw bolts up to 10 Nm, always following same sequence (Fig. 2 - 2.3). Repeat 3 times, increasing the bolting torque until proper torque (as shown in Table 5) has been reached.

**TYPE BR 22**

1. Refer to proper level gauge type to identify items (Table 2 and assembling Dwg. Fig. 760 and Fig. 3)
2. Clean tightening bolt thread to remove paint, rust or dirt. Apply some grease on thread.
3. Insert clamps (12) around centre piece (1) equally spaced.
4. Place sealing joint (2).
5. Place reflex glass (3) over centre piece, with prismatic shape surface faced to sealing joint; be careful to avoid contact with metallic items.
6. Place cushion joint (4).
7. Place angular pieces (13).
8. Manually screw tightening bolts until the bolts are in contact with the centre piece, following sequence shown in Fig. 2 (2.2). With a torque wrench screw bolts up to 10 Nm, always following the same sequence (Fig. 2 - 2.2). Repeat 3 times, increasing the bolting torque until proper torque (as shown in Table 5) has been reached.

**TYPE BR 23/24/25/28**

1. Refer to proper level gauge type to identify items (Table 4 and assembling Dwg. Fig. 4 and Fig. 761, 762, 763, 819)
2. Clean tightening bolt thread to remove paint, rust or dirt. Apply some grease on thread.
3. Depending on gauge type, couple centre piece (1) with "U" bolts (6), or "O" bolts (7) or standard bolts (11). "O" bolts (7) must be inserted around centre piece from one end, then slid to the right

position.

4. Place sealing joint (2) on the centre piece.
5. Insert reflex glass (3) inside gauge body, with prismatic shape surface faced to sealing joint; be careful to avoid contact with metallic items or damages to sealing joint.
6. Place cushion joint (4).
7. Place cover plate (5); be careful to avoid contact with metallic items that can scrape glass or damage cushion joint..
8. Grease the nut part contacting the cover plate and manually screw the nuts until they touch cover plate, following sequence shown in Fig. 2 -2.1. With a torque wrench screw bolts up to 10 Nm, always following the same sequence (Fig. 2 - 2.3). Repeat 3 times, increasing the bolting torque until proper torque (as shown in Table 5) has been reached.

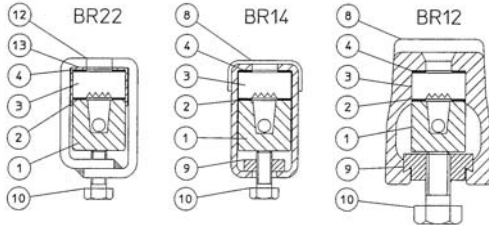


Fig. 3 - BR22, BR14 e BR12

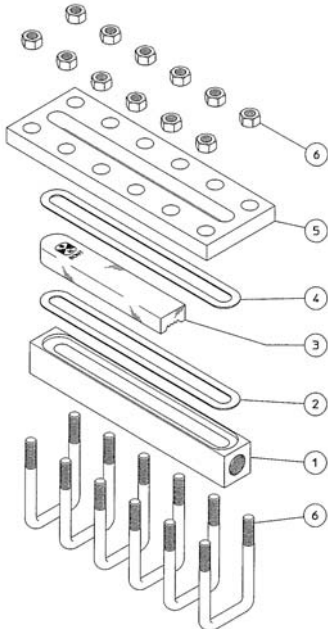


Fig. 4 - Reflex level gauge typical assembly Dwg.

### 11.2 ASSEMBLING TUBULAR GLASS LEVEL GAUGES TYPE BTV-GP11

Refer to typical assembly Dwg Fig. 5 to identify items.

1. Check the tubular glass whose external diameter must be 16 mm. Check the correct length: to find correct length follow this calculation:  
Tubular glass length without plexiglass or metal protection:  
Length = CC (centre to centre) less 28 mm;  
Tubular glass length with plexiglass or metal protection:  
Length = CC (centre to centre) less 92 mm;
2. Metal or plexiglass protection is recommended for safety. Its length can be calculated as follow:  
Plexiglass or metal protection length:  
Length = CC (centre to centre) less 92 mm;  
If both protections are used together, the plexiglass protection length can be calculated as follow:  
Plexiglass protection length:  
Length = CC (centre to centre) less 116 mm;
3. Fit gauge valves type GP11 on vessel, without tubular glass or protections, checking valve axis alignment
4. Unscrew nuts (12) of GP11 connecting part and remove these parts from valve body
5. Unscrew the joint packing ring (44) and fit tubular glass and plex-

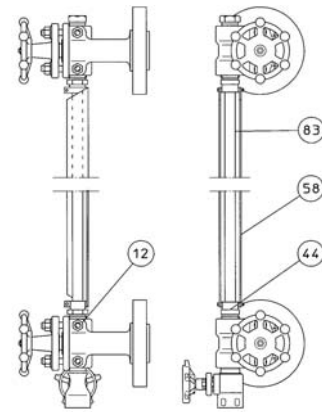


Fig. 5 - Type BTV-GP11 tubular glass level gauge

iglass protection on one of connecting part, then fit such assembly tubular glass/plexiglass protection on the other connecting part.

6. Screw the joint packing ring (44).
7. Fit both connecting part on GP11 valve bodies and screw nuts (12).
8. Fit the metallic protection, if any.

### 11.3 TRANSPARENT GLASS GAUGES ASSEMBLING

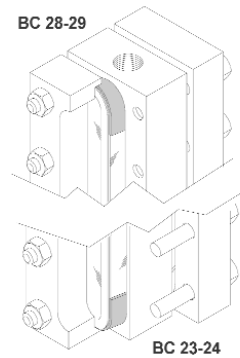


Fig. 824.1

**Note:** To perform the best result in reassembling transparent level gauges, we suggest to operate with the gage fixex on a bench, in horizontal position.

In any case, but mainly if the gage has to be reassembled in vertical position, we suggest the use of spacers of gasket material (approx mm 15 x 100 x 0.75 thickness) to be fitted on the upper and lower part of each glass, as shown in Fig. 824.1, to avoid any dangerous contact between glass and metal as in assembling as well in operation.

### Type BT (all) and type BC23, BC24, BC28

1. Refer to proper level gauge type to identify items (Table 3 and typical assembly Dwg Fig. 6 and Fig. 764, 765, 766, 767, 814.1, 815.1, 824-BC23/BC24/BC28).
2. Clean tightening bolt (or stud) and nuts thread to remove paint, rust or dirt. Apply some grease on thread and on nut side contacting cover plate .
3. Depending on gauge type, fit cover plate (6) with bolts (7), stud bolts (8) or studs (9) for Type BC level gauges.
4. Only for BT 32/33 fit angular pieces (13). Place cushion joint (5).
5. Place transparent glass (4) into its housing on cover plate so that glass side with the BONT® trade mark must be faced to the cushion joint. Be careful to avoid damages to glass (as scrapes) made by metal items. Insert mica shield (or Kel-F shield), if any (3). Mica shield has a side with printed the word "WASSER". Such side must be placed faced to the observer (internal side of level gauge).
6. Place sealing joint (2).
7. Place centre piece (1) so that it is correctly matching over sealing joint and glass. Be careful to avoid damages to glass or to sealing joint or to mica shield.
8. Place sealing joint (2) matching it on the centre body housing. Insert . Insert mica shield (or Kel-F shield), if any (3). Mica shield has a side with printed the word "WASSER". Such side must be placed faced to the centre piece (internal side of level gauge).
9. Place transparent glass (4) on its housing . Place transparent glass (4) into its housing on centre piece so that glass side with the BONT® trade mark must be faced to the observer (outside of the level gauge). Be careful to avoid damages to glass (as scrapes) made by metal items.
10. Place cushion joint (5). Only for BT32 / BT33 insert angular pieces ("L" bars) (13) .
11. Fit the cover plate (6); be very careful to avoid scrapes or dam-

TABLE 3	
N° ITEM	N° ITEM
1 CENTRE PIECE	7 BOLT AND NUT
2 SEALING JOINT	8 STUD BOLT AND NUT
3 PROTECTION SHIELD (IF ANY)	9 STUD AND NUT
4 TRANSPARENT GLASS	13 ANGULAR PIECE ("L" BAR)
5 CUSHION JOINT	14 BELLEVILLE WASHER
6 COVER PLATE	

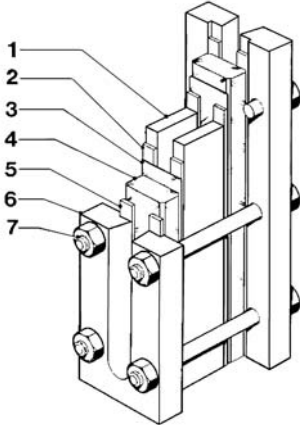


Fig. 764 - BT23

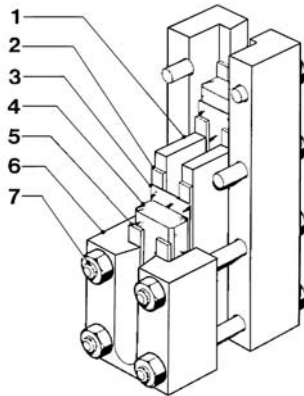


Fig. 765 - BT24

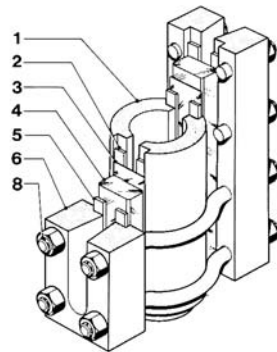


Fig. 766 - BT25

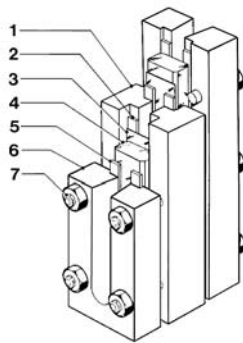


Fig. 767 - BT28 & BT29

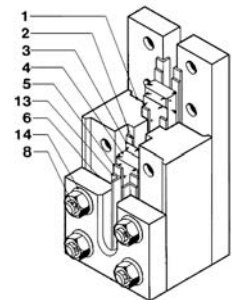


Fig. 814.1 - BT33

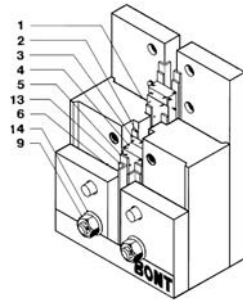


Fig. 815.1 - BT32

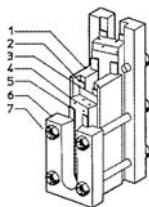


Fig. 824 - BC23

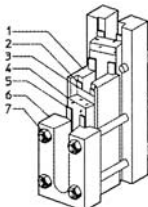


Fig. 824 - BC24

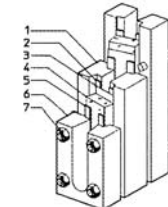


Fig. 824 - BC28

- ages to glasses surfaces or damages to the joints.
- Only for BT32 / BT33, insert belleville washers (14) on studs. Apply some grease on thread and on nut side contacting cover plate. Manually screw nut until they are in contact with cover plate, following the sequence shown in Fig. 2. For level gauges with bolts (7) or stud bolts (8), fix on the opposite side of the level gauge using a wrench and, using a torque wrench, screw nuts until a 10 Nm bolting torque is reached, following the nut sequence shown in Fig. 2. Repeat the operation 3 times increasing the bolting torque until bolting torque shown in Table 5 have been reached.

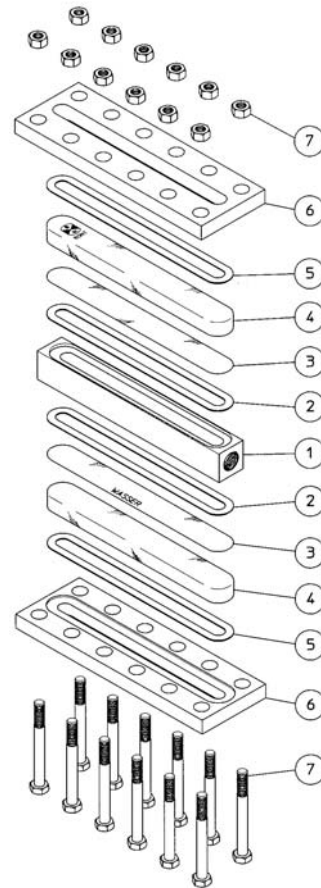


Fig. 6 - Transparent level gauge typical assembly dwg

#### Type BC32-33

- Refer to proper level gauge type to identify items (Table 3 and typical assembly Dwg. Fig. 6 e Fig. 7).
- Clean tightening stud and nuts thread to remove paint, rust or dirt. Apply some grease on thread and on nut side contacting cover plate.
- Screw studs (9) in the centre piece (1).
- Place sealing joint (2) centering it in its centre piece housing. Insert mica shield (3) if any. Mica shield has a side with printed the word "WASSER". Such side must be placed faced to the sealing joint (internal side of level gauge).
- Place transparent glass (4) into its housing on centre piece so that glass side with the BONT® trade mark must be faced to the cushion joint. Be careful to avoid damages to glass (as scrapes) or to mica shield made by metal items.
- Place cushion joint (5) and insert angular pieces ("L" bars).
- Place cover plate (6) so that it is correctly matching over cushion joint and glass. Be careful to avoid damages to glass or to joints or to mica shield.

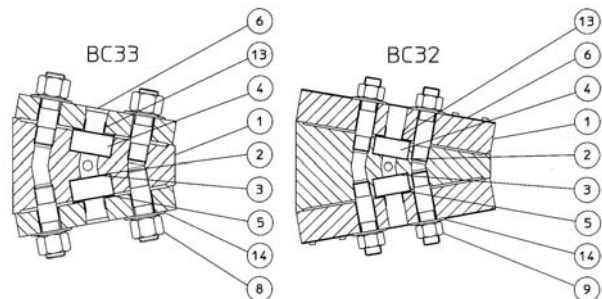


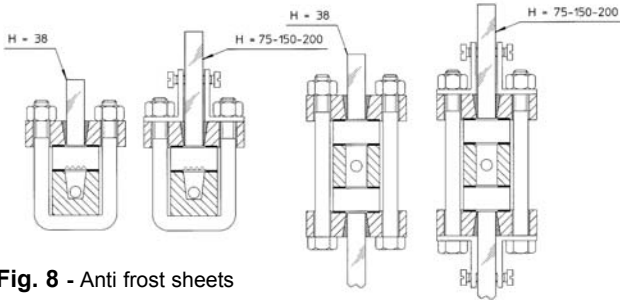
Fig. 7 - BC33 e BC32 typical assembly Dwg.

- Insert belleville washers (14) on studs. Apply some grease on thread and on nut side contacting cover plate. Manually screw nuts until they are in contact with cover plate, following the sequence shown in Fig. 2. Using a torque wrench, screw all nuts until a 10 Nm bolting torque is reached, following the nut sequence shown in Fig. 2. Repeat the operation 3 times increasing the bolting torque until bolting torque shown in Table 5 have been reached.

9. Rotate the level gauge 180°.
10. Repeat all operation from point 3 to point 8.

## 12.0 LOW TEMPERATURE OPERATING CONDITION

If the level gauge must operate in contact with process fluids having



**Fig. 8** - Anti frost sheets

temperature under 0 °C, to allow level visibility notwithstanding frost, a plexiglass sheet contacting reflex or transparent glass must be fitted and sealed on level gauge, as shown in Fig. 8.

To seal the plexiglass sheet a mastic must be used able to maintain softness and elasticity up to operating temperature. Apply the mastic avoiding to dirty glass surface.

Plexiglass height depends on process fluid temperature (see Table 4).

OPERATING TEMPERATURE	NO FROST SHEET HEIGHT
From 0 °C to -19 °C	38 mm
From -20 °C to -49 °C	75 mm
From -50 °C to -99 °C	150 mm
Less than -100 °C	200 mm

**WARNING:** Check point 13.0 of this manual if level gauge must operate at low temperature.

## 13.0 WORKING LIFE

Glass level gauge contains items that are subject to fair and normal wear.

Such items are glasses, joint and, if any, protection shield (mica or Kel-F). Therefore glass level gauges and its parts must be periodically inspected by user.

Inspection time scheduling and interval must be performed by user according to plant working condition, process fluid and plant knowledge and/or experience. For new application inspection interval must be shortened, up to daily inspection, before establishing the proper inspection interval.

Always avoid any improper use of level gauge and intercepting valves able to generate unfair valve wear as:

- do not use an on-off valve as regulating valve
- avoid in process fluid abrasive particles, or piping sandblasting residual, or swarf, or welding dross;
- avoid water freezing inside level gauges.

If level gauge must be used in temperature condition exceeding material creep temperature, Cesare Bonetti S.p.A. can give, under Customer request, technical data suitable for residual working life calculation, to be performed by Customer or by end user.

## 14.0 MAXIMUM ALLOWABLE WORKING TEMPERATURE

If glass level gauge has to be used in low temperature working condition, Customer or end user must verify level gauge and intercepting valves material fitness.

If glass level gauge has to be used in operating condition Temperature higher than temperature shown in Table 1, according the DIN 7081 procedure, temperature could be extended up to 430 °C, with a maximum operation pressure of 10 bar. If level gauges has to be used in such condition, ask Cesare Bonetti S.p.A. to know the proper bolting torque to apply to cover plate nuts, indicating operating temperature and pressure values. Incorrect bolting torques could generate stress able to reduce glass resistance or to break glasses.

**WARNING:** If Kel-F (PTFE Politrifluoroelene) shield are used, maximum temperature must be limited to 150° C.

## 15.0 WELDING AND QUALITY CONTROL

Any welding must be performed by qualified personnel and using qualified procedures according EN 288/287 or ASME IX standard. Any non destructive control must be performed by qualified personnel and using qualified procedures according EN 473 o SNT-TC-1A standard.

Intercepting valve welding must be performed with valve in semi-opened position, to avoid damages to sealing part.

## 16.0 FINAL WARNINGS

Preserve level gauge and intercepting valve specific maintenance manual together with this manual and let them consultable by maintenance personnel.

Be sure that maintenance personnel read any part of those manuals before any use or maintenance operation.

If you have lost the manuals, please contact Cesare Bonetti S.p.A. to obtain a copy.

Cesare Bonetti S.p.A. shall be happy to give you any further technical information.

**IMPORTANT WARNING:** Level gauges use, to be safe against glass ejection due to breakage while operating, must be fitted with a proper protection, not hindering level gauge visibility.

**Note:** Table 1 rating apply to level gauges with standard graphite joints. If special joint are used (PTFE, Kel-F, Viton, etc.), maximum and minimum operating condition could change. In such case refer to rating limitation stated by joint manufacturers. Compatibility of such materials with process fluid must be checked by the end user.

In Table 6 are listed dangers and stresses able to facilitate glass breakage and useful skills to avoid such danger.

LEVEL GAUGE TYPE	BOLTING TORQUE Nm
BR12	50
BR14	30
BR22	30
BR23	40
BR24	40
BR25	40
BR28	50
BT23 - BC23	40
BT24 - BC24	40
BT25	40
BT28	60
BC28	60
BT29	70
BT32 - BC32	90
BT33 - BC33	80

<b>TABLE 6</b>	
<b>DANGER OR STRESS</b>	<b>CURE</b>
Shock	To be avoided by user.
Bolts and nuts incorrect torque	Follow bolting torque as stated in the maintenance manual
Uniformity of bolting torque	Follow bolting torque as stated in the maintenance manual
Internal overpressure	To be avoided by user.
Thermal shock termico due to temperature sudden changes (DTmax.= 255°C)	To be avoided by user.
Process fluid chemical etching	Perform level gauge monitoring and change glasses immediately as any scrape, rugosity or opacity is checked. For transparent level gauges glasses apply, depending on process fluid, mica or Kel-F shields to protect internal glasses surfaces
Chemical etching generated by plant washing fluid	When washing the plant avoid to use level gauge, intercepting the gauge. If this is not possible, schedule a complete level gauge maintenance, as in this manual, before to start with the exercise
Structure deformation due to incorrect stress (absence of sustain); installation stretched by incorrect CC or by flanges not in the same plane	To be avoided by user.
Fire	To be avoided by user.