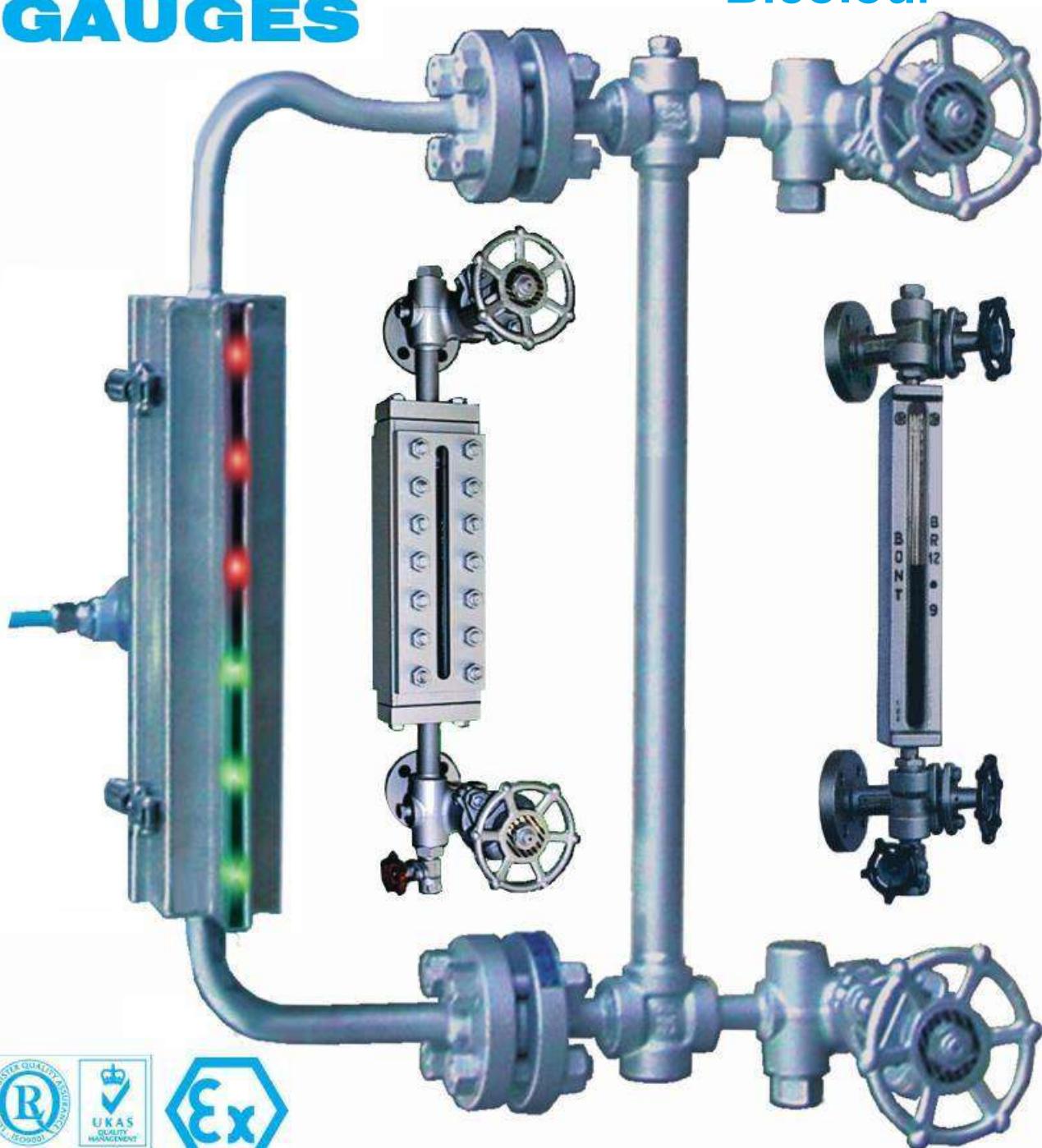


RAC[®]
BONETTI[®]

GLASS LEVEL GAUGES

- Reflex
- Transparent
- Bicolour



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BONETTI Glass level gauges are designed and manufactured in compliance with the international standards
These instruments have been also approved by several Bodies, Organizations and National and International
Authorities. For further information, please apply to our commercial department

BONETTI Glass Level Gauges

General information

CESARE BONETTI Company has been manufacturing level gauges since their origin. This product has been our industrial speciality in Italy and all over the world since the twenties.

This catalogue describes our glass level gauges, whereas our magnetic level gauges are shown in a separate bulletin.

When you only state the operating conditions, namely:

- fluid
- working pressure
- working temperature

we are able to supply the most suitable level gauge from both the points of view functionality and price.

There are three basic types of glass level gauges:

- reflex
- transparent
- bicolour.

BONETTI reflex level gauges (Fig. 701)

Working principle:

The liquid level is distinguished by the different brightness of the reflex glass in the water or in the steam space. in fact, where there is liquid in contact with the glass, the incidental light is refracted to the inside of the gauge and absorbed; in the steam space, the incidental light is reflected against the glass grooves and the glass appears very bright (Fig. 701).

Applications:

Reflex level gauges can be used in most of application and offer great advantages in terms of:

- low initial cost
- low operating cost
- easy level reading

Reflex level gauges cannot be used in certain cases as for example:

- when the separation level between two liquids has to be read (interface);
- when besides the level indication, the observation of the liquid colour is required;
- when the process fluid is high-pressure water steam, since in this case the glass must be protected from the solvent action of the boiler water by using mica shields;
- when the process fluid is such that can corrode the glass (e.g. high temperature alkaline solutions or hydrofluoric acid), since mica shields or Polytrifluorochloroethylene shields must be used to protect the glass.

BONETTI transparent level gauges (Fig. 702 and 703)

Working principle:

Apart from glass tube level gauges, transparent level gauges are always fitted with two plate transparent glasses between which the fluid is contained. The fluid level is indicated as the result of the different transparency of the two media (Fig. 702) and in some cases (for water steam), by conveying upwards on to the surface of separation (between liquid and gaseous substances) a source of light (Fig. 703) located at the back of the gauge, the rays of which are totally reflected down to the observer.

Applications:

Transparent level gauges are suitable for almost all installations.

In fact they permit:

- the use of mica shields or Polytrifluorochloroethylene shields to protect the glass from the corrosive action of the process fluid;
- the observation of interface;
- the observation of the liquid colour.

BONETTI bicolour level gauges (Fig. 704)

Working principle:

The two opposite glasses fitted into these bicolour level gauges are not parallel to each other. By means of a suitable illuminator into which a red and a green screens are fitted,

- the portion of visible length occupied by steam appears red whereas
- the portion of visible length occupied by water appears green.

The level reading is very easy even at a considerable distance. The reading of the bicolour level gauges is not affected by the blind spaces between one port-hole and the successive one (Fig. 704). Details on page 224-25.

Applications:

Their main application is on high pressure steam boilers.

BONETTI bicolour level gauges with parallel glasses (Fig. 812)

Working principle:

It is a variation of transparent level gauges, however equipped with two reflex glasses and a back illuminator, fitted with suitable coloured filters. The sharp reading is given by the contrast between the bright colour (usually: red) of filters in the lower part containing liquid and the colour of upper part of visible window (Fig. 812).

Applications:

These level gauges are particularly suitable for liquids:

- colourless,
- very fluid,
- non-corrosive for glasses (e.g. ammoniacal solutions, trichloroethylene, water steam up to 32 bar, etc.).

Remote Reading Level Gauges, type ITT-RDR

Now these level gauges are not frequently requested because Magnetic Remote Reading Level Gauges are preferred (specific bulletin on request).

Nevertheless they are appreciated and we still produce them.

The system includes: drum connections, condensate pot, downward connection pipes, operating device, down gauge body.

Usually bodies type BT29 or BT33 are used.

Further details on request.

Request of Offer and Order

The above descriptions are given as general information on the possible uses of BONETTI level gauges.

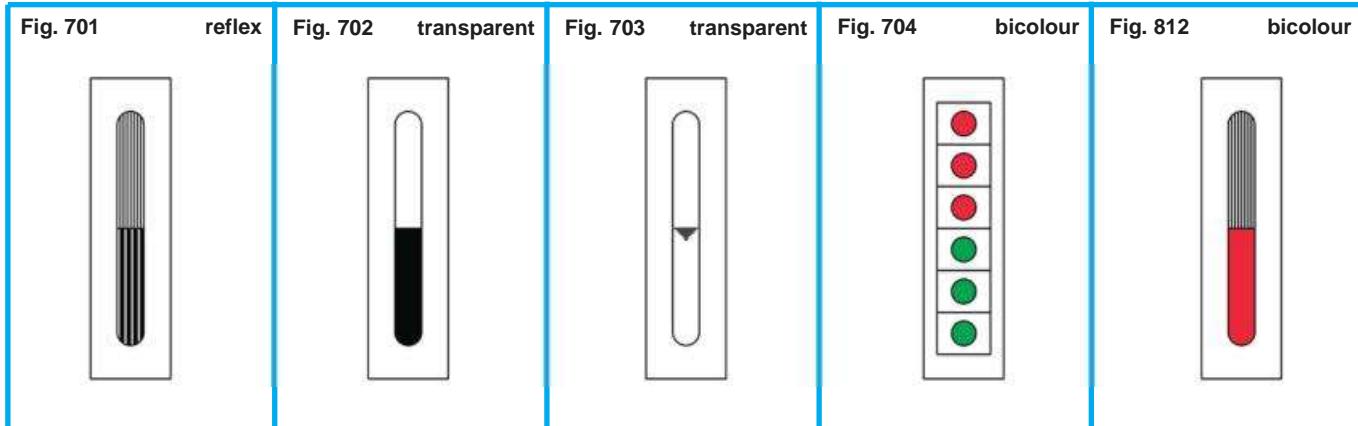
However the characteristics of the plant by same performances should guide the planner towards a well defined type of level gauge, that is most suitable for the purpose.

Guide elements can be:

- pressure, temperature, colour, viscosity, density, corrosion power of the process fluid,
- environmental conditions as dangerous area, indoor or outdoor, corroding atmosphere, etc.

Therefore when enquiring about level gauges or when placing order the following information must be supplied:

- type of the process fluid
- maximum working pressure
- maximum working temperature
- centre to centre distance between the vessel connections (or visible length required)
- type of connections (flanged, threaded, etc.) and standard (UNI, ASME, BS, DIN, AFNOR, GOST, etc.) according to which they are required
- optionals requested: see
 - page 27 for shut-off valves
 - page 37 for gauges bodies.



BONETTI Glass Level Gauges

Types, Material Schedules, Applications

In this Bulletin we give the description of our level gauges made of metallic materials and omit that ones of non- metallic materials (Ebonite, Polypropylene, PTFE, etc.): information on request.

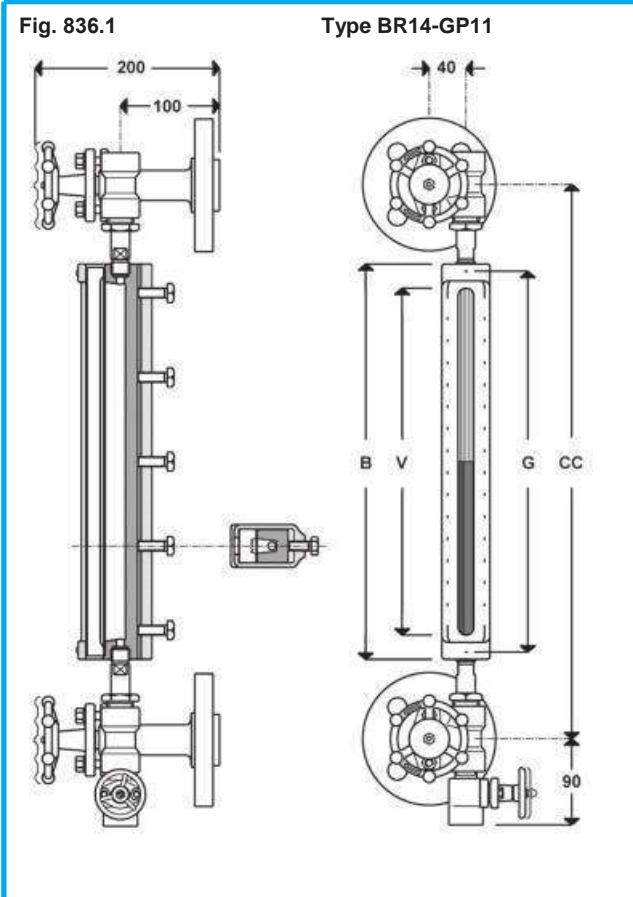
| Fig. 864 | Type | Page | Material Schedule | Max operating conditions Press. Bar | Temp. °C | Rating (**) ASME Class | PN bar | Fluid | |
|-------------|---|------|---------------------------|--|---------------|---------------------------|--------|--|--|
| Reflex | BR14 - GP11 | 6 | 52 | 20 | 211 | | 25 | Water steam, other fluids | |
| | BR 14 - G11 | 6 | | | | | | | |
| | BR12 - GP11 | 7 | 52 | 32 | 236 | | 40 | Water steam | |
| | BR12 - G11 | 7 | 52, 64 | 64 40 | 120 300(*) | | | Other fluids (Remark 14) | |
| | BR22 - GP11 | 8 | 52 | 12 | 187 | | 16 | Water steam | |
| | BR22 - GP12 | 8 | 52, 64 | 28 10 | 38 300(*) | | | Other fluids (Remark 14) | |
| | BR23 - GP11 | 9 | 52 | 22 | 216 | | | Water steam | |
| | BR23 - GP12 | 9 | 52, 63, 64 | 105 80 | 38 300(*) | 600 | 100 | Other fluids (Remark 14) | |
| | BR24 - GP11 | 10 | 52 | 32 | 236 | | | Water steam | |
| | BR24 - GP12 | 10 | 52, 63, 64 | 165 105 | 38 300(*) | 900 | 100 | Other fluids (Remark 14) | |
| | BR28 - G41 | 11 | 51, 52, 63, 64 | 200 160 | 38 300(*) | 1500 | 250 | Any fluids, water steam excepted (Remark 14) | |
| | BR28 - GP12 | 11 | 52, 63, 64 | 165 105 | 38 300(*) | | | Any fluids, water steam excepted (Remark 14) | |
| | BR25 - GP12 | 12 | 52, 63, 64 | 105 62 | 38 300(*) | 900 | 100 | Any fluids, water steam excepted (Remark 14) | |
| | BR13 - G51 | 13 | 52 | 400 | 120 | (2500) | (400) | Any fluids (Remark 9) | |
| Transparent | BR26 & BR27 | 14 | 52, 55, 61, 62, 63, 64 | | | (600) | | Any fluids, water steam excepted (Remark 10) | |
| | BTV - GP11 | 15 | 52, 63, 64 | 6 12 | 158 38 | | | Water steam (Remark 11) | |
| | BT23 - GP11 | 16 | 52 | 12 | 187 | | | Water steam (Remark 12) | |
| | BT23 - GP12 | 16 | 52, 63, 64 | 51 30 | 38 300(*) | 300 | | Other fluids (Remark 14) | |
| | BT24 - GP11 | 17 | 52 | 20 | 211 | | | Water steam (Remark 12) | |
| | BT24 - GP12 | 17 | 52, 63, 64 | 105 62 | 38 300(*) | 600 | 100 | Other fluids (Remark 14) | |
| | BT25 - GP12 | 18 | 52, 63, 64 | 105 62 | 38 300(*) | 600 | 100 | Any fluids, water steam excepted (Remark 14) | |
| | BT28 - GP11 | 19 | 52 | 50 | 264 | | | Water steam (Remark 12) | |
| | BT28 - GP12 | 19 | 52, 63, 64 | 120 80 | 38 300(*) | 600 | 100 | Other fluids (Remark 14) | |
| | BT29 - G41 | 20 | 52, 63, 64 | 165 100 | 38 300(*) | 900 | 160 | Any fluids, water steam excepted (Remark 14) | |
| | BT33 - G52 | 22 | 51 | 90 | 302 | | | Water steam | |
| | BT32 - G52 | 23 | 51 | 103 | 313 | | | Water steam | |
| | BT26 & BT27 | 26 | 52, 55, 61, 62, 63, 64 | | | (600) | | Any fluids, water steam excepted (Remark 10) | |
| Bicolour | BC24 - GP11 | 24 | 52 | 20 | 211 | | | Water steam | |
| | BC28 - GP11 | 24 | 52 | 40 | 249 | | | Water steam | |
| | BC33 - G52 | 24 | 52 | 90 | 302 | | | Water steam | |
| | BC32 - G52 | 24 | 51 | 103 | 313 | | | Water steam | |
| | BC1 - G55 | 25 | 51 | 210 | 368 | | | Water steam | |
| NOTE: | (*) Maximum allowable temperature according to DIN 7081 / 1999-05. For operating condition with temperature over 300 °C, please apply to our Sales or Technical department. | | | | | | | | |
| | (**) The shown rating is an indication only: level gauge rating can change according the level gauge valve fitted on it. See also notes on page 5 and apply to us for further information | | | | | | | | |

| Fig. 706 Material Schedule | Body and wetted pieces | Trim of shut-off valves (Remark 8) | Remarks | Application |
|---------------------------------------|--|---|--|--|
| 51 | Forged carbon steel | Stainless steel | | |
| 52 | Forged carbon steel | Stainless steel | Exclusion of copper, silver and their alloys | General purpose |
| 55 | Forged carbon steel ASTM A350 LF2 | Stainless steel AISI 316 | Exclusion of copper, silver and their alloys | Non corrosive fluids at low temperature up to $-45,6^{\circ}\text{C}$ (-50°F) |
| 61 | Forged stainless steel AISI 304 | Stainless steel AISI 316 | External not wetted parts of stainless steel AISI 304 | Corrosive fluids and/or fluids at temperature lower than $-45,6^{\circ}\text{C}$ (-50°F) |
| 62 | Forged stainless steel AISI 304 | Stainless steel AISI 316 | External not wetted parts of carbon steel. Exclusion of copper, silver and their alloys. | Corrosive fluids |
| 63 | Forged stainless steel AISI 316 | Stainless steel AISI 316 | External not wetted parts of stainless steel AISI 304 | Corrosive fluids and/or fluids at temperature lower than $-45,6^{\circ}\text{C}$ (-50°F) |
| 64 | Forged stainless steel AISI 316 | Stainless steel AISI 316 | External not wetted parts of carbon steel. Exclusion of copper, silver and their alloys. | Corrosive fluids |
| SPECIAL | For some types of level gauges we have normally available components made of different nuances of AISI 316, Monel 400 (ASTM B164 - Class A), Hastelloy B, Hastelloy C, Incoloy 825, Carpenter 20 CB 3, Nickel, Titanium, Ebonite, PVC, Polypropylene, PTFE. Apply to us for other materials. | | | |

- 1 The tag indicating the type of the level gauge consists of two parts that define:
 - the type of the level gauge body
 - the type of the set of valves.
- 2 The level gauges having their tag followed by a "Z" are special constructions. They are suitable for operating conditions different than the ones shown in Fig. 864 for the corresponding standard type.
- 3 The nominal passage diameter in the BONETTI level gauges is 10 mm, if not otherwise indicated. Only the gauge bodies type BR25 and BT25 have a "large chamber" with 40 mm inside diameter and are usually used where the medium boils surges.
- 4 The ASME ratings and the operating conditions shown in Fig. 864 refer to size 9. For smaller sizes the operating conditions can be higher. See diagrams on each description page or apply to us.
- 5 The classification shown in the column «ASME ratings» could be modified by temperature operating condition, due to the maximum limit temperature suitable for the glass according DIN 7081/199-05. As shown in the Table of Fig. 864 the maximum operating conditions are generally higher than those of ASME rating. Apply to us for further information.
- 6 The ASME ratings and the operating conditions shown in Fig. 864 refer to standard materials as carbon steel, stainless steel, Hastelloy and to standard glass joints. When special materials (Monel, Nickel, Ebonite, PVC, etc.) and/or special joints (pure PTFE, Kel-F, etc.) are required, the maximum operating conditions have to be verified.
- 7 In Fig. 706 are indicated the main Material schedules currently manufactured. Boldface are given the ones of major diffusion.
- 8 In Fig. 706 is indicated the material of the piston for the set of valves type GP11 and GP12. For a detailed list of material currently employed on shut-off valves, refer to tables shown on the pages illustrating the level gauges valves (from page 27 to page 33)
- 9 For type BR13-G51, the ASME rating is an indication only.
- 10 Types BR26, BR27, BT26, BT27 are manufactured for ASME 600 rating. Anyway the operating conditions must take into consideration the vessel project, the welding difficulties on the vessel of the level gauge body and especially that there are no shut-off fittings.
- 11 The type BTV-GP11 is equipped with a glass transparent tube. Because of its brittleness this level gauge can be used with dangerless fluids only, although in presence of glass protector.
- 12 In case the level gauge must be fitted directly on a steam boiler drum, please state it clearly.
- 13 Most of Figures show the level gauges fitted with the Sets type GP11, GP12 (Fig. 834 page 29). They can also be fitted with Sets G41, G42, GS41, GS42 (see pages 30 and 31). In the latter case the level gauges identification tag changes after the hyphen, e.g. from BR24-GP11 to BR24-G41. The maximum operating conditions, ratings and applications are a function of the gauge body, therefore Fig. 864 and 706 are still valid.
- 14 In case of fluid corrosive for the glass, please refer to our Technical department to define maximum allowable temperature and glass protection.

Reflex **BONETTI** Level Gauges

type BR14 with GP11 and G11 valves



| Size | Length of | length of | Visible | CC min. | CC min. | Weight |
|------|-----------|-----------|---------|-----------|----------|--------|
| | glass | body | length | with GP11 | with G11 | kg |
| 3 | 165 | 178 | 145 | 291 | 279 | 9,0 |
| 4 | 190 | 203 | 170 | 316 | 304 | 9,4 |
| 5 | 220 | 233 | 200 | 346 | 334 | 9,8 |
| 6 | 250 | 263 | 230 | 376 | 364 | 10,3 |
| 7 | 280 | 293 | 260 | 406 | 394 | 10,8 |
| 8 | 320 | 333 | 300 | 446 | 434 | 11,3 |
| 9 | 340 | 353 | 320 | 466 | 454 | 11,7 |

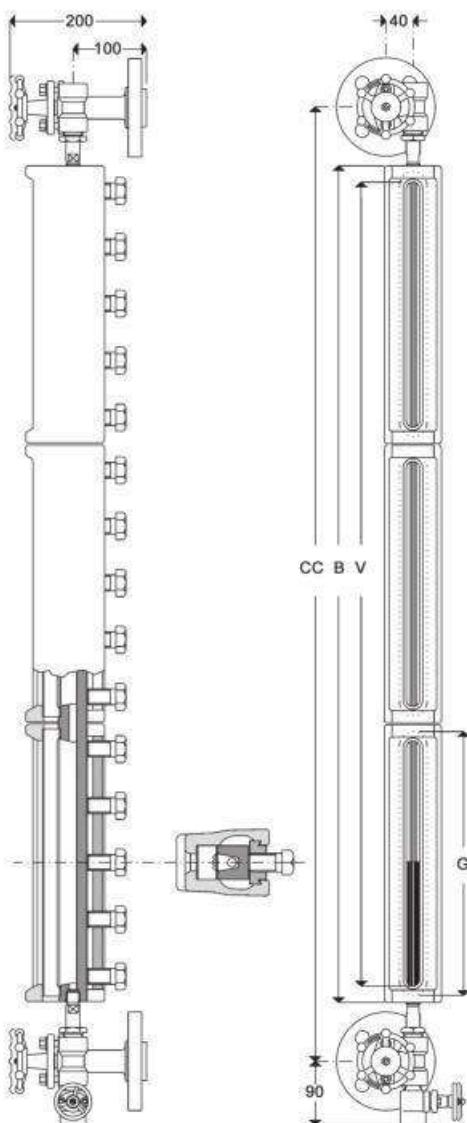
- 1 Connections between gauge and valves are made by end tues and stuffing boxes.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 836.1 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Pressure class
 - Size
 - Finishing
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BR14 gauges are fitted with reflex glasses type A (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37.

Reflex **BONETTI** Level Gauges

type BR12 with GP11, GP12, G11 and G12 valves

Fig. 837

Type BR12-GP11



| Size | Length of glass of body with GP11 with GP12 with G11 with G12 kg | | | | | | | |
|------|--|------|------|--------|---------|---------|---------|---------|
| | G | B | V | Length | Visible | CC min. | CC min. | CC min. |
| 1 | 115 | 128 | 95 | 241 | 209 | 229 | 182 | 11,7 |
| 2 | 140 | 153 | 120 | 266 | 234 | 254 | 207 | 12,1 |
| 3 | 165 | 178 | 145 | 291 | 259 | 279 | 232 | 12,9 |
| 4 | 190 | 203 | 170 | 316 | 284 | 304 | 257 | 13,3 |
| 5 | 220 | 233 | 200 | 346 | 314 | 334 | 287 | 14,1 |
| 6 | 250 | 263 | 230 | 376 | 344 | 364 | 317 | 15 |
| 7 | 280 | 293 | 260 | 406 | 374 | 394 | 347 | 15,5 |
| 8 | 320 | 333 | 300 | 446 | 414 | 434 | 387 | 16,5 |
| 9 | 340 | 353 | 320 | 466 | 434 | 454 | 407 | 17,2 |
| 2x4 | 190 | 413 | 380 | 526 | 494 | 514 | 467 | 18,2 |
| 2x5 | 220 | 473 | 440 | 586 | 554 | 574 | 527 | 19,8 |
| 2x6 | 250 | 533 | 500 | 646 | 614 | 634 | 587 | 21,7 |
| 2x7 | 280 | 593 | 560 | 706 | 674 | 694 | 647 | 22,6 |
| 2x8 | 320 | 673 | 640 | 786 | 754 | 774 | 727 | 24,6 |
| 2x9 | 340 | 713 | 680 | 826 | 794 | 814 | 767 | 26 |
| 3x6 | 250 | 803 | 770 | 916 | 884 | 904 | 857 | 28,4 |
| 3x7 | 280 | 893 | 860 | 1006 | 974 | 994 | 947 | 29,8 |
| 3x8 | 320 | 1013 | 980 | 1126 | 1094 | 1114 | 1067 | 32,8 |
| 3x9 | 340 | 1073 | 1040 | 1186 | 1154 | 1174 | 1127 | 34,9 |
| 4x7 | 280 | 1193 | 1160 | 1306 | 1274 | 1294 | 1247 | 36,9 |
| 4x8 | 320 | 1353 | 1320 | 1466 | 1434 | 1454 | 1407 | 40,9 |
| 4x9 | 340 | 1433 | 1400 | 1546 | 1514 | 1534 | 1487 | 43,7 |
| 5x7 | 280 | 1493 | 1460 | 1606 | 1574 | 1594 | 1547 | 44,3 |
| 5x8 | 320 | 1693 | 1660 | 1806 | 1774 | 1794 | 1747 | 49,1 |
| 5x9 | 340 | 1793 | 1760 | 1906 | 1874 | 1894 | 1847 | 52,6 |
| 6x8 | 320 | 2033 | 2000 | 2146 | 2114 | 2134 | 2087 | 57,2 |
| 6x9 | 340 | 2153 | 2120 | 2266 | 2234 | 2254 | 2207 | 61,4 |
| 7x9 | 340 | 2513 | 2480 | 2626 | 2594 | 2614 | 2567 | 70,3 |

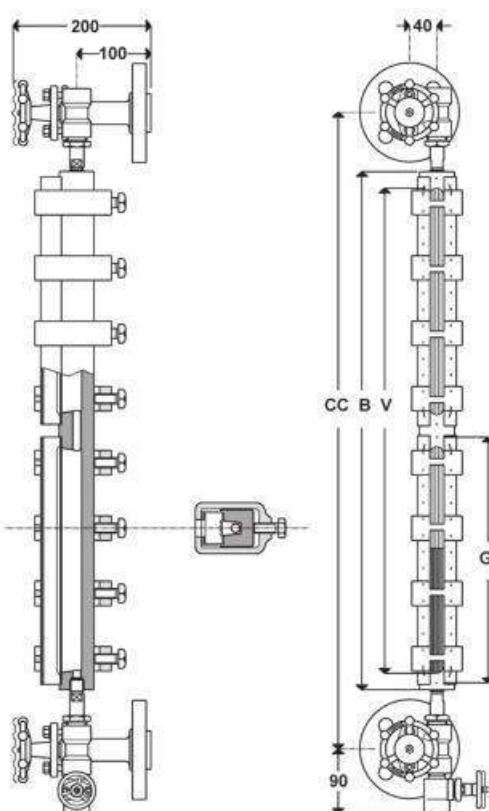
- 1 Connections between gauge and valves are made:
 - for BR12 with GP11 or G11, by end tubes and stuffing boxes
 - for BR12 with GP12 or G12, by NPT screwed nipples.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 837 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Pressure class
 - Size
 - Finishing
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BR12 gauges are fitted with reflex glasses type A (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37.
- 10 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.

Reflex **BONETTI** Level Gauges

type BR22 with GP11, GP12, G41/42 and GS41/42 valves

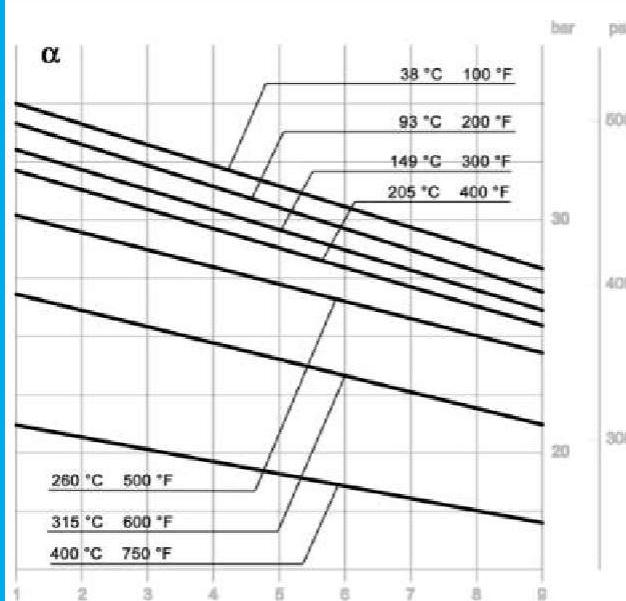
Fig. 838.1

Type BR22-GP11



| Size | Length of glass G | Length of body B | Visible length V | CC min. with GP11 | | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | Weight kg |
|------|-------------------|------------------|------------------|-------------------|-------------------|-------------------|-----------|-----------------------------|-----------|
| | | | | CC min. with GP11 | CC min. with GP12 | | | | |
| 1 | 115 | 128 | 95 | 241 | 209 | 10,0 | 218 | 15,0 | |
| 2 | 140 | 153 | 120 | 266 | 234 | 10,3 | 243 | 15,7 | |
| 3 | 165 | 178 | 145 | 291 | 259 | 10,8 | 268 | 16,2 | |
| 4 | 190 | 203 | 170 | 316 | 284 | 11,1 | 293 | 16,5 | |
| 5 | 220 | 233 | 200 | 346 | 314 | 11,3 | 323 | 16,7 | |
| 6 | 250 | 263 | 230 | 376 | 344 | 12,0 | 353 | 17,4 | |
| 7 | 280 | 293 | 260 | 406 | 374 | 12,2 | 383 | 17,6 | |
| 8 | 320 | 333 | 300 | 446 | 414 | 12,8 | 423 | 18,2 | |
| 9 | 340 | 353 | 320 | 466 | 434 | 13,0 | 443 | 18,4 | |
| 2x4 | 190 | 413 | 380 | 526 | 494 | 13,9 | 503 | 19,3 | |
| 2x5 | 220 | 473 | 440 | 586 | 554 | 14,4 | 563 | 19,8 | |
| 2x6 | 250 | 533 | 500 | 646 | 614 | 15,7 | 623 | 21,1 | |
| 2x7 | 280 | 593 | 560 | 706 | 674 | 16,1 | 683 | 21,5 | |
| 2x8 | 320 | 673 | 640 | 786 | 754 | 17,4 | 763 | 22,8 | |
| 2x9 | 340 | 713 | 680 | 826 | 794 | 17,8 | 803 | 23,2 | |
| 3x6 | 250 | 803 | 770 | 916 | 884 | 19,4 | 893 | 24,8 | |
| 3x7 | 280 | 893 | 860 | 1006 | 974 | 20,0 | 983 | 25,4 | |
| 3x8 | 320 | 1013 | 980 | 1126 | 1094 | 21,9 | 1103 | 27,3 | |
| 3x9 | 340 | 1073 | 1040 | 1186 | 1154 | 22,5 | 1163 | 27,9 | |
| 4x7 | 280 | 1193 | 1160 | 1306 | 1274 | 23,9 | 1283 | 29,3 | |
| 4x8 | 320 | 1353 | 1320 | 1466 | 1434 | 26,5 | 1443 | 31,9 | |
| 4x9 | 340 | 1433 | 1400 | 1546 | 1514 | 27,3 | 1523 | 32,7 | |
| 5x7 | 280 | 1493 | 1460 | 1606 | 1574 | 27,8 | 1583 | 33,2 | |
| 5x8 | 320 | 1693 | 1660 | 1806 | 1774 | 31,0 | 1783 | 36,4 | |
| 5x9 | 340 | 1793 | 1760 | 1906 | 1874 | 32,0 | 1883 | 37,4 | |
| 6x8 | 320 | 2033 | 2000 | 2146 | 2114 | 35,6 | 2123 | 41,0 | |
| 6x9 | 340 | 2153 | 2120 | 2266 | 2234 | 36,8 | 2243 | 42,2 | |
| 7x9 | 340 | 2513 | 2480 | 2626 | 2594 | 41,5 | 2603 | 46,9 | |

- 1 Connections between gauge and valves are made
 - for BR22-GP11, by end tubes and stuffing boxes
 - for BR22-GP12, by NPT screwed nipples
 - for BR22-G41/42 & GS41/42, by NPT screwed nipples.
 Minimum CC distance, shown on table is referred to 1/2" NPT connections.
 On request 3/4" NPT connection can be supplied.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 838.1 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Pressure class – Finishing
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BR22 gauges are fitted with reflex glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37.
- 10 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 11 For level gauges type BR22-G41, BR22-G42, BR22-GS41, BR22-GS42, see page 30-31.

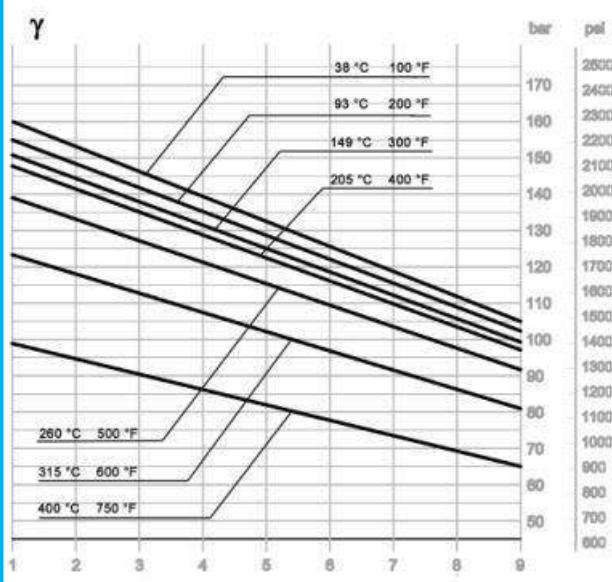
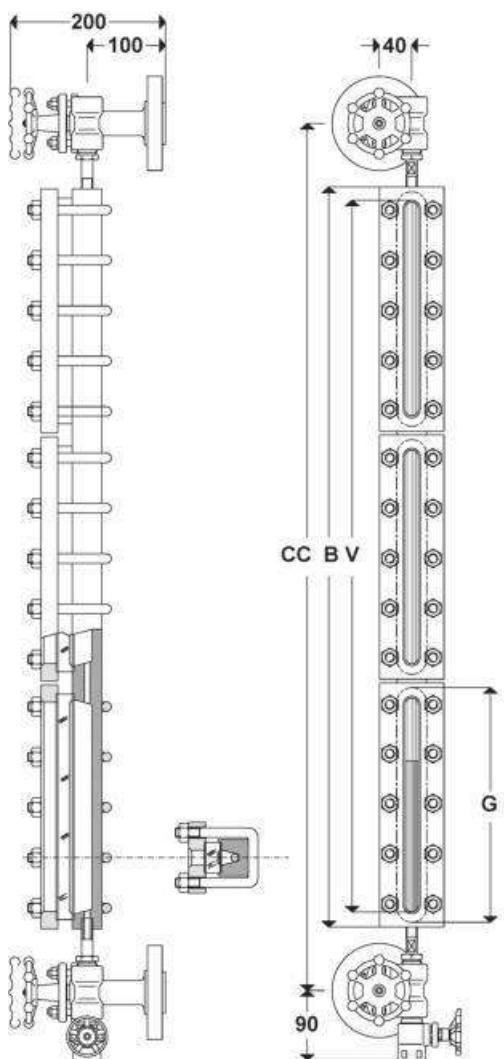


Reflex **BONETTI** Level Gauges

type BR23 with GP11, GP12, G41/42 and GS41/42 valves

Fig. 839.1

Type BR23-GP11



| Size | Length of glass G | Length of body B | Visible length V | CC min. with GP11 | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | Weight kg |
|------|-------------------|------------------|------------------|-------------------|-------------------|-----------|-----------------------------|-----------|
| 1 | 115 | 128 | 95 | 241 | 209 | 10,4 | 218 | 15,8 |
| 2 | 140 | 153 | 120 | 266 | 234 | 10,8 | 243 | 16,2 |
| 3 | 165 | 178 | 145 | 291 | 259 | 11,7 | 268 | 17,1 |
| 4 | 190 | 203 | 170 | 316 | 284 | 12,2 | 293 | 17,6 |
| 5 | 220 | 233 | 200 | 346 | 314 | 13,0 | 323 | 18,4 |
| 6 | 250 | 263 | 230 | 376 | 344 | 13,9 | 353 | 19,3 |
| 7 | 280 | 293 | 260 | 406 | 374 | 14,2 | 383 | 19,6 |
| 8 | 320 | 333 | 300 | 446 | 414 | 15,2 | 423 | 20,6 |
| 9 | 340 | 353 | 320 | 466 | 434 | 15,7 | 443 | 21,1 |
| 2x4 | 190 | 413 | 380 | 526 | 494 | 18,0 | 503 | 23,4 |
| 2x5 | 220 | 473 | 440 | 586 | 554 | 19,5 | 563 | 24,9 |
| 2x6 | 250 | 533 | 500 | 646 | 614 | 21,4 | 623 | 26,8 |
| 2x7 | 280 | 593 | 560 | 706 | 674 | 22,0 | 683 | 27,4 |
| 2x8 | 320 | 673 | 640 | 786 | 754 | 23,9 | 763 | 29,3 |
| 2x9 | 340 | 713 | 680 | 826 | 794 | 24,9 | 803 | 30,3 |
| 3x6 | 250 | 803 | 770 | 916 | 884 | 28,9 | 893 | 34,3 |
| 3x7 | 280 | 893 | 860 | 1006 | 974 | 29,7 | 983 | 35,1 |
| 3x8 | 320 | 1013 | 980 | 1126 | 1094 | 32,7 | 1103 | 38,1 |
| 3x9 | 340 | 1073 | 1040 | 1186 | 1154 | 34,2 | 1163 | 39,6 |
| 4x7 | 280 | 1193 | 1160 | 1306 | 1274 | 37,5 | 1283 | 42,9 |
| 4x8 | 320 | 1353 | 1320 | 1466 | 1434 | 41,5 | 1443 | 46,9 |
| 4x9 | 340 | 1433 | 1400 | 1546 | 1514 | 43,5 | 1523 | 48,9 |
| 5x7 | 280 | 1493 | 1460 | 1606 | 1574 | 45,3 | 1583 | 50,7 |
| 5x8 | 320 | 1693 | 1660 | 1806 | 1774 | 50,2 | 1783 | 55,6 |
| 5x9 | 340 | 1793 | 1760 | 1906 | 1874 | 52,8 | 1883 | 58,2 |
| 6x8 | 320 | 2033 | 2000 | 2146 | 2114 | 58,1 | 2123 | 63,5 |
| 6x9 | 340 | 2153 | 2120 | 2266 | 2234 | 62,0 | 2243 | 67,4 |
| 7x9 | 340 | 2513 | 2480 | 2626 | 2594 | 71,3 | 2603 | 76,7 |

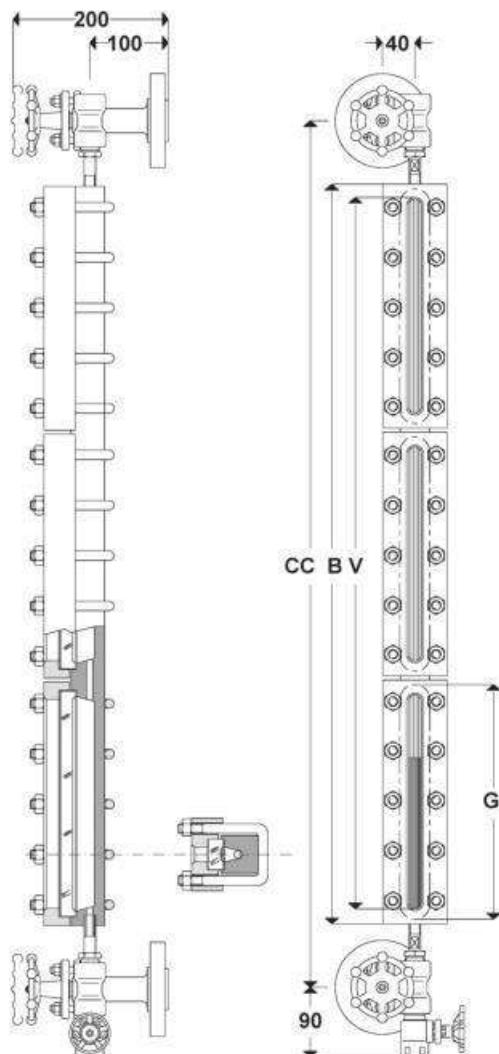
- 1 Connections between gauge and valves are made
 - for BR23-GP11, by end tubes and stuffing boxes
 - for BR23-GP12, by NPT screwed nipples
 - for BR23-G41/42 & GS41/42, by NPT screwed nipples.
 Minimum CC distance, shown on table is referred to 1/2" NPT connections. On request 3/4" NPT connection can be supplied.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 839.1 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Size
 - Pressure class
 - Finishing
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BR23 gauges are fitted with reflex glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37
- 10 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 11 For level gauges type BR23-G41, BR23-G42, BR23-GS41, BR23-GS42, see page 30-31.

Reflex **BONETTI** Level Gauges

Type BR24 with GP11, GP12, G41/42 and GS41/42 valves

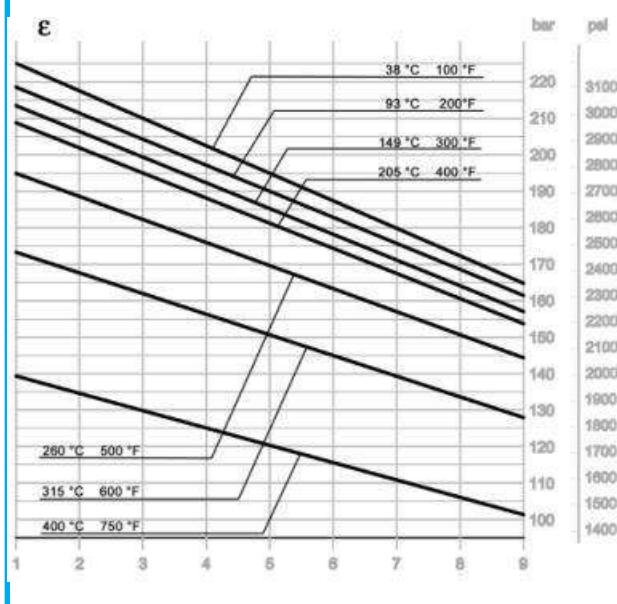
Fig. 840.1

Type BR24-GP11



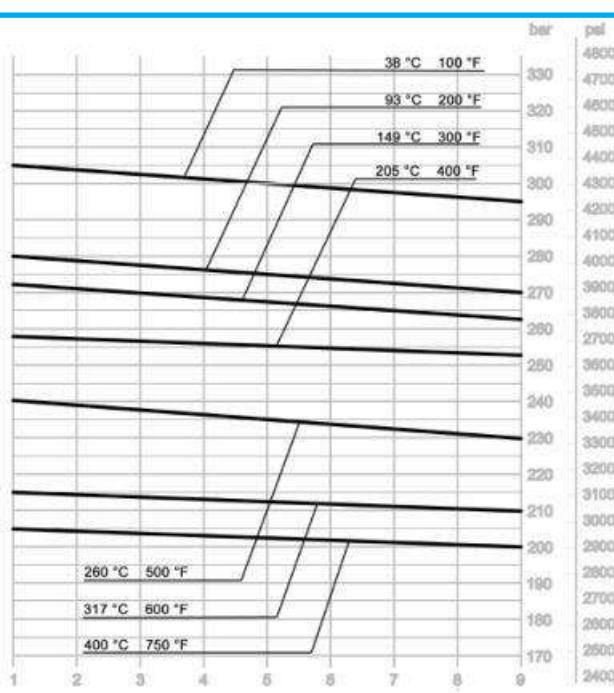
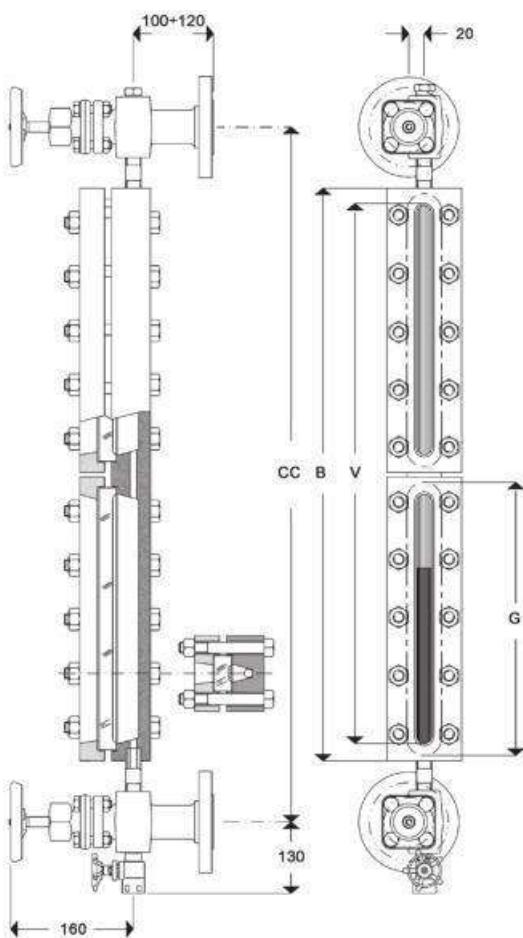
| Size | Length of glass G | Length of body B | Visible length V | CC min. with GP11 | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | Weight kg |
|------|-------------------|------------------|------------------|-------------------|-------------------|-----------|-----------------------------|-----------|
| | | | | 218 | 243 | 268 | 293 | 323 |
| 1 | 115 | 128 | 95 | 241 | 209 | 11,3 | 218 | 16,7 |
| 2 | 140 | 153 | 120 | 266 | 234 | 11,8 | 243 | 17,2 |
| 3 | 165 | 178 | 145 | 291 | 259 | 12,8 | 268 | 18,2 |
| 4 | 190 | 203 | 170 | 316 | 284 | 13,3 | 293 | 18,7 |
| 5 | 220 | 233 | 200 | 346 | 314 | 14,3 | 323 | 19,7 |
| 6 | 250 | 263 | 230 | 376 | 344 | 15,3 | 353 | 20,7 |
| 7 | 280 | 293 | 260 | 406 | 374 | 15,8 | 383 | 21,2 |
| 8 | 320 | 333 | 300 | 446 | 414 | 16,9 | 423 | 22,3 |
| 9 | 340 | 353 | 320 | 466 | 434 | 17,7 | 443 | 23,1 |
| 2x4 | 190 | 413 | 380 | 526 | 494 | 19,2 | 503 | 24,6 |
| 2x5 | 220 | 473 | 440 | 586 | 554 | 21,3 | 563 | 26,7 |
| 2x6 | 250 | 533 | 500 | 646 | 614 | 23,1 | 623 | 28,5 |
| 2x7 | 280 | 593 | 560 | 706 | 674 | 24,4 | 683 | 29,8 |
| 2x8 | 320 | 673 | 640 | 786 | 754 | 26,3 | 763 | 31,7 |
| 2x9 | 340 | 713 | 680 | 826 | 794 | 27,9 | 803 | 33,3 |
| 3x6 | 250 | 803 | 770 | 916 | 884 | 31,0 | 893 | 36,4 |
| 3x7 | 280 | 893 | 860 | 1006 | 974 | 33,0 | 983 | 38,4 |
| 3x8 | 320 | 1013 | 980 | 1126 | 1094 | 35,7 | 1103 | 41,1 |
| 3x9 | 340 | 1073 | 1040 | 1186 | 1154 | 38,1 | 1163 | 43,5 |
| 4x7 | 280 | 1193 | 1160 | 1306 | 1274 | 41,7 | 1283 | 47,1 |
| 4x8 | 320 | 1353 | 1320 | 1466 | 1434 | 45,1 | 1443 | 50,5 |
| 4x9 | 340 | 1433 | 1400 | 1546 | 1514 | 48,2 | 1523 | 53,6 |
| 5x7 | 280 | 1493 | 1460 | 1606 | 1574 | 50,3 | 1583 | 55,7 |
| 5x8 | 320 | 1693 | 1660 | 1806 | 1774 | 54,6 | 1783 | 60,0 |
| 5x9 | 340 | 1793 | 1760 | 1906 | 1874 | 58,4 | 1883 | 63,8 |
| 6x8 | 320 | 2033 | 2000 | 2146 | 2114 | 64,0 | 2123 | 69,4 |
| 6x9 | 340 | 2153 | 2120 | 2266 | 2234 | 68,6 | 2243 | 74,0 |
| 7x9 | 340 | 2513 | 2480 | 2626 | 2594 | 78,7 | 2603 | 84,1 |

- 1 Connections between gauge and valves are made
 - for BR24-GP11, by end tubes and stuffing boxes
 - for BR24-GP12, by NPT screwed nipples
 - for BR24-G41/42 & GS41/42, by NPT screwed nipples.
 Minimum CC distance, shown on table is referred to 1/2" NPT connections. On request 3/4" NPT connection can be supplied.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 840.1 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Pressure class – Finishing
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BR24 gauges are fitted with reflex glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37.
- 10 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 11 For level gauges type BR24-G41, BR24-G42, BR24-GS41, BR24-GS42, see page 30-31.



Reflex **BONETTI** Level Gauges type BR28 with GP12, G41/42 and GS41/42 valves

Fig. 856
Type BR28-G41



| Size | Length | Length | Visible | CC min. | CC min. | CC min. |
|------|----------|---------|---------|---------|---------|---------|
| | of glass | of body | length | with | Weight | with |
| | G | B | V | GP12 | kg | G & GS |
| 1 | 115 | 165 | 95 | 246 | 18,8 | 255 |
| 2 | 140 | 190 | 120 | 271 | 19,6 | 280 |
| 3 | 165 | 215 | 145 | 296 | 20,5 | 305 |
| 4 | 190 | 240 | 170 | 321 | 21,5 | 330 |
| 5 | 220 | 270 | 200 | 351 | 22,7 | 360 |
| 6 | 250 | 300 | 230 | 381 | 24,1 | 390 |
| 7 | 280 | 330 | 260 | 411 | 25,4 | 420 |
| 8 | 320 | 370 | 300 | 451 | 26,8 | 460 |
| 9 | 340 | 390 | 320 | 471 | 27,7 | 480 |
| 2x4 | 190 | 450 | 380 | 531 | 38,9 | 540 |
| 2x5 | 220 | 510 | 440 | 591 | 41,3 | 600 |
| 2x6 | 250 | 570 | 500 | 651 | 44,1 | 660 |
| 2x7 | 280 | 630 | 560 | 711 | 46,7 | 720 |
| 2x8 | 320 | 710 | 640 | 791 | 49,5 | 800 |
| 2x9 | 340 | 750 | 680 | 831 | 51,3 | 840 |
| 3x6 | 250 | 840 | 770 | 921 | 64,1 | 930 |
| 3x7 | 280 | 930 | 860 | 1011 | 68,0 | 1020 |
| 3x8 | 320 | 1050 | 980 | 1131 | 72,2 | 1140 |
| 3x9 | 340 | 1110 | 1040 | 1191 | 74,9 | 1200 |
| 4x7 | 280 | 1230 | 1160 | 1311 | 89,3 | 1320 |
| 4x8 | 320 | 1390 | 1320 | 1471 | 94,9 | 1480 |
| 4x9 | 340 | 1470 | 1400 | 1551 | 98,5 | 1560 |
| 5x7 | 280 | 1530 | 1460 | 1611 | 110,6 | 1620 |
| 5x8 | 320 | 1730 | 1660 | 1811 | 117,6 | 1820 |
| 5x9 | 340 | 1830 | 1760 | 1911 | 122,1 | 1920 |
| 6x8 | 320 | 2070 | 2000 | 2151 | 140,3 | 2160 |
| 6x9 | 340 | 2190 | 2120 | 2271 | 145,7 | 2280 |
| 7x9 | 340 | 2550 | 2480 | 2631 | 169,3 | 2640 |
| | | | | | | 174,7 |

- 1 Connections between gauge and valves are made
 - for BR28-GP11, by end tubes and stuffing boxes
 - for BR28-GP12, by NPT screwed nipples
 - for BR28-G41/42 & GS41/42, by NPT screwed nipples. Gauge/valve standard NPT connection is 1/2". On request 3/4" NPT connection can be supplied.
- 2 According to the right or left position of the stop valves handle of the gauge body, the level gauges are named right handed or left-handed. Fig. 856 shows a left-handed level gauges.
- 3 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 4 Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Pressure class – Finishing

The inside passage through the gauge is 12,5 mm.
- 5 Instead of flanges, connections can be delivered with threaded ends. It is standard 3/4" NPT union.
- 6 BR28 gauges are fitted with reflex glasses type B (see page 38).
- 7 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 8 Applicable optionals and bolting torques on pages 27, 36, 37.
- 9 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).

Please state connecting dimensions and Standard.
- 10 For level gauges type BR28-G42, BR28-GS41, BR28-GS42, see page 30-31.

Reflex **BONETTI** Level Gauges

type BR25 with GP12, G41/42 and GS41/42 valves

Fig. 841

Type BR25-GP12

| Size | Length of glass | | | Visible length | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | |
|------|-----------------|------|------|----------------|-------------------|-----------|-----------------------------|--|
| | G | B | V | | | | Weight kg | |
| 1 | 115 | 158 | 95 | 239 | 14,4 | 248 | 19,8 | |
| 2 | 140 | 183 | 120 | 264 | 15,5 | 273 | 20,9 | |
| 3 | 165 | 208 | 145 | 289 | 16,6 | 298 | 22,0 | |
| 4 | 190 | 233 | 170 | 314 | 18,6 | 323 | 24,0 | |
| 5 | 220 | 263 | 200 | 344 | 19,0 | 353 | 24,4 | |
| 6 | 250 | 293 | 230 | 374 | 20,3 | 383 | 25,7 | |
| 7 | 280 | 323 | 260 | 404 | 22,8 | 413 | 28,2 | |
| 8 | 320 | 363 | 300 | 444 | 23,3 | 453 | 28,7 | |
| 9 | 340 | 383 | 320 | 464 | 24,2 | 473 | 29,6 | |
| 2x4 | 190 | 443 | 380 | 524 | 26,6 | 533 | 32,0 | |
| 2x5 | 220 | 503 | 440 | 584 | 29,2 | 593 | 34,6 | |
| 2x6 | 250 | 563 | 500 | 644 | 31,8 | 653 | 37,2 | |
| 2x7 | 280 | 623 | 560 | 704 | 34,4 | 713 | 39,8 | |
| 2x8 | 320 | 703 | 640 | 784 | 37,9 | 793 | 43,3 | |
| 2x9 | 340 | 743 | 680 | 824 | 39,6 | 833 | 45,0 | |
| 3x6 | 250 | 833 | 770 | 914 | 43,3 | 923 | 48,7 | |
| 3x7 | 280 | 923 | 860 | 1004 | 47,2 | 1013 | 52,6 | |
| 3x8 | 320 | 1043 | 980 | 1124 | 52,4 | 1133 | 57,8 | |
| 3x9 | 340 | 1103 | 1040 | 1184 | 55,0 | 1193 | 60,4 | |
| 4x7 | 280 | 1223 | 1160 | 1304 | 60,0 | 1313 | 65,4 | |
| 4x8 | 320 | 1383 | 1320 | 1464 | 66,9 | 1473 | 72,3 | |
| 4x9 | 340 | 1463 | 1400 | 1544 | 70,4 | 1553 | 75,8 | |
| 5x7 | 280 | 1523 | 1460 | 1604 | 72,8 | 1613 | 78,2 | |
| 5x8 | 320 | 1723 | 1660 | 1804 | 81,5 | 1813 | 86,9 | |
| 5x9 | 340 | 1823 | 1760 | 1904 | 85,8 | 1913 | 91,2 | |
| 6x8 | 320 | 2063 | 2000 | 2144 | 96,0 | 2153 | 101,4 | |
| 6x9 | 340 | 2183 | 2120 | 2264 | 101,2 | 2273 | 106,6 | |
| 7x9 | 340 | 2543 | 2480 | 2624 | 116,6 | 2633 | 122,0 | |

- 1 Type BR25-GP12 level gauge is **LARGE CHAMBERED**. The gauge body is machined from a tube having thick wall and internal Ø of about 40 mm. Large chamber level gauges should be used where the medium boils or surges.
- 2 Connections between gauge and valves are made by NPT screwed nipples. Minimum CC distance, shown on table is referred to 1/2" NPT connections. On request 3/4" NPT connection can be supplied.
- 3 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 841 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed.
- 4 When large chamber body is required with butt-welding end caps, length of body (B) and minimum C. to C. (CC min) have to be increased of 40 mm.
- 5 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 6 Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Finishing – Pressure class
 The inside passage through the gauge is 40 mm.
- 7 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 8 BR25 gauges are fitted with reflex glasses type B (see page 38).
- 9 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 10 Applicable optionals and bolting torques on pages 27, 36, 37.
- 11 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 12 For level gauges type BR25-G41, BR25-G42, BR25-GS41, BR25-GS42, see page 30-31.

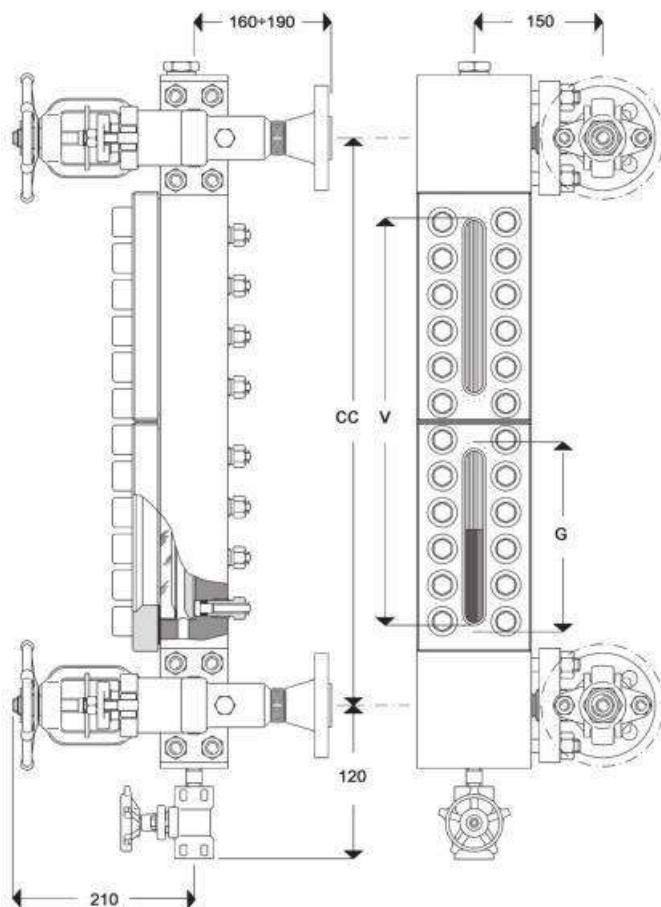
12 **RAC**
BONETTI

Reflex **BONETTI** Level Gauges

type BR13 with G51 valves

Fig. 857

Type BR13-G51



- 1 Connections between gauge and valves are made by flanges. Gauge body cannot be rotated on its axis. Other connections on request.
- 2 According to the right or left position of the handwheel of the stop valves on the gauge body, the level gauges are named right-handed or left-handed fig. 857 shows a right-handed level gauge.
- 3 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard. Size and Finishing of connections
 - Whether right-handed or left-handed.
- 4 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Size
 - Pressure class
 - Finishing
 The inside passage through the gauge is at least 12,5 mm.
- 5 Instead of flanges, connections to vessel can be delivered with threaded ends or with weld ends.
- 6 BR13 gauges are fitted with reflex glasses type A-BR13 (see page 38), that ARE NOT COMPRESSED by the tightening screw. Joint Dimensions and Maintenance Instructions on request.
- 7 Operating conditions and material schedules on pages 4 and 5.
- 8 Applicable optionals and bolting torques on pages 27, 36, 37.
- 9 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.

| Size | Length | Length | Visible | CC min. | Weight |
|------|----------|---------|---------|---------|--------|
| | of glass | of body | length | length | |
| | G | B | V | | |
| 3 | 165 | 481 | 143 | 331 | 75 |
| 4 | 190 | 506 | 168 | 356 | 78 |
| 5 | 220 | 536 | 198 | 386 | 81 |
| 6 | 250 | 566 | 228 | 416 | 85 |
| 7 | 280 | 596 | 258 | 446 | 88 |
| 8 | 320 | 636 | 298 | 486 | 92 |
| 9 | 340 | 656 | 318 | 506 | 94 |
| 2x4 | 190 | 721 | 383 | 571 | 106 |
| 2x5 | 220 | 794 | 456 | 644 | 112 |
| 2x6 | 250 | 867 | 529 | 717 | 120 |
| 2x7 | 280 | 897 | 559 | 747 | 126 |
| 2x8 | 320 | 980 | 642 | 830 | 134 |
| 2x9 | 340 | 1043 | 705 | 893 | 138 |
| 3x6 | 250 | 1168 | 830 | 1018 | 155 |
| 3x7 | 280 | 1198 | 860 | 1048 | 164 |
| 3x8 | 320 | 1324 | 986 | 1174 | 176 |
| 3x9 | 340 | 1430 | 1092 | 1280 | 182 |
| 4x7 | 280 | 1499 | 1161 | 1349 | 202 |
| 4x8 | 320 | 1668 | 1330 | 1518 | 218 |
| 5x7 | 280 | 1800 | 1462 | 1650 | 225 |
| 4x9 | 340 | 1817 | 1479 | 1667 | 226 |
| 5x8 | 320 | 2012 | 1674 | 1862 | 260 |
| 5x9 | 340 | 2204 | 1866 | 2054 | 270 |
| 6x8 | 320 | 2356 | 2018 | 2206 | 302 |
| 6x9 | 340 | 2591 | 2253 | 2441 | 314 |
| 7x9 | 340 | 2978 | 2640 | 2828 | 358 |

Reflex **BONETTI** Level Gauges Weld - on Bodies, type BR26 and BR27

Fig. 717

Type BR26

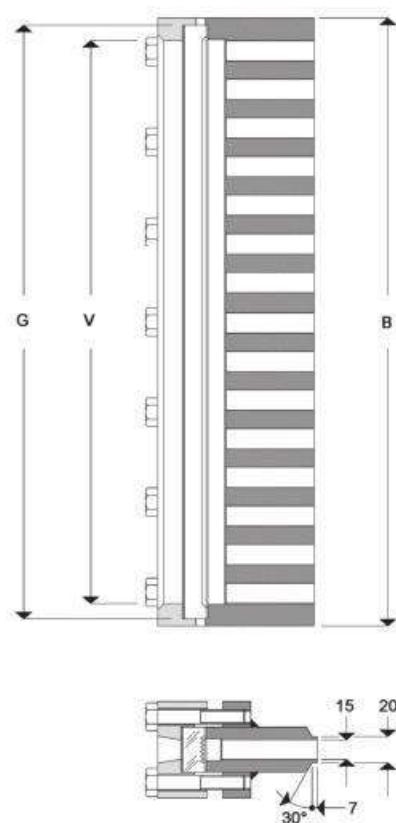
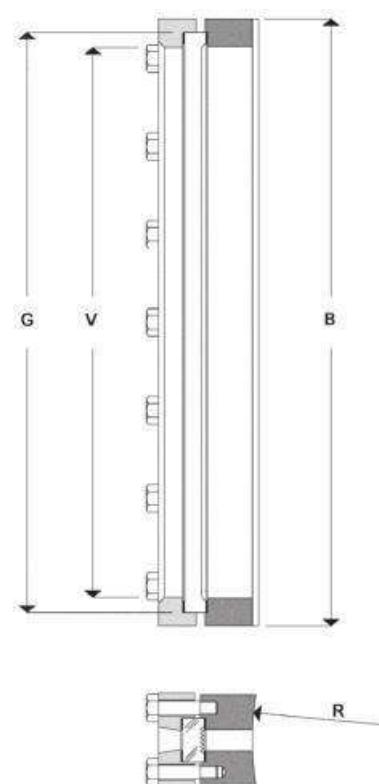


Fig. 821

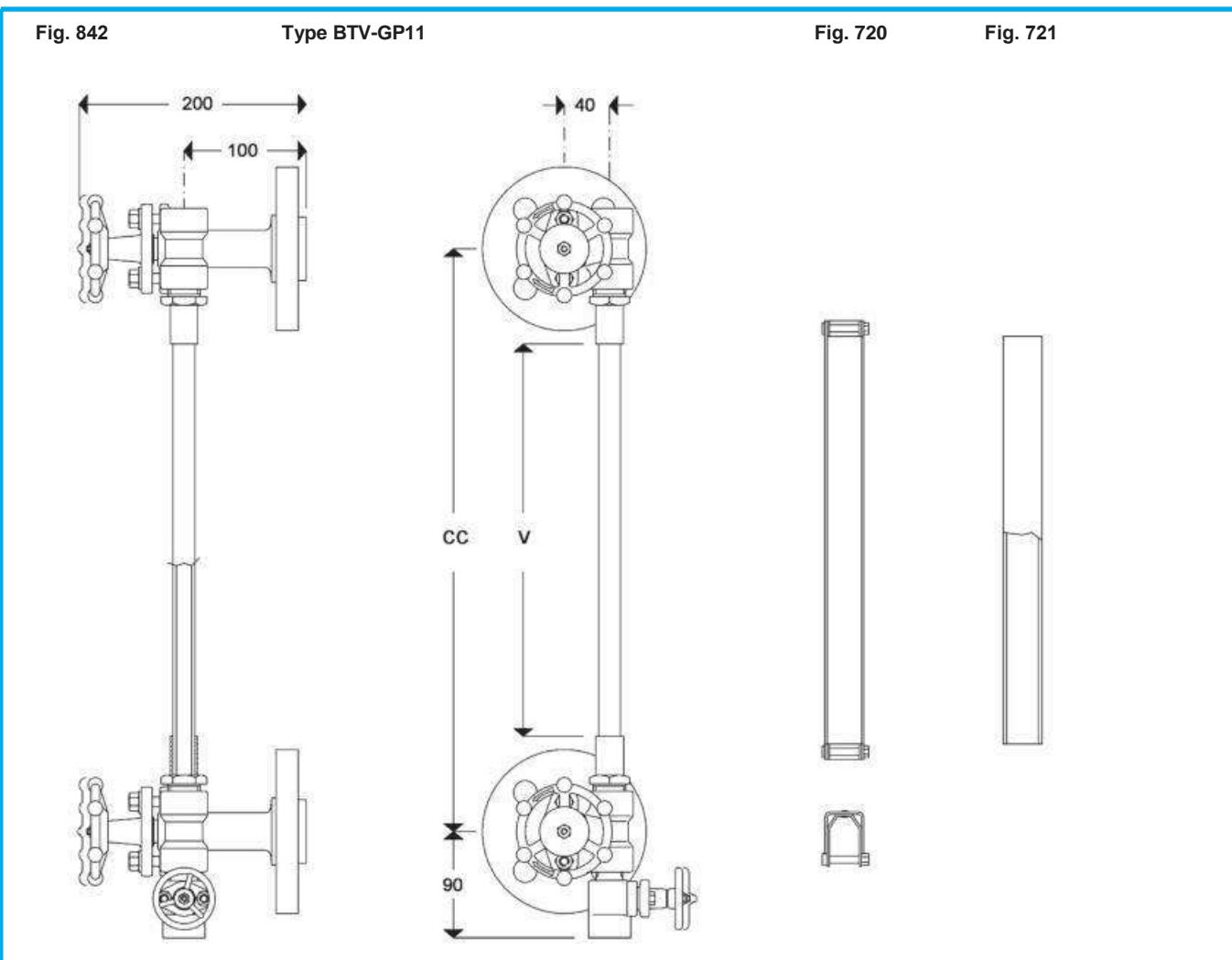
Type BR27



| Size | Length | Length | Visible | Weight | |
|------|----------|---------|---------|--------|------|
| | of glass | of body | length | BR26 | BR27 |
| | G | B | V | kg | kg |
| 1 | 115 | 128 | 95 | 4.8 | 3.6 |
| 2 | 140 | 153 | 120 | 5.7 | 4.3 |
| 3 | 165 | 178 | 145 | 6.6 | 5.0 |
| 4 | 190 | 203 | 170 | 7.5 | 5.7 |
| 5 | 220 | 233 | 200 | 8.6 | 6.6 |
| 6 | 250 | 263 | 230 | 9.8 | 7.5 |
| 7 | 280 | 293 | 260 | 10.9 | 8.3 |
| 8 | 320 | 333 | 300 | 12.4 | 9.4 |
| 9 | 340 | 353 | 320 | 13.1 | 10.0 |

- 1 These gauge bodies are suitable for welding directly on the vessel. Therefore, no valves can be fitted between vessel and gauge, and in case of glass breakage, the fluid flowing from the vessel cannot be stopped.
- 2 It is necessary to control the suitability of the vessel wall, on which the gauge body is to be welded as this must not be excessively weakened by the holes or communicating window with the gauge. Steel plates to strengthen the vessel wall should be used whenever this is possible.
- 3 During the welding operation, be careful to not expose the gauge body for long time to high temperatures, as this might damage the flatness of the glass sealing surface.
- 4 For BR26 the connecting lip is provided to facilitate the welding operation.
- 5 When enquiring or ordering BR27 please state the external radius (R) of the vessel on which the gauge must be welded.
- 6 For visible lengths over 320 mm two or more single gauge bodies will have to be welded on the vessel. In this case it is advisable to fit the gauge bodies not along the same vertical line, but offset.
- 7 BR26 and BR27 are fitted with reflex glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5.
- 9 Applicable optionals and bolting torques on pages 36, 37.

Tubular glass **BONETTI** Level Gauges type BTV-GP11



Dimensions:

| | | |
|-------------------|--------|---------------|
| Max C. to C. | CC max | = 2000 mm |
| Glass tube length | G | = CC - 28 mm |
| Visible length | V | = CC - 110 mm |
| Weight | | nearly kg 7,0 |

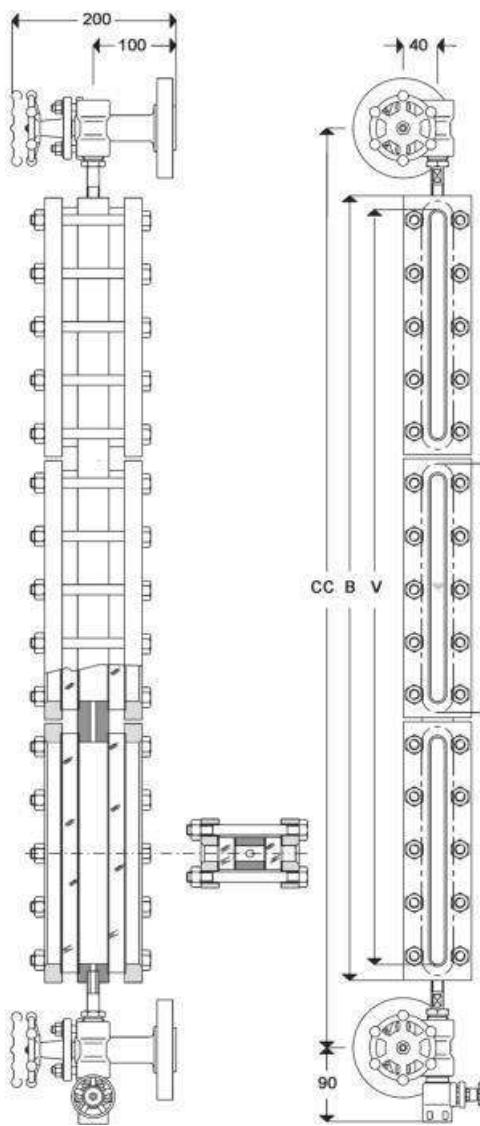
- 1 Type BTV-GP11 level gauges are equipped with a transparent glass tube of 16 mm outside diameter. The limitation of the operating conditions is due to the glass tube, while the valves type GP11 are suitable for higher pressure and temperature.
- 2 As the glass tubes are usually found on sale up to a maximum standard length of about 2000 mm, when the centre to centre distance is longer than this size, the installation of several, cascade disposed level gauges or the application of an intermediate support with stuffing-boxes are necessary. In the latter case the length of each glass tube will be half the centre to centre distance minus 17 mm.
- 3 To protect the glass tube against shocks we supply on request
 - U shaped metallic protector (Fig. 720) to be fixed to the stuffing box gland and/or
 - acrylic resin tube protector (Fig. 721) sealed by O-Rings to the stuffing box gland.
- 4 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 842 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.

- 5 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 6 Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Pressure class – Finishing
 The inside passage through the gauge is 10 mm.
- 7 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 8 BTV-GP11 gauges are fitted with glass tubes having 16 mm outside diameter and length equal to the centre to centre distance minus 28 mm.
- 9 Operating conditions and material schedules on pages 4 and 5.
- 10 Applicable optionals on pages 27 and 37.

Transparent **BONETTI** Level Gauges type BT23 with GP11, GP12, G41/42 and GS41/42 valves

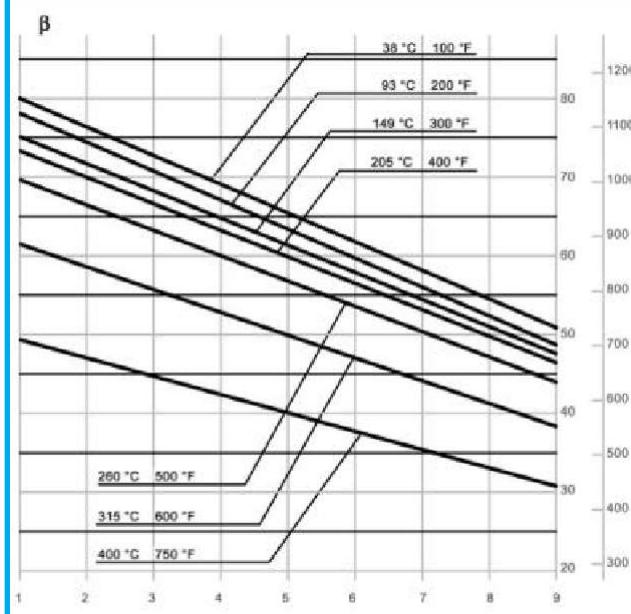
Fig. 843.1

Type BT23-GP11



| Size | Length of glass G | Length of body B | Visible length V | CC min. with GP11 | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | Weight kg |
|------|-------------------|------------------|------------------|-------------------|-------------------|-----------|-----------------------------|-----------|
| 1 | 115 | 128 | 95 | 241 | 209 | 10,9 | 218 | 16,3 |
| 2 | 140 | 153 | 120 | 266 | 234 | 11,5 | 243 | 16,9 |
| 3 | 165 | 178 | 145 | 291 | 259 | 12,3 | 268 | 17,7 |
| 4 | 190 | 203 | 170 | 316 | 284 | 12,9 | 293 | 18,3 |
| 5 | 220 | 233 | 200 | 346 | 314 | 13,9 | 323 | 19,3 |
| 6 | 250 | 263 | 230 | 376 | 344 | 14,6 | 353 | 20,0 |
| 7 | 280 | 293 | 260 | 406 | 374 | 15,6 | 383 | 21,0 |
| 8 | 320 | 333 | 300 | 446 | 414 | 16,7 | 423 | 22,1 |
| 9 | 340 | 353 | 320 | 466 | 434 | 17,4 | 443 | 22,8 |
| 2x4 | 190 | 413 | 380 | 526 | 494 | 18,9 | 503 | 24,3 |
| 2x5 | 220 | 473 | 440 | 586 | 554 | 20,8 | 563 | 26,2 |
| 2x6 | 250 | 533 | 500 | 646 | 614 | 22,4 | 623 | 27,8 |
| 2x7 | 280 | 593 | 560 | 706 | 674 | 24,5 | 683 | 29,9 |
| 2x8 | 320 | 673 | 640 | 786 | 754 | 26,7 | 763 | 32,1 |
| 2x9 | 340 | 713 | 680 | 826 | 794 | 27,7 | 803 | 33,1 |
| 3x6 | 250 | 803 | 770 | 916 | 884 | 30,3 | 893 | 35,7 |
| 3x7 | 280 | 893 | 860 | 1006 | 974 | 33,2 | 983 | 38,6 |
| 3x8 | 320 | 1013 | 980 | 1126 | 1094 | 36,4 | 1103 | 41,8 |
| 3x9 | 340 | 1073 | 1040 | 1186 | 1154 | 38,6 | 1163 | 44,0 |
| 4x7 | 280 | 1193 | 1160 | 1306 | 1274 | 41,9 | 1283 | 47,3 |
| 4x8 | 320 | 1353 | 1320 | 1466 | 1434 | 46,3 | 1443 | 51,7 |
| 4x9 | 340 | 1433 | 1400 | 1546 | 1514 | 49,2 | 1523 | 54,6 |
| 5x7 | 280 | 1493 | 1460 | 1606 | 1574 | 50,7 | 1583 | 56,1 |
| 5x8 | 320 | 1693 | 1660 | 1806 | 1774 | 56,2 | 1783 | 61,6 |
| 5x9 | 340 | 1793 | 1760 | 1906 | 1874 | 59,8 | 1883 | 65,2 |
| 6x8 | 320 | 2033 | 2000 | 2146 | 2114 | 66,1 | 2123 | 71,5 |
| 6x9 | 340 | 2153 | 2120 | 2266 | 2234 | 70,4 | 2243 | 75,8 |
| 7x9 | 340 | 2513 | 2480 | 2626 | 2594 | 80,9 | 2603 | 86,3 |

- 1 Connections between gauge and valves are made
 - for BT23-GP11, by end tubes and stuffing boxes
 - for BT23-GP12, by NPT screwed nipples
 - for BT23-G41/42 & GS41/42, by NPT screwed nipples.
 Minimum CC distance, shown on table is referred to 1/2" NPT connections. On request 3/4" NPT connection can be supplied.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 843.1 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Finishing – Pressure class
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BT23 gauges are fitted with transparent glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37.
- 10 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 11 For level gauges type BT23-G41, BT23-G42, BT23-GS41, BT23-GS42, see page 30-31.

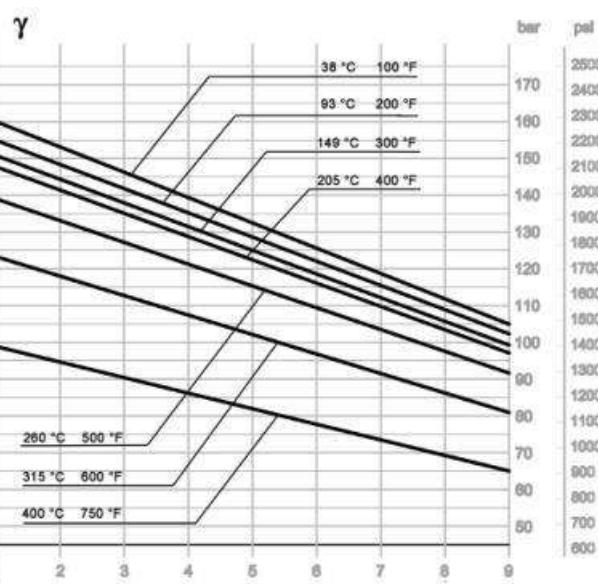
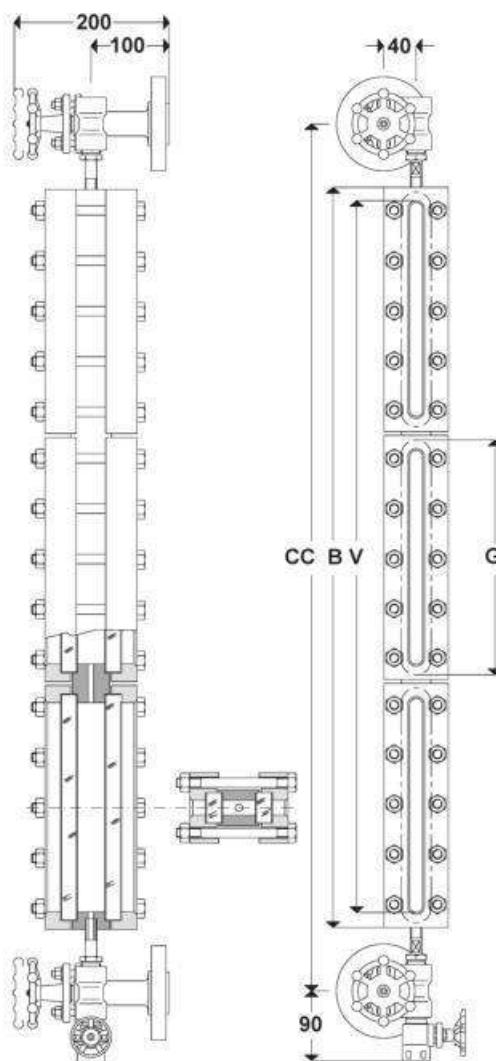


Transparent **BONETTI** Level Gauges

type BT24 with GP11, GP12, G41/42 and GS41/42 valves

Fig. 844.1

Type BT24-GP11



| Size | Length of glass G | Length of body B | Visible length V | CC min. with GP11 | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | Weight kg |
|------|-------------------|------------------|------------------|-------------------|-------------------|-----------|-----------------------------|-----------|
| | | | | 241 | 291 | | 316 | |
| 1 | 115 | 128 | 95 | 241 | 209 | 12,1 | 218 | 17,5 |
| 2 | 140 | 153 | 120 | 266 | 234 | 13,1 | 243 | 18,5 |
| 3 | 165 | 178 | 145 | 291 | 259 | 13,9 | 268 | 19,3 |
| 4 | 190 | 203 | 170 | 316 | 284 | 14,9 | 293 | 20,3 |
| 5 | 220 | 233 | 200 | 346 | 314 | 16,1 | 323 | 21,5 |
| 6 | 250 | 263 | 230 | 376 | 344 | 17,2 | 353 | 22,6 |
| 7 | 280 | 293 | 260 | 406 | 374 | 18,4 | 383 | 23,8 |
| 8 | 320 | 333 | 300 | 446 | 414 | 19,8 | 423 | 25,2 |
| 9 | 340 | 353 | 320 | 466 | 434 | 21,0 | 443 | 26,4 |
| 2x4 | 190 | 413 | 380 | 526 | 494 | 23,1 | 503 | 28,5 |
| 2x5 | 220 | 473 | 440 | 586 | 554 | 25,3 | 563 | 30,7 |
| 2x6 | 250 | 533 | 500 | 646 | 614 | 27,6 | 623 | 33,0 |
| 2x7 | 280 | 593 | 560 | 706 | 674 | 30,2 | 683 | 35,6 |
| 2x8 | 320 | 673 | 640 | 786 | 754 | 32,8 | 763 | 38,2 |
| 2x9 | 340 | 713 | 680 | 826 | 794 | 34,8 | 803 | 40,2 |
| 3x6 | 250 | 803 | 770 | 916 | 884 | 38,1 | 893 | 43,5 |
| 3x7 | 280 | 893 | 860 | 1006 | 974 | 41,7 | 983 | 47,1 |
| 3x8 | 320 | 1013 | 980 | 1126 | 1094 | 45,7 | 1103 | 51,1 |
| 3x9 | 340 | 1073 | 1040 | 1186 | 1154 | 49,3 | 1163 | 54,7 |
| 4x7 | 280 | 1193 | 1160 | 1306 | 1274 | 53,4 | 1283 | 58,8 |
| 4x8 | 320 | 1353 | 1320 | 1466 | 1434 | 58,7 | 1443 | 64,1 |
| 4x9 | 340 | 1433 | 1400 | 1546 | 1514 | 63,4 | 1523 | 68,8 |
| 5x7 | 280 | 1493 | 1460 | 1606 | 1574 | 65,1 | 1583 | 70,5 |
| 5x8 | 320 | 1693 | 1660 | 1806 | 1774 | 71,7 | 1783 | 77,1 |
| 5x9 | 340 | 1793 | 1760 | 1906 | 1874 | 77,6 | 1883 | 83,0 |
| 6x8 | 320 | 2033 | 2000 | 2146 | 2114 | 84,7 | 2123 | 90,1 |
| 6x9 | 340 | 2153 | 2120 | 2266 | 2234 | 91,7 | 2243 | 97,1 |
| 7x9 | 340 | 2513 | 2480 | 2626 | 2594 | 105,9 | 2603 | 111,3 |

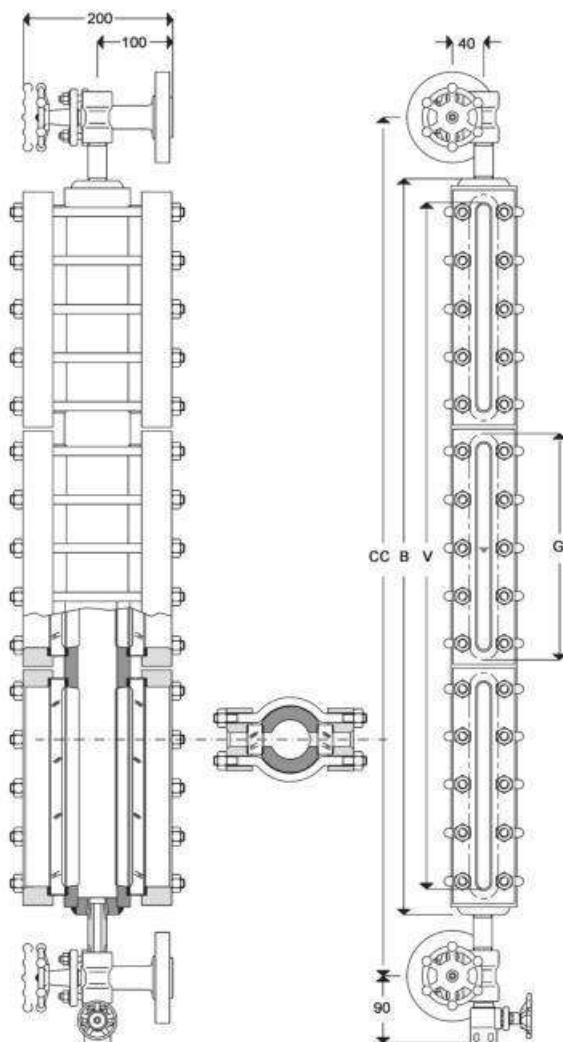
- 1 Connections between gauge and valves are made
 - for BT24-GP11, by end tubes and stuffing boxes
 - for BT24-GP12, by NPT screwed nipples
 - for BT24-G41/42 & GS41/42, by NPT screwed nipples.
 Minimum CC distance, shown on table is referred to 1/2" NPT connections. On request 3/4" NPT connection can be supplied.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 844.1 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Pressure class
 - Size
 - Finishing
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BT24 gauges are fitted with transparent glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37.
- 10 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 11 For level gauges type BT24-G41, BT24-G42, BT24-GS41, BT24-GS42, see page 30-31.

Transparent **BONETTI** Level Gauges

type BT25 with GP12, G41/42 and GS41/42 valves

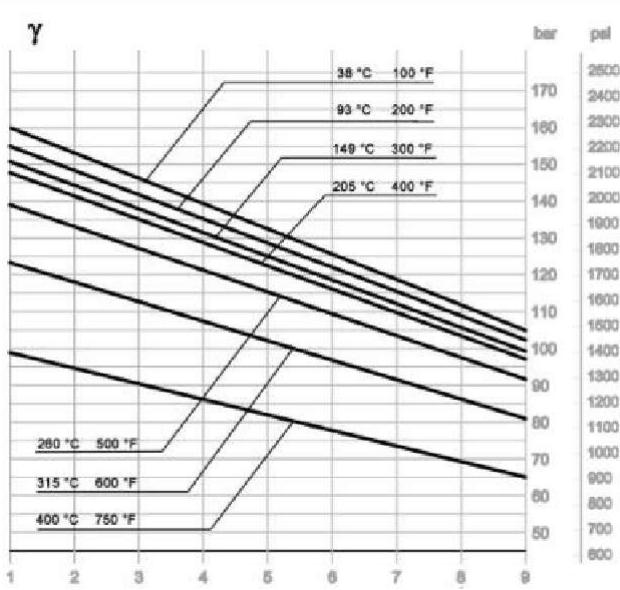
Fig. 845

Type BT25-GP12



| Size | Length of glass | | | Visible length | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | Weight kg |
|------|-----------------|------|------|----------------|-------------------|-----------|-----------------------------|-----------|
| | G | B | V | | | | | |
| 1 | 115 | 158 | 95 | 239 | 16,9 | 248 | 22,3 | |
| 2 | 140 | 183 | 120 | 264 | 18,4 | 273 | 23,8 | |
| 3 | 165 | 208 | 145 | 289 | 19,9 | 298 | 25,3 | |
| 4 | 190 | 233 | 170 | 314 | 21,3 | 323 | 26,7 | |
| 5 | 220 | 263 | 200 | 344 | 23,1 | 353 | 28,5 | |
| 6 | 250 | 293 | 230 | 374 | 24,9 | 383 | 30,3 | |
| 7 | 280 | 323 | 260 | 404 | 26,6 | 413 | 32,0 | |
| 8 | 320 | 363 | 300 | 444 | 29,0 | 453 | 34,4 | |
| 9 | 340 | 383 | 320 | 464 | 30,1 | 473 | 35,5 | |
| 2x4 | 190 | 443 | 380 | 524 | 33,4 | 533 | 38,8 | |
| 2x5 | 220 | 503 | 440 | 584 | 36,9 | 593 | 42,3 | |
| 2x6 | 250 | 563 | 500 | 644 | 40,4 | 653 | 45,8 | |
| 2x7 | 280 | 623 | 560 | 704 | 44,0 | 713 | 49,4 | |
| 2x8 | 320 | 703 | 640 | 784 | 48,7 | 793 | 54,1 | |
| 2x9 | 340 | 743 | 680 | 824 | 51,0 | 833 | 56,4 | |
| 3x6 | 250 | 833 | 770 | 914 | 56,0 | 923 | 61,4 | |
| 3x7 | 280 | 923 | 860 | 1004 | 61,3 | 1013 | 66,7 | |
| 3x8 | 320 | 1043 | 980 | 1124 | 68,4 | 1133 | 73,8 | |
| 3x9 | 340 | 1103 | 1040 | 1184 | 72,0 | 1193 | 77,4 | |
| 4x7 | 280 | 1223 | 1160 | 1304 | 78,7 | 1313 | 84,1 | |
| 4x8 | 320 | 1383 | 1320 | 1464 | 88,1 | 1473 | 93,5 | |
| 4x9 | 340 | 1463 | 1400 | 1544 | 92,8 | 1553 | 98,2 | |
| 5x7 | 280 | 1523 | 1460 | 1604 | 96,0 | 1613 | 101,4 | |
| 5x8 | 320 | 1723 | 1660 | 1804 | 107,8 | 1813 | 113,2 | |
| 5x9 | 340 | 1823 | 1760 | 1904 | 113,7 | 1913 | 119,1 | |
| 6x8 | 320 | 2063 | 2000 | 2144 | 127,5 | 2153 | 132,9 | |
| 6x9 | 340 | 2183 | 2120 | 2264 | 134,6 | 2273 | 140,0 | |
| 7x9 | 340 | 2543 | 2480 | 2624 | 155,5 | 2633 | 160,9 | |

- 1 Type BT25-GP12 level gauge is **LARGE CHAMBERED**. The gauge body is machined from a tube having thick wall and internal Ø of about 40 mm. Large chamber level gauges should be used where the medium boils or surges.
- 2 Connections between gauge and valves are made by NPT screwed nipples. Minimum CC distance, shown on table is referred to 1/2" NPT connections. On request 3/4" NPT connection can be supplied.
- 3 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 845 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed.
- 4 When large chamber body is required with butt-welding end caps, length of body (B) and minimum C. to C. (CC min) have to be increased of 40 mm.
- 5 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 6 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Pressure class
 - Size
 - Finishing
 The inside passage through the gauge is 40 mm.
- 7 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 8 BT25 gauges are fitted with transparent glasses type B (see page 38).
- 9 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 10 Applicable optionals and bolting torques on pages 27, 36, 37.
- 11 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 12 For level gauges type BT25-G41, BT25-G42, BT25-GS41, BT25-GS42, see page 30-31.

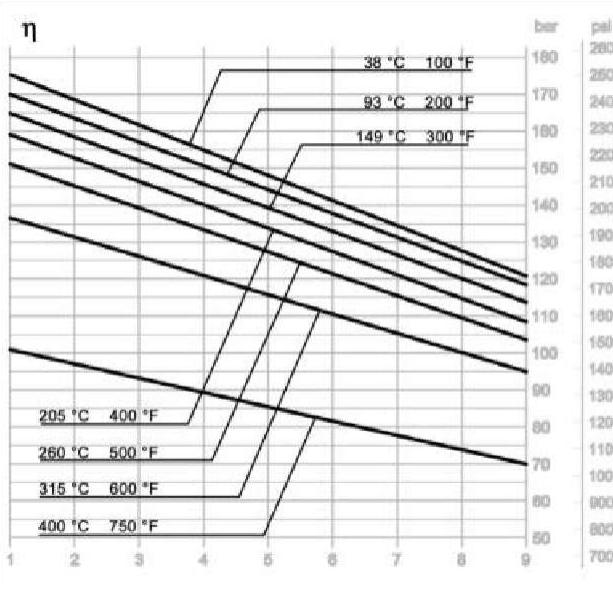
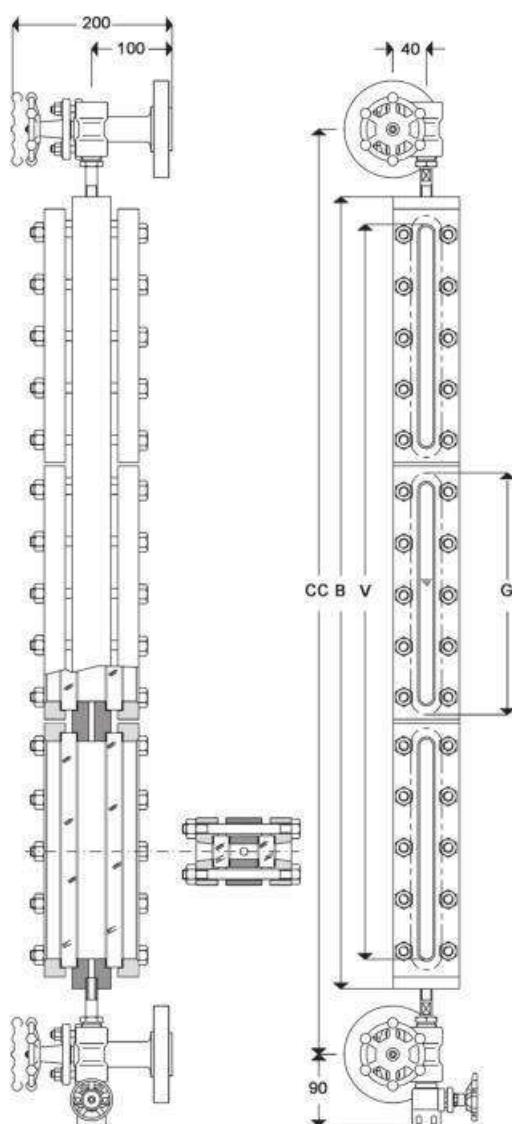


Transparent **BONETTI** Level Gauges

type BT28 with GP11, GP12, G41/42 and GS41/42 valves

Fig. 846

Type BT28-GP11



| Size | Length of glass G | Length of body B | Visible length V | CC min. with GP11 | CC min. with GP12 | Weight kg | CC min. with G & GS 41 & 42 | Weight kg |
|------|-------------------|------------------|------------------|-------------------|-------------------|-----------|-----------------------------|-----------|
| | | | | | | | | |
| 1 | 115 | 165 | 95 | 278 | 246 | 17,1 | 255 | 22,5 |
| 2 | 140 | 190 | 120 | 303 | 271 | 18,8 | 280 | 24,2 |
| 3 | 165 | 215 | 145 | 328 | 296 | 20,5 | 305 | 25,9 |
| 4 | 190 | 240 | 170 | 353 | 321 | 22,0 | 330 | 27,4 |
| 5 | 220 | 270 | 200 | 383 | 351 | 24,1 | 360 | 29,5 |
| 6 | 250 | 300 | 230 | 413 | 381 | 26,3 | 390 | 31,7 |
| 7 | 280 | 330 | 260 | 443 | 411 | 28,3 | 420 | 33,7 |
| 8 | 320 | 370 | 300 | 483 | 451 | 31,0 | 460 | 36,4 |
| 9 | 340 | 390 | 320 | 503 | 471 | 32,3 | 480 | 37,7 |
| 2x4 | 190 | 450 | 380 | 563 | 531 | 34,5 | 540 | 39,9 |
| 2x5 | 220 | 510 | 440 | 623 | 591 | 38,7 | 600 | 44,1 |
| 2x6 | 250 | 570 | 500 | 683 | 651 | 43,1 | 660 | 48,5 |
| 2x7 | 280 | 630 | 560 | 743 | 711 | 47,1 | 720 | 52,5 |
| 2x8 | 320 | 710 | 640 | 823 | 791 | 52,5 | 800 | 57,9 |
| 2x9 | 340 | 750 | 680 | 863 | 831 | 55,1 | 840 | 60,5 |
| 3x6 | 250 | 840 | 770 | 953 | 921 | 59,9 | 930 | 65,3 |
| 3x7 | 280 | 930 | 860 | 1043 | 1011 | 65,9 | 1020 | 71,3 |
| 3x8 | 320 | 1050 | 980 | 1163 | 1131 | 74,0 | 1140 | 79,4 |
| 3x9 | 340 | 1110 | 1040 | 1223 | 1191 | 77,9 | 1200 | 83,3 |
| 4x7 | 280 | 1230 | 1160 | 1343 | 1311 | 84,7 | 1320 | 90,1 |
| 4x8 | 320 | 1390 | 1320 | 1503 | 1471 | 95,5 | 1480 | 100,9 |
| 4x9 | 340 | 1470 | 1400 | 1583 | 1551 | 100,7 | 1560 | 106,1 |
| 5x7 | 280 | 1530 | 1460 | 1843 | 1611 | 103,5 | 1620 | 108,9 |
| 5x8 | 320 | 1730 | 1660 | 1843 | 1811 | 117,0 | 1820 | 122,4 |
| 5x9 | 340 | 1830 | 1760 | 1943 | 1911 | 123,5 | 1920 | 128,9 |
| 6x8 | 320 | 2070 | 2000 | 2183 | 2151 | 138,5 | 2160 | 143,9 |
| 6x9 | 340 | 2190 | 2120 | 2303 | 2271 | 146,3 | 2280 | 151,7 |
| 7x9 | 340 | 2550 | 2480 | 2663 | 2631 | 169,1 | 2640 | 174,5 |

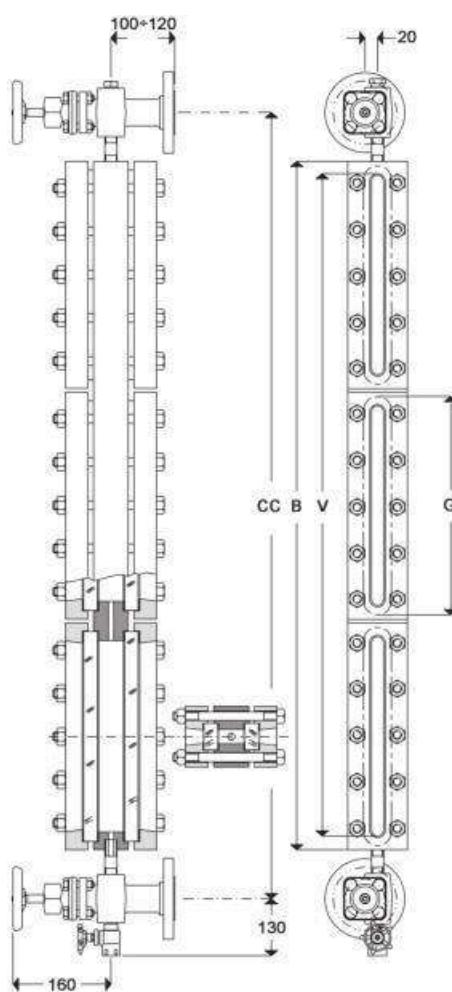
- 1 Connections between gauge and valves are made
 - for BT28-GP11, by end tubes and stuffing boxes
 - for BT28-GP12, by NPT screwed nipples
 - for BT28-G41/42 & GS41/42, by NPT screwed nipples.
 Gauge valve standard NPT connection is 1/2". On request 3/4" NPT connection can be supplied.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 846 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed. Usually two level gauges (1 right and 1 left) are installed on steam vessels.
- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 5 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Pressure class
 - Size
 - Finishing
 The inside passage through the gauge is 10 mm.
- 6 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 7 BT28 gauges are fitted with transparent glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 9 Applicable optionals and bolting torques on pages 27, 36, 37.
- 10 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 11 For level gauges type BT28-G41, BT28-G42, BT28-GS41, BT28-GS42, see page 30-31.
- 12 The BT28 gauge body can be fitted with set of valves G42: this level gauge is called type BT28-G42 and is suitable for water steam up to 50 bar and 263 °C.

Transparent **BONETTI** Level Gauges

type BT29 with GP12, G41/42 and GS 41/42 valves

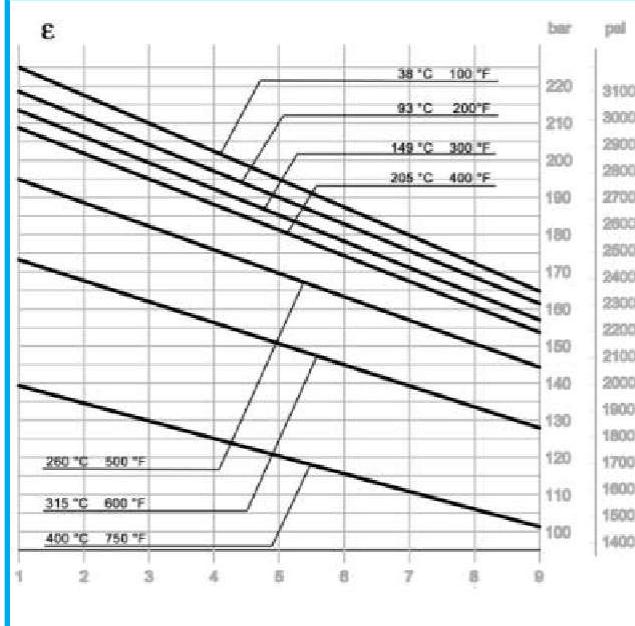
Fig. 868

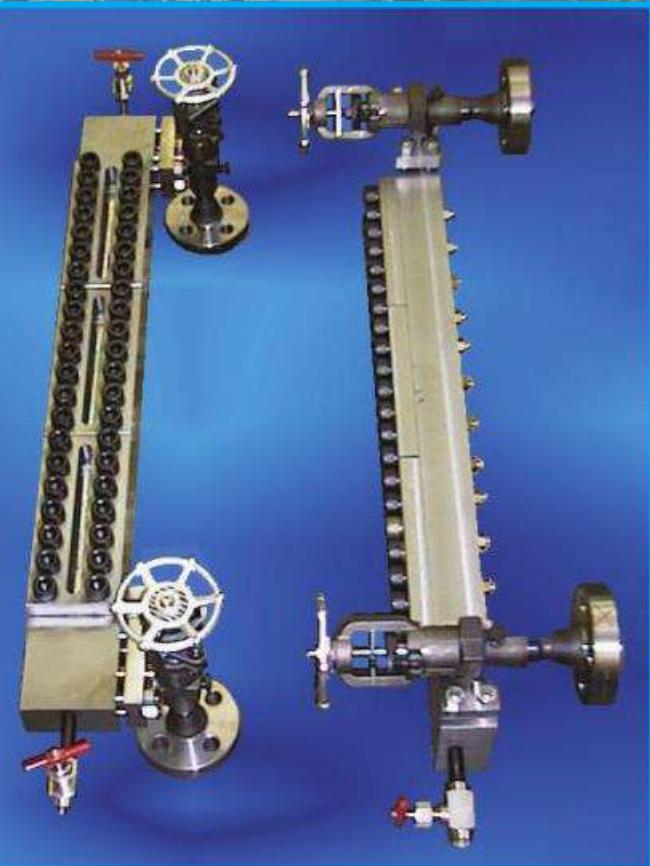
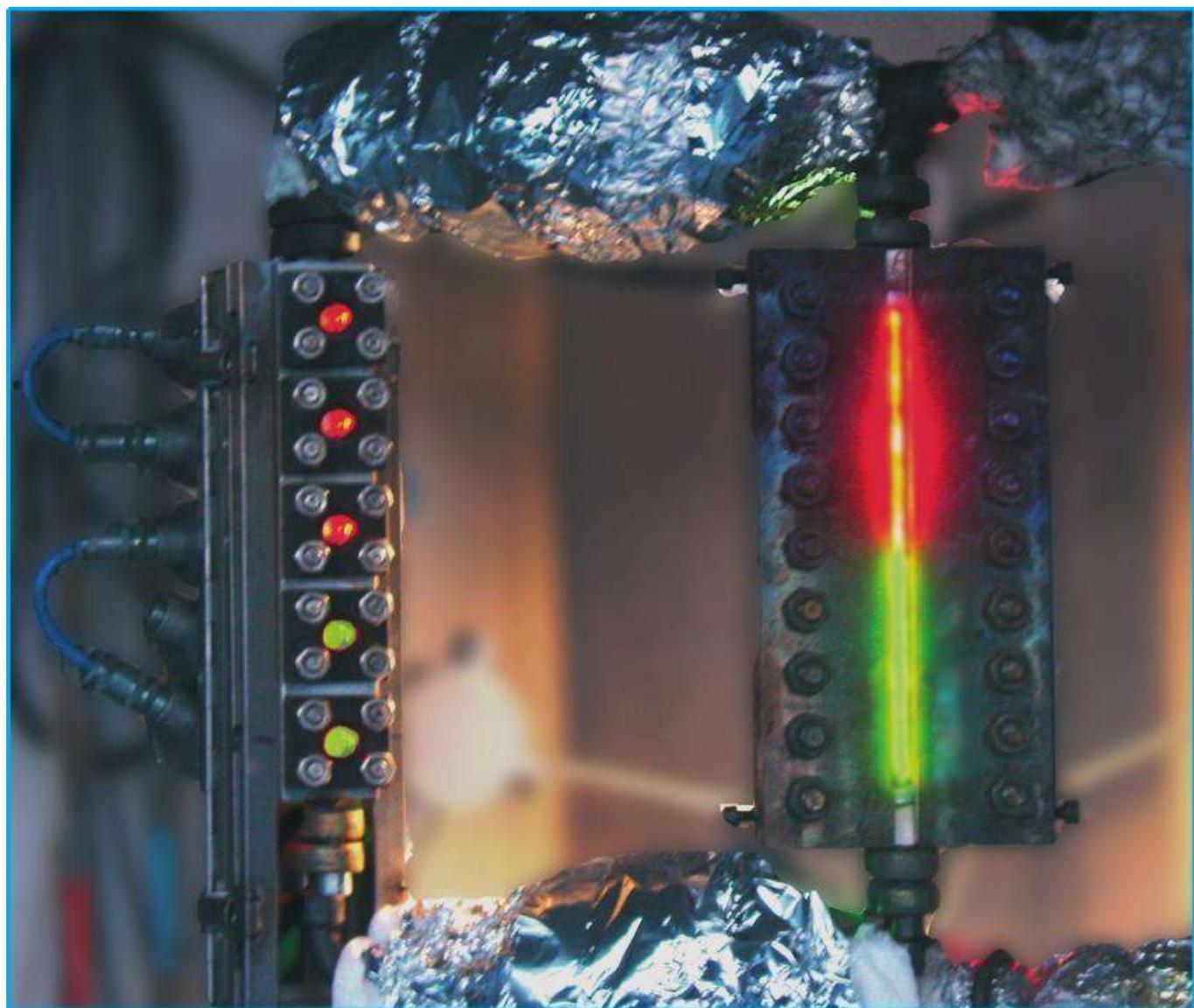
Type BT29-G41



| Size | Length | Length | Visible | CC min. | Weight | CC min. | Weight |
|------|----------|---------|---------|-----------|--------|---------|--------|
| | of glass | of body | length | | | with | |
| | G | B | V | with GP12 | kg | G & GS | |
| 1 | 115 | 165 | 95 | 246 | 17,1 | 255 | 22,5 |
| 2 | 140 | 190 | 120 | 271 | 18,8 | 280 | 24,2 |
| 3 | 165 | 215 | 145 | 296 | 20,5 | 305 | 25,9 |
| 4 | 190 | 240 | 170 | 321 | 22,0 | 330 | 27,4 |
| 5 | 220 | 270 | 200 | 351 | 24,1 | 360 | 29,5 |
| 6 | 250 | 300 | 230 | 381 | 26,3 | 390 | 31,7 |
| 7 | 280 | 330 | 260 | 411 | 28,3 | 420 | 33,7 |
| 8 | 320 | 370 | 300 | 451 | 31,0 | 460 | 36,4 |
| 9 | 340 | 390 | 320 | 471 | 32,3 | 480 | 37,7 |
| 2x4 | 190 | 450 | 380 | 531 | 34,5 | 540 | 39,9 |
| 2x5 | 220 | 510 | 440 | 591 | 38,7 | 600 | 44,1 |
| 2x6 | 250 | 570 | 500 | 651 | 43,1 | 660 | 48,5 |
| 2x7 | 280 | 630 | 560 | 711 | 47,1 | 720 | 52,5 |
| 2x8 | 320 | 710 | 640 | 791 | 52,5 | 800 | 57,9 |
| 2x9 | 340 | 750 | 680 | 831 | 55,1 | 840 | 60,5 |
| 3x6 | 250 | 840 | 770 | 921 | 59,9 | 930 | 65,3 |
| 3x7 | 280 | 930 | 860 | 1011 | 65,9 | 1020 | 71,3 |
| 3x8 | 320 | 1050 | 980 | 1131 | 74,0 | 1140 | 79,4 |
| 3x9 | 340 | 1110 | 1040 | 1191 | 77,9 | 1200 | 83,3 |
| 4x7 | 280 | 1230 | 1160 | 1311 | 84,7 | 1320 | 90,1 |
| 4x8 | 320 | 1390 | 1320 | 1471 | 95,5 | 1480 | 100,9 |
| 4x9 | 340 | 1470 | 1400 | 1551 | 100,7 | 1560 | 106,1 |
| 5x7 | 280 | 1530 | 1460 | 1611 | 103,5 | 1620 | 108,9 |
| 5x8 | 320 | 1730 | 1660 | 1811 | 117,0 | 1820 | 122,4 |
| 5x9 | 340 | 1830 | 1760 | 1911 | 123,5 | 1920 | 128,9 |
| 6x8 | 320 | 2070 | 2000 | 2151 | 138,5 | 2160 | 143,9 |
| 6x9 | 340 | 2190 | 2120 | 2271 | 146,3 | 2280 | 151,7 |
| 7x9 | 340 | 2550 | 2480 | 2631 | 169,1 | 2640 | 174,5 |

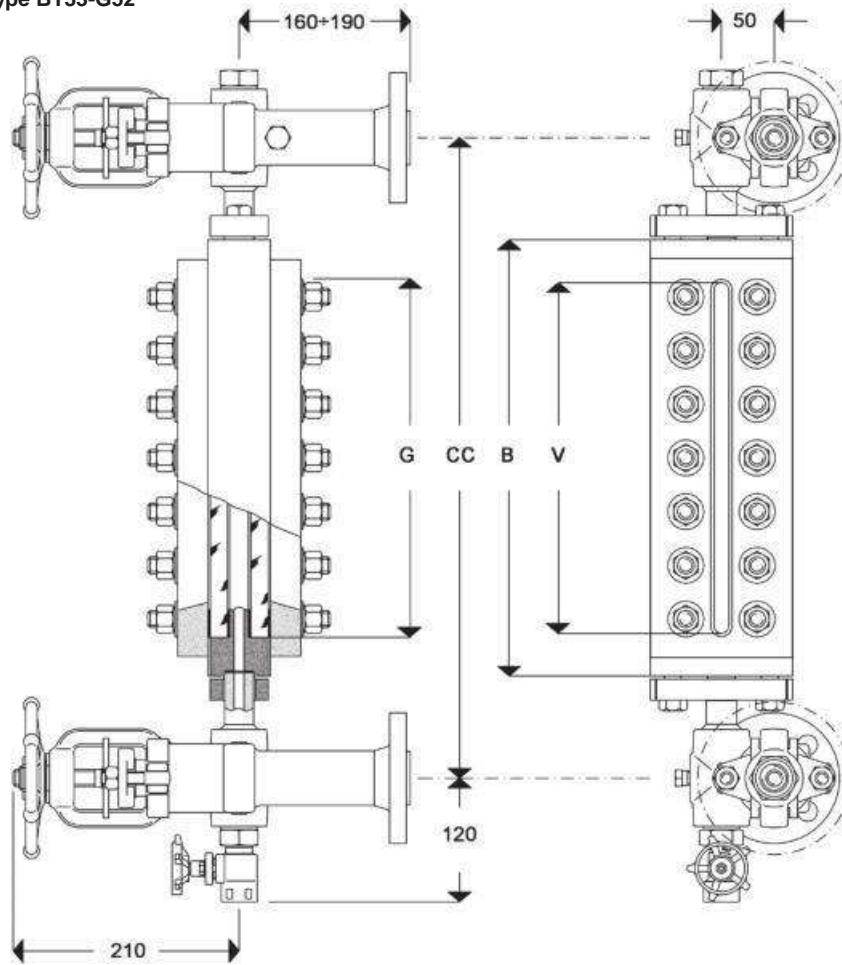
- 1 Connections between gauge and valves are made
 - for BT29-GP12, by NPT screwed nipples
 - for BT29-G41/42 & GS41/42, by NPT screwed nipples.
 Gauge valve standard NPT connection is 1/2".
 On request 3/4" NPT connection can be supplied.
- 2 According to the position of the shut-off valves compared with the gauge body, the level gauge is named "right-handed" or "left-handed". Fig. 868 shows a left-handed gauge.
- 3 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 4 Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Pressure class – Finishing
 The inside passage through the gauge is 10 mm.
- 5 Instead of flanges, connections can be delivered with threaded ends. Standard is 3/4" NPT, union. Other Standard and size on request.
- 6 BT29 gauges are fitted with transparent glasses type B (see page 38).
- 7 Operating conditions and material schedules on pages 4 and 5. Graph below shows rating for size 9 and smaller, combined included.
- 8 Applicable optionals and bolting torques on pages 27, 36, 37.
- 9 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 10 For level gauges type BT29-G41, BT29-GS41, BT29-G42, BT29 GS42, see page 30-31.





Transparent **BONETTI** Level Gauges type BT33 with G52 valves

Fig. 858 Type BT33-G52



| Size | Length of glass G | Length of body B | Visible length V | CC min. length | Weight |
|------|-------------------|------------------|------------------|----------------|--------|
| 3 | 165 | 225 | 145 | 387 | 41,1 |
| 4 | 190 | 250 | 170 | 412 | 43,4 |
| 5 | 220 | 280 | 200 | 442 | 46,3 |
| 6 | 250 | 310 | 230 | 472 | 49,1 |
| 7 | 280 | 340 | 260 | 502 | 51,9 |
| 8 | 320 | 380 | 300 | 542 | 55,6 |
| 9 | 340 | 400 | 320 | 562 | 57,5 |
| 2x4 | 190 | 457 | 377 | 619 | 62,9 |
| 2x5 | 220 | 517 | 437 | 679 | 68,5 |
| 2x6 | 250 | 577 | 497 | 739 | 74,1 |
| 2x7 | 280 | 637 | 557 | 799 | 79,7 |
| 2x8 | 320 | 717 | 637 | 879 | 87,2 |
| 2x9 | 340 | 757 | 677 | 919 | 91,0 |
| 3x6 | 250 | 844 | 764 | 1006 | 99,2 |
| 3x7 | 280 | 934 | 854 | 1096 | 107,6 |
| 3x8 | 320 | 1054 | 974 | 1216 | 118,9 |
| 3x9 | 340 | 1114 | 1034 | 1276 | 124,5 |
| 4x7 | 280 | 1231 | 1151 | 1393 | 135,5 |
| 4x8 | 320 | 1391 | 1311 | 1553 | 150,5 |
| 4x9 | 340 | 1471 | 1391 | 1633 | 158,0 |
| 5x7 | 280 | 1528 | 1448 | 1690 | 163,3 |
| 5x8 | 320 | 1728 | 1648 | 1890 | 182,1 |
| 5x9 | 340 | 1828 | 1748 | 1990 | 191,5 |
| 6x8 | 320 | 2065 | 1985 | 2227 | 213,7 |
| 6x9 | 340 | 2185 | 2105 | 2347 | 224,9 |
| 7x9 | 340 | 2542 | 2462 | 2704 | 258,4 |

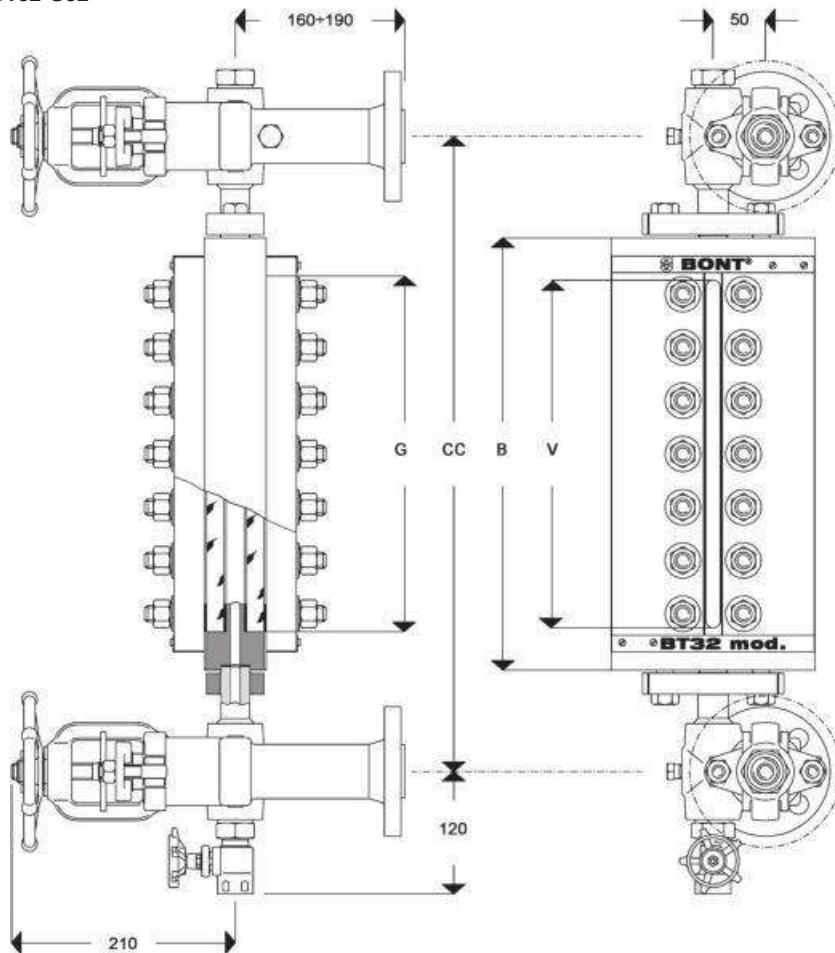
- 1 Connections between gauge and valves are made by flanges and bolts. Provided valves are closed, gauge body can be easily rotated on its axis even with boiler under steam in order to adjust easy reading from control floor.
- 2 According to the right or left position of the stop valves handle on the gauge body, the level gauges are named right-handed

or left-handed. Fig. 858 shows a right-handed level gauge. Usually two level gauges (1 right and 1 left) are installed on steam vessels.

- 3 According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- 4 For visible length over 320 mm we manufacture combined level gauges having two or more gauge bodies on common centre piece. Side gauge for by-passing blind distance is recommended (see Fig. 820, page 36).
- 5 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 6 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Size
 - Pressure class
 - Finishing
 The inside passage through the gauge is at least 12.5 mm.
- 7 Instead of flanges, connections can be delivered with welding ends (Socket welding or Butt welding). Please state connecting dimensions, size and Standard.
- 8 BT33 gauges are fitted with transparent glasses type B (see page 38).
- 9 Operating conditions and material schedules on pages 4 and 5.
- 10 Applicable optionals and bolting torques on pages 27, 36, 37.
- 11 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 12 This level gauge is in compliance with ASME Boiler - Section I – requirements

Transparent **BONETTI** Level Gauges type BT32 with G52 valves

Fig. 859 Type BT32-G52



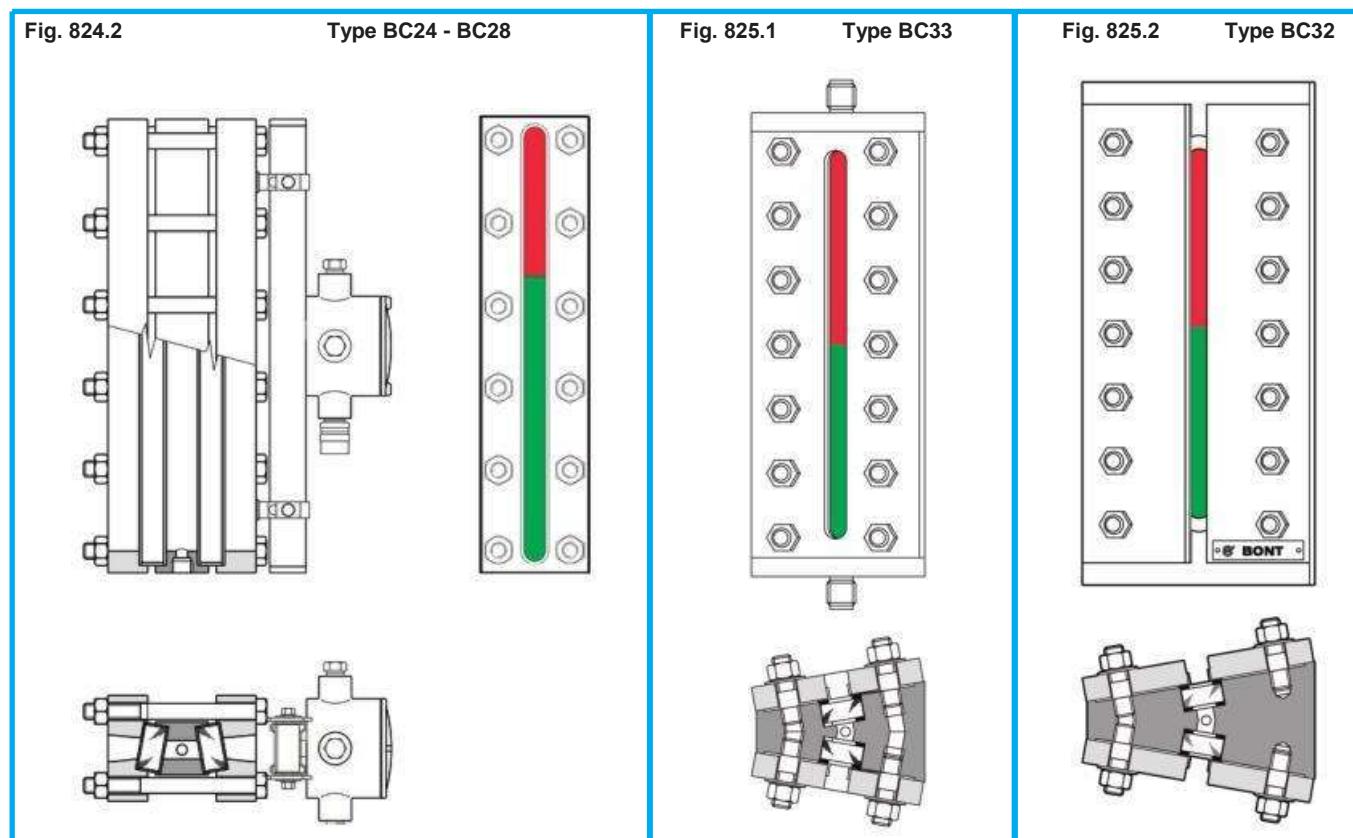
| Size | Length of glass | Length of body | Visible length | CC min. length | Weight |
|------|-----------------|----------------|----------------|----------------|--------|
| | G | B | V | | |
| 3 | 165 | 225 | 145 | 387 | 51,7 |
| 4 | 190 | 250 | 170 | 412 | 55,2 |
| 5 | 220 | 280 | 200 | 442 | 59,4 |
| 6 | 250 | 310 | 230 | 472 | 63,6 |
| 7 | 280 | 340 | 260 | 502 | 67,8 |
| 8 | 320 | 380 | 300 | 542 | 73,5 |
| 9 | 340 | 400 | 320 | 562 | 76,3 |
| 2x4 | 190 | 497 | 417 | 659 | 89,9 |
| 2x5 | 220 | 557 | 477 | 719 | 98,4 |
| 2x6 | 250 | 617 | 537 | 779 | 106,8 |
| 2x7 | 280 | 677 | 597 | 839 | 115,2 |
| 2x8 | 320 | 757 | 677 | 919 | 126,5 |
| 2x9 | 340 | 797 | 717 | 959 | 132,1 |
| 3x6 | 250 | 924 | 844 | 1086 | 150,0 |
| 3x7 | 280 | 1014 | 934 | 1176 | 162,7 |
| 3x8 | 320 | 1134 | 1054 | 1296 | 179,5 |
| 3x9 | 340 | 1194 | 1114 | 1356 | 188,0 |
| 4x7 | 280 | 1351 | 1271 | 1513 | 210,1 |
| 4x8 | 320 | 1511 | 1431 | 1673 | 232,6 |
| 4x9 | 340 | 1591 | 1511 | 1753 | 243,8 |
| 5x7 | 280 | 1688 | 1608 | 1850 | 257,5 |
| 5x8 | 320 | 1888 | 1808 | 2050 | 285,6 |
| 5x9 | 340 | 1988 | 1908 | 2150 | 299,7 |
| 6x8 | 320 | 2265 | 2185 | 2427 | 338,7 |
| 6x9 | 340 | 2385 | 2305 | 2547 | 355,5 |
| 7x9 | 340 | 2782 | 2702 | 2944 | 411,4 |

- Connections between gauge and valves are made by flanges and bolts. Provided valves are closed, gauge body can be easily rotated on its axis even with boiler under steam in order to adjust easy reading from control floor.
- According to the right or left position of the stop valves handle on the gauge body, the level gauges are named right-handed or left-handed.

handed. Fig. 859 shows a right-handed level gauge. Usually two level gauges (1 right and 1 left) are installed on steam vessels.

- According to some Steam Boiler Regulations, the visible length of the level gauges installed on steam boilers must be not shorter than a fixed length. Therefore the suitability of the smaller sizes must be checked.
- For visible length over 315 mm we manufacture combined level gauges having two or more gauge bodies on common centre piece. Side gauge for bypassing blind distance is recommended (see Fig. 820, page 36).
- When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- Flanges are finished to customer prescriptions. Please state:
 - Standard – Size
 - Pressure class – Finishing
 The inside passage through the gauge is at least 12.5 mm.
- Instead of flanges, connections to the vessel can be delivered with welding ends (Socket welding or Butt welding). Please state connecting dimensions, size and Standard.
- BT32 gauges are fitted with transparent glasses type B (see page 38).
- Operating conditions and material schedules on pages 4 and 5.
- Applicable optionals and bolting torques on pages 27, 36, 37.
- Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- This level gauge is in compliance with ASME Boiler - Section I – requirements**

Bicolour **BONETTI** Level Gauges type BC24, BC28, BC33, BC32



Design and working principle

BONETTI bicolour level gauges are made of:

- 1 metallic centre piece containing steam and water of which level is to be measured;
- 1 or more flat transparent glasses (long or circular) on the front face of the gauges;
- an equal number of identical glasses on the back face of the gauge;
- 1 or more front covers and an equal number of back covers holding the glass assemblies against the centre piece;
- 1 illuminator case containing LED lamps of two colour (normally green and red);
- 1 set of shut-off valves for connection to boiler or tank.

The bicolour level gauge has a trapezoidal body and consequently the front and the back glasses are non-parallel.

They form a small angle. This special assembly and the different index of refraction of water and steam allows that the red and the green light of the illuminator entering the gauge passes through the gauge itself and is seen by the observer as follows:

- **RED** in correspondence of **STEAM**
- **GREEN** in correspondence of **WATER**.

Application

Bicolour level gauges are manufactured by our Company since more than 70 years. At the beginning only port-hole level gauges were produced (that is with small circular glasses) suitable for high pressure water/steam, up to 225 bar (see BONETTI level gauges type BC1-G55). For these severe conditions the small circular glasses are absolutely necessary and cannot be substituted by other types of glasses.

In the recent year bicolour gauges have been very much appreciated because of the brilliant and sure reading they give and therefore they are more and more requested for low and medium pressure water/steam also, for which long glasses can safely be used. In case of combined level gauges, with the bicolour reading it is not necessary to use side bodies for the uninterrupted visibility, allowing a simplification of the instrument.

For the same operating conditions, we produce both transparent and bicolour level gauges, (see Fig. 824, 825.1 and 825.2).

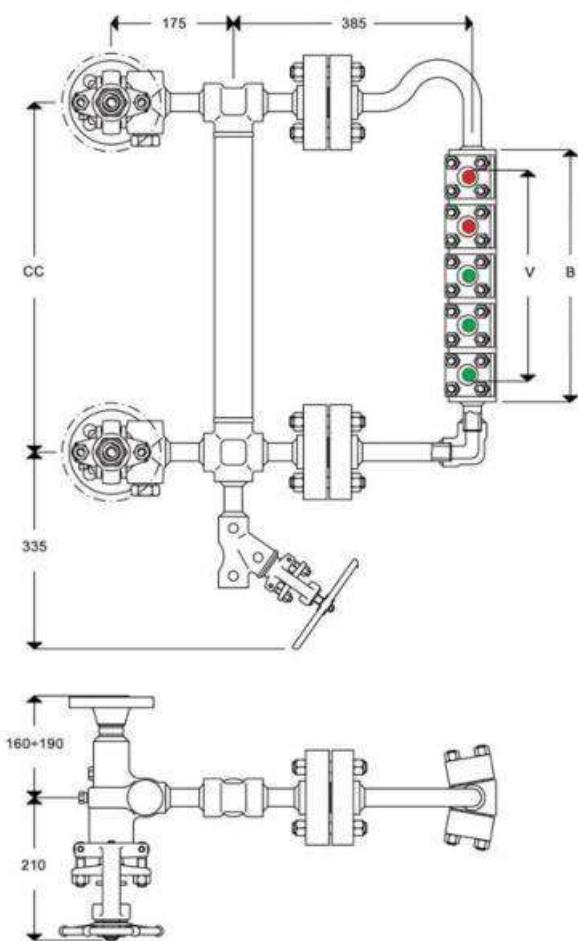
Dimensions (Body length, C to C Distance according to the different type of valve sets, etc.), Description and Maintenance Instructions of the Bicolour Level Gauges are identical to those of the corresponding Transparent Level Gauge.

| Bicolour | Transparent | Max. Operating Conditions | | | Fluid |
|---|-------------|---------------------------|-------------------|--------------|-------|
| | | Pressure bar | Temperature °C | | |
| Fig. 844 | | | | | |
| BC24-GP11 | BT24-GP11 | 20 | 211 | Water steam | |
| | BT24-GP11 | 105 | 38 | Other fluids | |
| | | 62 | 300 (*) | | |
| Fig. 846 | | | | | |
| BC28-GP11 | BT28-GP11 | 40 | 249 | Water steam | |
| | BT24-GP11 | 120 | 38 | Other fluids | |
| | | 80 | 300 (*) | | |
| Fig. 858 | | | | | |
| BC33-G52 | BT33-G52 | 90 | 302 | Water steam | |
| Fig. 859 | | | | | |
| BC32-G52 | BT32-G52 | 103 | 313 | Water steam | |
| (*) NOTE: Maximum allowable temperature according to DIN 7081 / 1999-05. For operating condition with temperature over 300 °C, please apply to our Sales or Technical department. | | | | | |

Bicolour **BONETTI** Level Gauges type BC1 with G55 valves

Fig. 860

Type BC1-G55



- 1 According to the right or left position of the handwheel of the stop valves on the gauge body, the level gauges are named right-handed or left-handed. Fig. 860 shows a left-handed level gauge. Usually two level gauges (1 right and 1 left) are installed on steam vessel.
- 2 This level gauge consists of one gauge type BC1, and one set of valves type G55. It MUST be installed with the gauge body in vertical position. G55 set is connected to a vertical pipe, which links upper and bottom gauge parts. It avoid condensate to flow through gauge body therefore granting better visibility and longer life of glasses. Gauge body is connected to pipe/valve assembly through two flanges and can be easily removed for inspection and service.
- 3 This gauge consists of a central body type BC1 and a certain number of covers attached to the front and the back of the body: the covers contain small circular glasses. Central body is manufactured of stainless steel for a longer life of the whole instrument. The illuminator is fitted and has bicolour LED lamps, half red and half green. The illumination of the gauge is based on the difference of refractive indexes of steam and water. The light source projects its rays through the adjacent coloured filter and in the steam and water spaces these coloured light rays are refracted to a different degree depending upon the refractive index of the medium. This permits only one colour of light to emerge from each medium, the other being absorbed in the wall of the gauge.

| Size | Number of port-holes | C. to C. distance CC min | Length of body B | Visible length V | Weight kg |
|------|----------------------|-----------------------------|------------------------|------------------------|--------------|
| 5 | 5 | 472 | 372 | 311 | 094 |
| 6 | 6 | 545 | 445 | 384 | 100 |
| 7 | 7 | 618 | 518 | 457 | 107 |
| 8 | 8 | 691 | 591 | 530 | 113 |
| 9 | | | | | |
| 10 | 9 | 764 | 664 | 603 | 119 |
| | 10 | 837 | 737 | 676 | 126 |
| 11 | 11 | 910 | 810 | 749 | 132 |

Longer or shorter visible length can be supplied on request

In particular the circular glasses appear:

- **RED** in correspondence of **STEAM**

- **GREEN** in correspondence of **WATER**

The level can be:

- read by observer standing directly IN FRONT of the level gauge, at the same height of body, or it can be outfitted with:
 - special "periscope" mirrors able to transmit the signal to the control station by means of a simple perisopic arrangement with mirrors. The mirrors (both top and bottom) adjustable to assist alignment,
 - closed TV circuit, also transmitting a 4,20 mA signal
 - "Red Cherry" optics-fiber system: this system can transmit the red and green light signal to the control station by means of fiber-optic remote viewing device.

Ask for peculiar bulletin. Needs of each plant should be known before stating supplying

- 4 The standard illuminator is explosion-proof and consists of a stainless steel box containing red and green LED lamps, is suitable for the number of port holes and is suitable for 110-240 V AC @ 50/60Hz or 18-36 V DC power supply. The illuminator is slotted so as to fit into the level gauge centre piece. The red line of LED lamps must be placed in correspondence of the narrow side of the gauge body; the green line on the wide side. In this way the view of red steam and green water will be produced. We recommend to use only original BONETTI illuminator as spare.
- 5 We manufacture BC1 gauges with adequate number of port holes on one single centre piece. Shorter or longer visible length than those listed in the table can be supplied on request.
- 6 Centre to centre distance (CC) shown on table are referred to bodies with holes having standard pitch of 73 mm. To meet special visibility request, different pitch length can be supplied.
- 7 When ordering a level gauge please state:
 - Centre to centre distance between connections (CC)
 - Standard, Size and Finishing of connections
 - Whether right-handed or left-handed.
- 8 Flanges are finished to customer prescriptions. Please state:
 - Standard
 - Size
 - Pressure class
 - Finishing
 The inside passage through the gauge is at least 12,5 mm.
- 9 Instead of flanges, connections can be delivered with welding ends (Socket welding or Butt welding). Please state connecting dimensions, size and Standard.
- 10 BC1 gauges are fitted with transparent glass discs (Dia. 31,6 x 12,7 mm). Dimensions of joints and mica and Maintenance Instructions on request.
- 11 Operating conditions and material schedules on pages 4 and 5.
- 12 Applicable optionals and bolting torques on pages 27 and 37.
- 13 Gauge bodies without valves can be supplied:
 - end connected (threaded or flanged)
 - side connected (threaded or flanged)
 - back connected (threaded or flanged).
 Please state connecting dimensions and Standard.
- 14 This level gauge is in compliance with ASME Boiler - Section I - requirements

Transparent BONETTI Level Gauges Weld - on Bodies, type BT26 and BT27

Fig. 734

Type BT26

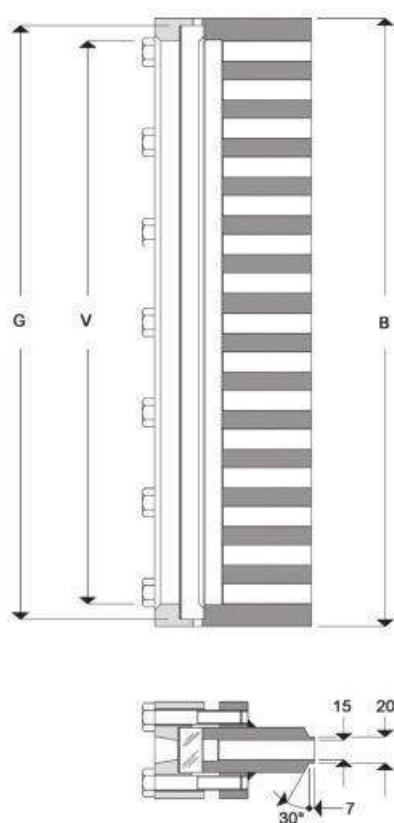
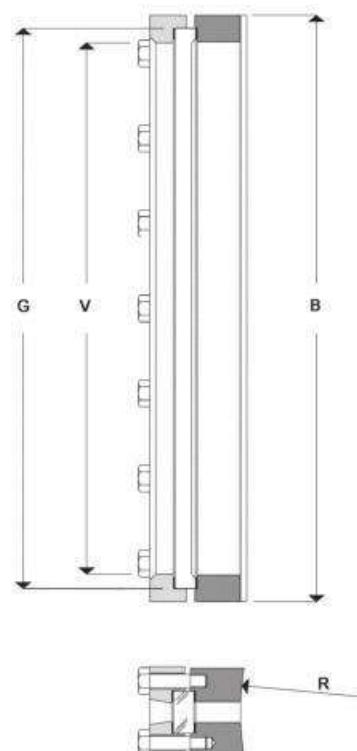


Fig. 822

Type BT27



| Size | Length | Length | Visible | Weight | |
|------|----------|---------|---------|--------|------|
| | of glass | of body | length | BT26 | BT27 |
| | G | B | V | kg | kg |
| 1 | 115 | 128 | 95 | 4.8 | 3.6 |
| 2 | 140 | 153 | 120 | 5.7 | 4.3 |
| 3 | 165 | 178 | 145 | 6.6 | 5.0 |
| 4 | 190 | 203 | 170 | 7.5 | 5.7 |
| 5 | 220 | 233 | 200 | 8.6 | 6.6 |
| 6 | 250 | 263 | 230 | 9.8 | 7.5 |
| 7 | 280 | 293 | 260 | 10.9 | 8.3 |
| 8 | 320 | 333 | 300 | 12.4 | 9.4 |
| 9 | 340 | 353 | 320 | 13.1 | 10.0 |

- 1 These gauge bodies are suitable for welding directly on the vessel. Therefore, no valves can be fitted between vessel and gauge, and in case of glass breakage, the fluid flowing from the vessel cannot be stopped.
- 2 It is necessary to control the suitability of the vessel wall, on which the gauge body is to be welded as this must not be excessively weakened by the holes or communicating window with the gauge. Steel plates to strengthen the vessel wall should be used whenever this is possible.
- 3 During the welding operation, be careful to not expose the gauge body for long time to high temperatures, as this might damage the flatness of the glass sealing surface.
- 4 For BT26 the connecting lip is provided to facilitate the welding operation.

- 5 When enquiring or ordering BT27 please state the external radius (R) of the vessel on which the gauge must be welded.
- 6 For visible lengths over 320 mm two or more single gauge bodies will have to be welded on the vessel. In this case it is advisable to fit the gauge bodies not along the same vertical line, but offset.
- 7 BT26 and BT27 are fitted with transparent glasses type B (see page 38).
- 8 Operating conditions and material schedules on pages 4 and 5.
- 9 Applicable optionals and bolting torques on pages 36, 37.

BONETTI Level Gauges

Optionals for Sets of Valves

Fig. 865

| Set | | Valve | | | Plug | | Top and bottom ball-check | Operated by | | | | Heating | |
|------|------|-------|--------------|------|-------|------|---------------------------|-------------|-----------------|--------------|----------------|----------|----------|
| Type | Fig. | top | bottom drain | vent | drain | vent | | handwheel | chain handwheel | double lever | weighted lever | external | internal |
| G11 | 737 | S | S | S | A | A | A | S | NA | A | NA | A | NA |
| G12 | 738 | S | S | S | A | A | A | S | NA | A | NA | A | NA |
| GP11 | 831 | S | S | S | A | A | A | S | NA | NA | NA | A | NA |
| GP12 | 832 | S | S | S | A | A | A | S | NA | NA | NA | A | NA |
| G41 | 747 | S | S | A | A | A | A | S | NA | A | A | A | A |
| G42 | 748 | S | S | A | A | A | A | S | A | A | A | A | A |
| GS41 | 854 | S | S | A | A | A | A | S | NA | A | A | A | NA |
| GS42 | 855 | S | S | A | A | A | A | S | A | A | A | A | NA |
| G51 | 861 | S | S | S | A | NR | NR | A | S | A | NA | A | NA |
| G52 | 862 | S | S | S | A | NR | NR | A | S | A | NA | A | NA |
| G55 | 863 | S | S | S | A | NR | NR | A | S | A | NA | A | NA |

Keys and Remarks to Fig. 865

S – Standard Equipment

NA – Not applicable

A – Applicable

NR – Possible, but not recommended

- 1 We mean by Set the assembly of two valves (1 top and 1 bottom) for the connection of the gauge body to the vessel. The set stops fluid between vessel and level gauge in case of servicing.
- 2 This bulletin shows steel level gauges only; the sets fitted on the level gauges include the following patterns:
 - type G11 and G12, top and bottom: sleeve packed cocks; (see page 27)
 - type GP11 and GP12, top and bottom: piston valves; (see pages 28 and 29)
 - type G41 and G42, "Offset" metallic seating valves, with stainless steel screwed-in seat and stainless steel disk (see pages 30 and 31).
 - type GS41 and GS42, "Straight" metallic seating valves, with stainless steel screwed-in seat and stainless steel disk (see pages 30 and 31). type G51, G52, G55, metallic seating valves, with Stellite faced trim (see pages 32 and 33).

- 3 Each set is usually supplied with or without some optionals according to its original design and its main application.
- 4 EXTERNAL HEATING has electrical or steam tracing, installed on job site. By INTERNAL HEATING gauge body is inside traced for heating fluid.
- 5 All sets can be supplied with INTERMEDIATE SUPPORT fitted on the vessel in the middle between top and bottom valve in case of very large C. to C. distance. Intermediate support usually clamps the gauge bodies only and is not in connection with the vessel inside.
- 6 Optionals for gauge bodies on pages 36 and 37.

BONETTI Gauge Valves

General information

These are the classical cocks for level gauges having a cylindrical plug with soft tightening packing sleeve.

The advantages of this design are:

- circular through flow passage;
- very long life of body and plug, since the elastic packing sleeve is interposed between this two pieces;
- no sensitivity to changes of temperature;
- no possible plug seizure;
- best performance at high temperature;
- possibility to restore tightness during service by compressing packing sleeve;
- complete interchangeability of worn pieces.

Offset Valves type G11 and G12

**suitable for ASME 300 and PN 40 (type G11)
ASME 900 and PN 160 (type G12)**

These sets are suitable for:

- type G11 (connection to gauge by stuffing box) Fig. 737;
- ASME Class 300 and PN 40
- type G12 (connection to gauge by screwed nipples) Fig. 738
- ASME Class 900 and PN 160

Handles and plug are made so that each handle face downward when the gauge is in service, that is when shut-off (top and bottom) are open and drain cock is closed.

According to the right or the left position of the shut-off cocks handle, the set (and therefore the level gauge) is named right handed or left handed.

Centre to Centre distance

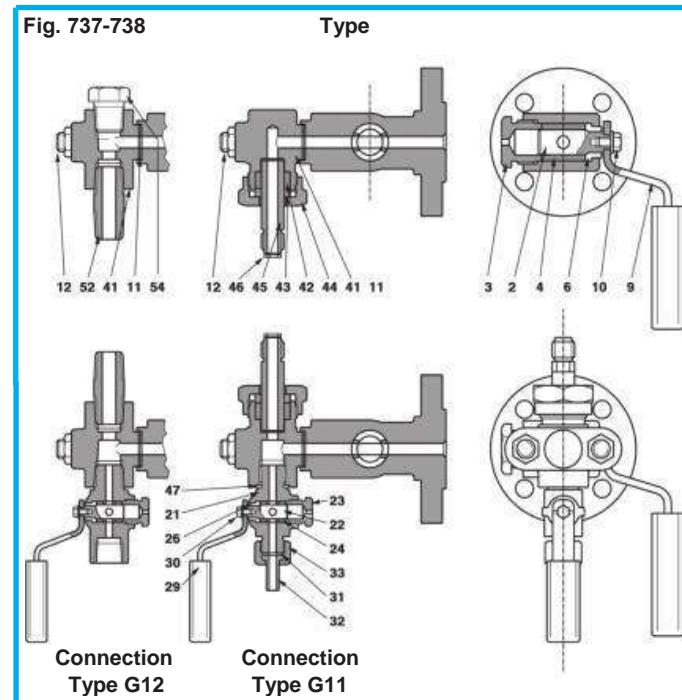
When these sets of cocks are chosen for the level gauge, the value of the minimum vessel C. to C. distance is given from the formula:

- type G11: min. C. to C. = Length of body + 101 mm
(CC min. = B + 101 mm); exceptionally CC min = B + 92 mm
- type G12: min. C. to C. with 1/2" NPT nipples = Length of body + 50 mm
(CC min = B + 50 mm)

Optionals

- Double ended handle for chain operating;
- Automatic safety ball check with removal device for bottom ball

Please apply to our sales organisation for more details and technical information.



| Top and bottom cock | Drain cock | |
|--|---|------------------------------------|
| 1 Body | 21 Body | 41 Connecting head |
| 2 Plug | 22 Plug | 42 P16 packing ring |
| 3 Tightening nut | 23 Tightening nut | 43 Stuffing box ring (16/23, 5/10) |
| 4 Packing sleeve with 2 eyelets, type M2.2 | 24 Packing sleeve with 2 eyelets, type M1.2 | 44 Stuffing box nut |
| 6 Ring | 26 Ring | 45 End tube |
| 9 Handle* | 29 Handle* | 46 Tube joint ring |
| 10 Screw and washer* | 30 Screw and washer* | 47 Drain joint ring |
| 11 Head joint | 31 Tailpipe joint | 52 NPT nipple |
| 12 Stud and nut | 32 Tailpipe | 54 NPT plug |
| | 33 Union nut | |

BONETTI Gauge Valves

Offset Valves type GP11 and GP12 suitable for ASME 300 and PN 40 (type GP11) ASME 900 and PN 160 (type GP12)

Fig. 831

Type GP11

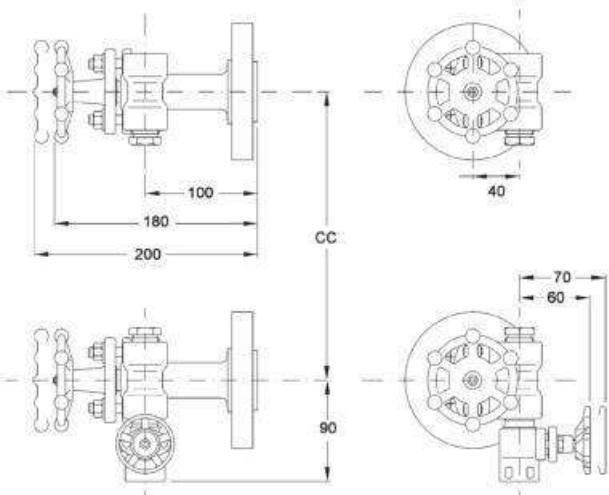
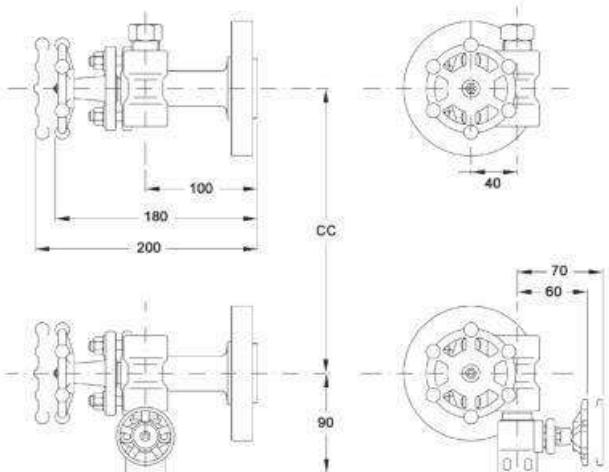


Fig. 832

Type GP12



General information

General information

These sets of valves consist usually of:

- 2 shut-off valves (1 top and 1 bottom)
- 1 drain valve.

The advantages of this design are:

- excellent performance of Piston Valves, qualified according to:
- API 6 FA and BS 6775: Fire Safe
- TA Luft: German Clean Air, TÜV Mannheim
- Druckbehälterverordnung § 22: for railway and road tankers down to -40°C, TÜV München
- easy servicing
- easy dismantling of the gauge body, to facilitate replacement of the glass.

These sets are suitable for:

- type GP11 (Fig. 831): connection to gauge body by stuffing box **ASME class 300 and PN 40**
- type GP12 (Fig. 832): connection to gauge body by screwed nipples - **ASME class 900 and PN 160**

Maximum service temperature: 425°C (797°F).

According to the position of the shut-off valves compared with the gauge body, the Set of valves (and therefore the level gauge) is named "right-handed" or "left-handed".

Fig. 831 shows a left-handed gauge. Each level gauge can be assembled right-handed or left-handed

Connection to the vessel

Can be:

- flanged to customer requirements.

Please state:

| | |
|------------------|-------------|
| - Standard | - Size |
| - Pressure class | - Finishing |

The flanges are integral with the body.

Different sizes and finishing of flanges can be obtained according to the most used international Standards (ASME, AFNOR, BS, DIN, GOST, UNI, etc.).

- screwed:

- 3/4" NPT Male Plain Union
- 3/4" NPT Male Spherical Union
- 3/4" NPT Male Integral

- welded: 3/4" Socket Welding

- other connections on request.

Connection to the gauge body

Can be:

- type GP11 (Fig. 831): connection by stuffing boxes and endtubes.
- type GP12: connection by NPT screwed nipples (Fig. 832).

In both choices the connection is made by means of head-pieces (item 41 or 51) and allows easy dismantling of the gauges for servicing and easy rotating on its axis for the best reading, provided valves are closed even with vessel under pressure.

Centre to Centre distance

When these sets of valves are chosen for the level gauge, the value of the minimum vessel C. to C. distance is given from the formula:

- type GP11:

Minimum C. to C. = Body length + 113 mm
(CC min = B + 107 mm)

- type GP12:

Minimum C. to C. with 1/2" NPT nipples = Body length + 81 mm
(CC min = B + 81 mm)

Fig. 833

| Material Schedule | Body and wetted parts | Trim | Remarks | Application |
|-------------------|---------------------------------|--------------------------|---|---|
| 52 | Forged carbon steel ASTM A 105 | Stainless steel | Exclusion of copper, silver and their alloys. | General purpose |
| 63 | Forged stainless steel AISI 316 | Stainless steel AISI 316 | External not wetted parts of S.S. AISI 304 or 303. | Corrosive fluids and/or fluids at temperature lower than -29 °C |
| 64 | Forged stainless steel AISI 316 | Stainless steel AISI 316 | External not wetted parts of carbon steel. Exclusion of copper, silver and their alloys. | Corrosive fluids |

Fig. 834

GP11

GP12

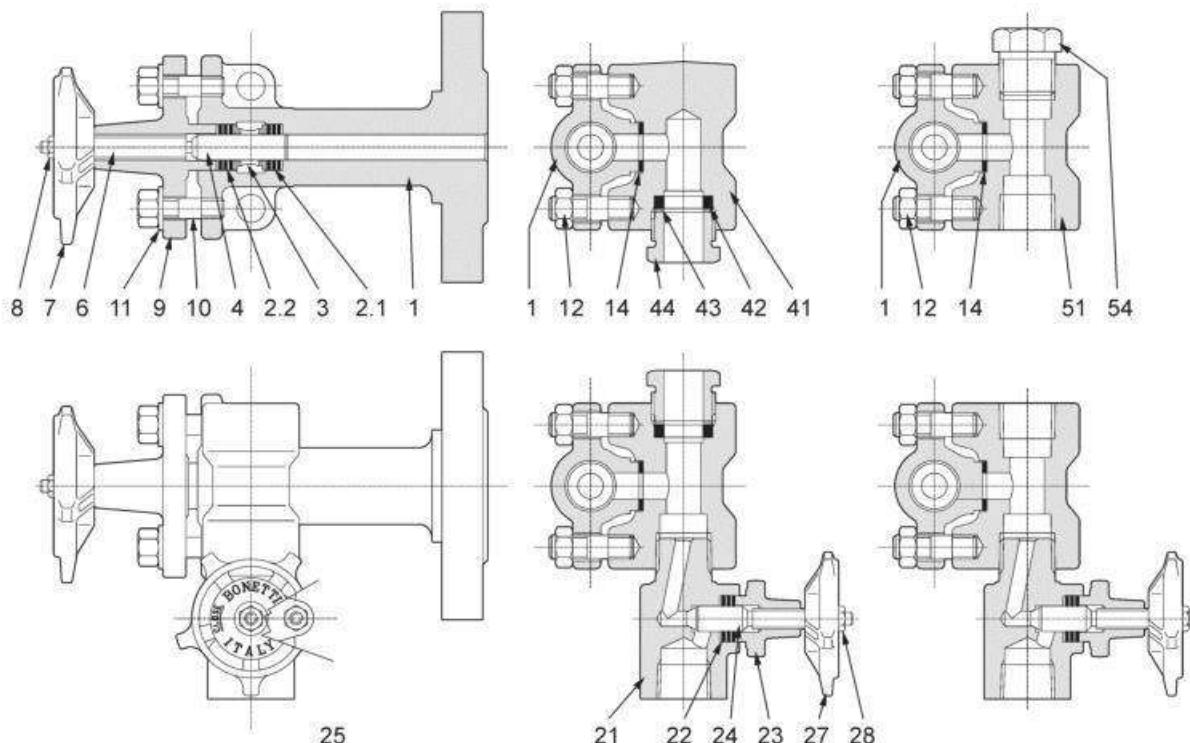


Fig. 866

| Item Part | Part Material for Material Schedule | | |
|--|-------------------------------------|------------------|------------------|
| | 52 | 63 | 64 |
| Upper and Lower Valve | | | |
| 1 Body | ASTM A105 | ASTM A182 F316 | ASTM A182 F316 |
| 2.1 Lower Valve Ring | Graphite St. St. | Graphite St. St. | Graphite St. St. |
| 2.2 Upper Valve Ring | Graphite St. St. | Graphite St. St. | Graphite St. St. |
| 3 Lantern Bush | Carbon Steel | ASTM A479 T316 | ASTM A479 T316 |
| 4 Piston | ASTM A479 T316 | ASTM A479 T316 | ASTM A479 T316 |
| 6 Spindle | ASTM A479 T410 | ASTM A479 T304 | ASTM A479 T410 |
| 7 Handwheel | Aluminium | Aluminium | Aluminium |
| 8 Handwheel Nut | Carbon Steel | Carbon Steel | Carbon Steel |
| 9 Bonnet | ASTM A105 | ASTM A182 F316 | ASTM A105 |
| 10 Stud Bolt and Nut A193 B7 - A194 2H A193 B8 - A194 G8 A193 B7 - A194 2H | | | |
| 11 Washer | Carbon Steel | Carbon Steel | Carbon Steel |
| 12 Stud Bolt and Nut A193 B7 - A194 2H A193 B8 - A194 G8 A193 B7 - A194 2H | | | |
| 14 Gasket | Asbestosfree | Asbestosfree | Asbestosfree |
| Drain Valve | | | |
| 21 Body | ASTM A105 | ASTM A182 F316 | ASTM A182 F316 |
| 22 Valve Ring | Graphite St. St. | Graphite St. St. | Graphite St. St. |
| 23 Bonnet | ASTM A105 | ASTM A182 F316 | ASTM A105 |
| 24 Needle | ASTM A479 T410 | ASTM A479 T316 | ASTM A479 T316 |
| 25 Screw | A193 B7 | A193 B8 | A193 B7 |
| 27 Handwheel | Aluminium | Aluminium | Aluminium |
| 28 Handwheel Nut | Carbon Steel | Carbon Steel | Carbon Steel |
| 41 Head GP11 | ASTM A105 | ASTM A479 T316 | ASTM A479 T316 |
| 42 Packing Ring | Graphite St. St. | Graphite St. St. | Graphite St. St. |
| 43 Stuffing Box Ring | Carbon Steel. | ASTM A479 T316 | ASTM A479 T316 |
| 44 Stuffing Box Nut | Carbon Steel | ASTM A479 T316 | Carbon Steel |
| 51 Head GP12 | ASTM A105 | ASTM A479 T316 | ASTM A479 T316 |
| 54 NPT Vent Plug | Carbon Steel | ASTM A479 T316 | ASTM A479 T316 |

Optionals

- Vent Plug on the upper head-piece (standard for GP12)
- Vent Valve on the upper head-piece
- Automatic Safety Ball-Check, in the upper and lower valve
- External tracing for heating or cooling, by electrical wire or pipe (to be made on field)
- Intermediate support not connected with the vessel, for very long C. to C. distance.

Material Schedules

Standard Material Schedules as per Fig. 833.
Other Material Schedules available on request.
Parts material is listed on Fig. 866.

Request or Order

Please state:

- type of set: Code GP11 or GP12
- right-handed or left-handed
- connections to the vessel: to be detailed
- optionals, if any
- Material Schedule: Fig. 833

Service

Before the valves are put in service:

- shut off the upper and lower valve and lightly follow up the bonnet Nuts (10)
- open the drain valve and lightly follow up the bonnet Screws (25)
- follow up the Gaskets (14) by the Nuts (12).

Spare parts

One complete set of sealing elements for 1 level gauge consists of:
 – 5 Valve Rings (item 2.1 - 2.2 - 22) B 10 x B 18 x 6
 – 2 Gaskets (item 14) B 20 x B 10,5 x 1
 – 2 Packing Rings (item 42) B 16 x B 23,5 x 5, for GP11 only.

BONETTI Gauge Valves

General information

These sets of valves are designed and manufactured expressly for use with level gauges and pressure gauges up to ASME 1500 and PN 250. For use with water steam, we recommend the type GS42 and G42, with outside screw and yoke.

These valves have bolted bonnet and metallic trim with renewable seat.

The valves are available:

| | | |
|-----------------|--|-----------|
| OFFSET | with Inside Screw (Fig. 747) | Code G41 |
| | with Outside Screw and Yoke (Fig. 748) | Code G42 |
| STRAIGHT | with Inside Screw (Fig. 854) | Code GS41 |
| | with Outside Screw and Yoke (Fig. 855) | Code GS42 |

They are both suitable for ASME 1500 and PN 250.

- The **Body** is of drop forged steel.
- The **Bonnet** is of drop forged steel and of the same material as body. It is bolted to the body by means of four bolts with nut. The advantages of this design are quite obvious, with respect to a bonnet screwed into the body or to a bonnet connected to the body by means of studs.
- The **Disk** is integral on the Stem, is made of stainless steel AISI 316 and is backseating against the bonnet when the valve is full open, for easy repacking under pressure..
- The **Seat** is of stainless steel AISI 316 (Monel or special material on request) and is easy renewable, being screwed into the body.
- One **Safety Ball-Check** of stainless steel AISI 316 (special material on request) is fitted to both valves as standard, for safety in the event of glass breakage. The safety ball is removed from its seat during the closing operation of the valve by means of the Stem extremity.
- The **Packing** is made of an adequate number of preformed rings of an approved high pressure - temperature quality. Special material on request.
- The **Name Plate** bears all prescribed indications and is fixed on each valve.
- For **Operating** three solutions are available:
 - Handwheel for plain-closing stem
 - Weighted lever for quick-closing stem
 - Double-ended lever for quick-closing stem

Code 1
Code 2
Code 3

Connections to the vessel

Can be:

- flanged: integral flange up to 125 mm o.D. (standard)
weld-on flange for major o.D.

Please state:

- Standard - Pressure class
- Size - Finishing
- screwed: 3/4" NPT male union (standard)
3/4" NPT male union spherical,
3/4" NPT male integral.
- welded: 3/4" socket welding
- other connections on request.

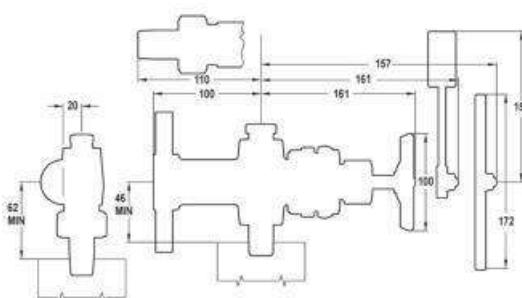
Connections to the gauge body

Can be:

- screwed 1/2" NPT female for nipple (standard) **Code 4**
- screwed 3/4" NPT female for nipple,
- socket welding 1/2" or 3/4"
- with union tailpipe 1/2" NPT male and union nut (standard) **Code 5**
- stuffing box for glass tube 16 mm. o.D. **Code 6**
Length of glass tube must be 21 mm. shorter than the Centre to Centre distance
- other connections on request.

Fig. 745

Type G41 and GS41



Set of Valves type G41, G42, GS41, GS42 suitable for ASME 1500 and PN 250

Centre to Centre distance

When these sets of valves are chosen for the level gauge, the value of the minimum vessel C. to C. distance is given by tables for each level gauge type, provided that the connection between the level gauge and its valves is obtained by means of 1/2" NPT screwed nipples.

The min. C. to C. distance is given from the formula:

- Minimum C. to C. with 1/2" NPT nipples = Body length + 90 mm (CC min = B + 90 mm)
- If tailpipe connection with 1/2" NPT and Union nut is requested, 50 mm must be added to the minimum CC length.
- Minimum C. to C. with 3/4" NPT nipples becomes 30 mm longer.

Connection to drain and vent

Can be:

- screwed 1/2" NPT female (standard) **Code 7**
- screwed 3/4" NPT female,
- other connections on request.

Optionals (see also page 29)

- For Heating or Cooling the valves are available with internal tube (only G41 and G42).
- For Very Low Temperature the inside screw valves (type G41 and GS41) are available with prolonged stem.

Material Schedules

Material Schedules currently manufactured on Fig. 749.

Other Material Schedules with other materials on request.

Part material is listed on Fig. 750.

Request or Order

Please state

- OFFSET, inside screw **Code G41**
- OFFSET, outside screw **Code G42**
- STRAIGHT, inside screw **Code GS41**
- STRAIGHT, outside screw **Code GS42**
- Operating **Code 1 or 2 or 3**
- Connections to the vessel **to be detailed**
- Connections to gauge body **Code 4 or 5 or 6**
- Connections to drain and vent **Code 7**
- Material Schedule **Code 52 or 55 or 63**
- Centre to Centre distance **to be stated**

Code

When these sets are chosen with our standard variants, the use of our Code is recommended. For instance:

- 1 Set of valves
 - inside screw OFFSET **Code G41**
 - operated by handwheel 1
 - connections to gauge body screwed 1/2" NPT female. 4
 - connections to drain and vent 1/2" NPT female. 7
 - material schedule 52

Resulting CODE: **G41.1.4.7.52**

It is to be stated in detail:

- connections to the vessel,
- Centre to Centre distance.

Maintenance

These sets don't need any special maintenance. We only recommend to check from time to time the tightening of Packing gland (45) and of body-bonnet Bolts (5).

Fig. 746

Type G42 and GS42

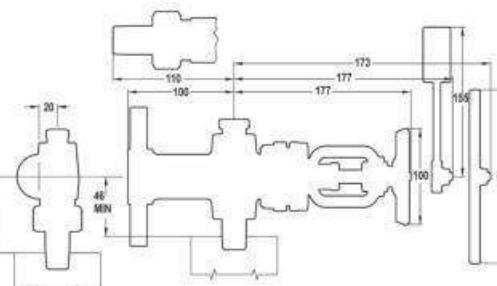


Fig. 749

| Material Schedule | Body bonnet and wetted parts | Trim and Ball-check | Remarks | Application |
|-------------------|-----------------------------------|--------------------------|---|--|
| 52 | Forged carbon steel ASTM A105 | Stainless steel AISI 316 | Exclusion of cooper silver and their alloys | General purpose |
| 55 | Forged carbon steel ASTM A350 LF2 | Stainless steel AISI 316 | External not wetted parts of S.S. AISI 304 or 303 | Non corrosive fluids at low temperature up to $-45,6^{\circ}\text{C}$ (-50°F). |
| 63 | Forged stainless steel AISI 316 | Stainless steel AISI 316 | External not wetted parts of S.S. AISI 304 or 303 | Corrosive fluids and/or fluids at temperature lower than $-45,6^{\circ}\text{C}$ (-50°F) |

Fig. 747

Type G41 (offset 20 mm)

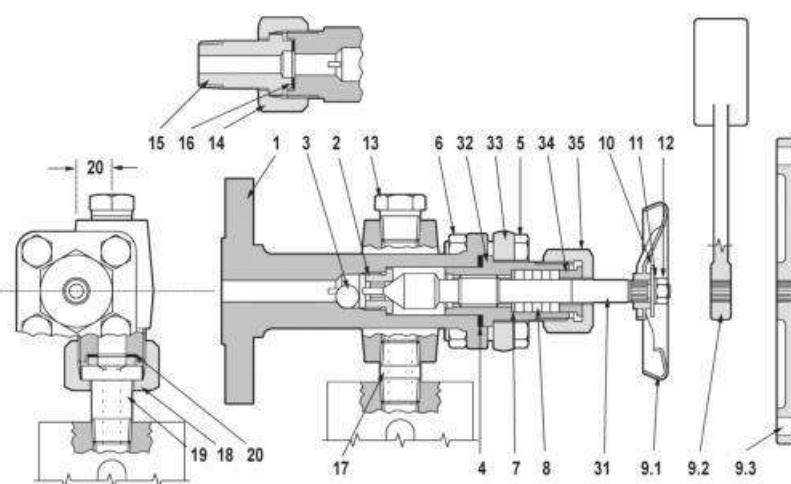


Fig. 748

Type G42 (offset 20 mm)

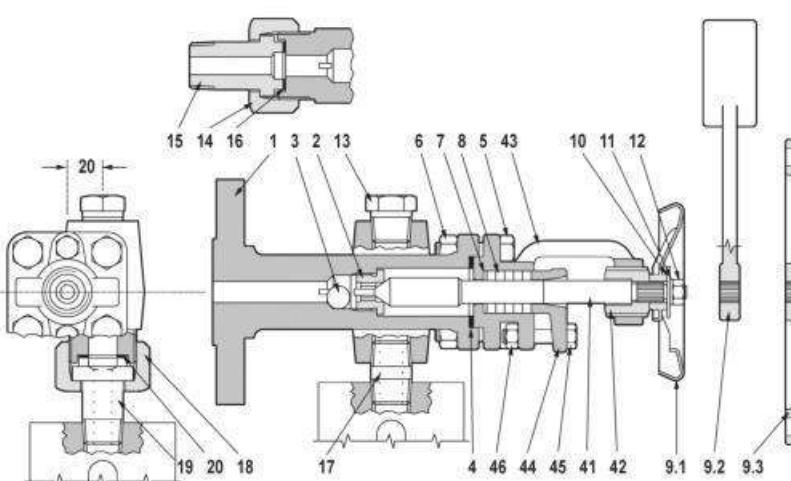


Fig. 854 - 855

Type GS41 (straight)
Type GS42 (straight)

Note: remaining parts identical to:

- Fig. 747 for GS41
- Fig. 748 for GS42

Fig. 750

| Item | Part | Materials for Material Schedule | | | Item | Part | Materials for Material Schedule | | |
|------|-------------------------|---------------------------------|-----------------|-----------------|------|----------------|---------------------------------|---------------|---------------|
| | | 52 | 55 | 63 | | | 52 | 55 | 63 |
| 1 | Body | ASTM A105 | ASTM A350 LF2 | S.S. AISI 316 | 17 | Nipple | Carbon steel | S.S. AISI 316 | S.S. AISI 316 |
| 2 | Seat | S.S. AISI 316 | S.S. AISI 316 | S.S. AISI 316 | 18 | Nut | Carbon steel | S.S. AISI 303 | S.S. AISI 303 |
| 3 | Ball-check | S.S. AISI 316 | S.S. AISI 316 | S.S. AISI 316 | 19 | Union tailpipe | Carbon steel | S.S. AISI 316 | S.S. AISI 316 |
| 4 | Bonnet joint ring | Soft iron | S.S. AISI 316 | S.S. AISI 316 | 20 | Joint ring | Suitable compressed material | | |
| 5 | Bolt | ASTM A193 B7 | S.S. AISI 303 | S.S. AISI 303 | 31 | Stem | S.S. AISI 316 | S.S. AISI 316 | S.S. AISI 316 |
| 6 | Nut | ASTM A194 2H | S.S. AISI 303 | S.S. AISI 303 | 32 | Bonnet | ASTM A105 | ASTM A350 LF2 | S.S. AISI 316 |
| 7 | Bottom ring | Carbon steel | S.S. AISI 316 | S.S. AISI 316 | 33 | Bonnet flange | ASTM A105 | ASTM A350 LF2 | S.S. AISI 304 |
| 8 | Packing | Preformed rings | Preformed rings | Preformed rings | 34 | Gland | Carbon steel | S.S. AISI 304 | S.S. AISI 304 |
| 9.01 | Handwheel | Carbon steel | Carbon steel | Carbon steel | 35 | Gland nut | Carbon steel | S.S. AISI 304 | S.S. AISI 304 |
| 9.02 | Weighted lever | Carbon steel | Carbon steel | Carbon steel | 41 | Stem | S.S. AISI 316 | S.S. AISI 316 | S.S. AISI 316 |
| 9.03 | Double-ended lever | Carbon steel | Carbon steel | Carbon steel | 42 | Stem bush | S.S. AISI 410 | S.S. AISI 410 | S.S. AISI 410 |
| 10 | Name plate | Stainless steel | Stainless steel | Stainless steel | 43 | Bonnet | ASTM A105 | ASTM A350 LF2 | S.S. AISI 316 |
| 11 | Washer | Carbon steel | Carbon steel | Carbon steel | 44 | Packing gland | Carbon steel | S.S. AISI 304 | S.S. AISI 304 |
| 12 | Nut | ASTM A194 2H | S.S. AISI 303 | S.S. AISI 303 | 45 | Bolt | ASTM A193 B7 | S.S. AISI 303 | S.S. AISI 303 |
| 13 | Taper plug (on request) | Carbon steel | S.S. AISI 316 | S.S. AISI 316 | 46 | Nut | ASTM A194 2H | S.S. AISI 303 | S.S. AISI 303 |
| 14 | Union nut | Carbon steel | S.S. AISI 303 | S.S. AISI 303 | | | | | |
| 15 | Union tailpipe | Carbon steel | S.S. AISI 316 | S.S. AISI 316 | | | | | |
| 16 | Joint ring | Suitable compressed material | | | | | | | |

BONETTI Gauge Valves

General information

These sets of valves consist of metallic seating valves.

Each set is generally composed by:

- 2 shut-off valves sized 1" (1 top and 1 bottom)
- 1 drain valve sized 1/2".

The Set of valves fully comply with the main international Standard and specifically with ASME Code Section I, when applicable. The shut-off valves are bonnetless type, operated by hand-wheel with rising non-rotating stem and stroke indicator.

- The **Body** (1) is forged of carbon steel or stainless steel and is the only valve part under pressure. Seat is integral of Stellite deposited with highly specialized and automatic procedure. The Backseat ring (46) is threaded into the body and can be easily replaced.
- The **Yoke** (2) is always forged and is standard of carbon steel, has structural functions only and is not under pressure. Threaded outside the body and kept in place by means of one welding tack that can be easily removed and remake for inspection or maintenance.
- The **Disk** (3) is of alloy steel with seating surface Stellite. When backseated, disk is pulled against bonnet with axial (not rotating) movement.
- The **Stem** (4) is of stainless steel, heat treated. Threads are ACME. Being designed rising and non-rotating insures a lower driving and closing torque and less wear of packing rings.
- The **Yoke Bushing** (11) is usually of special aluminium bronze and is kept in place by two Antifriction Rings (43) and form a Locking Ring (39).
- The **Packing** includes one Bottom Ring (5), one Graphite Packing (6), one Packing Flange (10), two Swing Bolts (8) turning for easier repacking.
- The **Safety Ball-check** (80) are in stainless steel AISI 316 and tighten on a seat made of stainless steel AISI 316.

Fig. 867

| Item Part | Part Material for Material Schedule | | |
|-------------------------------|-------------------------------------|------------------------------------|------------------------------------|
| | 51 | 64 | 63 |
| 1 Body | ASTM 105 + Stellite Gr. 6 | ASTM A182 F316 + Stellite Gr. 6 | ASTM A182 F316 + Stellite Gr. 6 |
| 2 Yoke | ASTM A105 | ASTM A105 | ASTM A105 |
| 3 Disk | ASTM A479 T.316 | ASTM A479 T.316 | ASTM A479 T.316 |
| 4 Stem | ASTM A182 F6 | ASTM A564 T.630 | ASTM A564 T.630 |
| 5 Bottom ring | ASTM A479 T.316 | ASTM A479 T.316 | ASTM A479 T.316 |
| 6 Packing | Graphite | Graphite | Graphite |
| 8 Swing bolt | ASTM A193 B7 | ASTM A193 B7 | ASTM A193 B8 |
| 9 Pin | Alloy steel | Alloy steel | Alloy steel |
| 10 Packing flange | ASTM A105 | ASTM A182 F316 | ASTM A182 F316 |
| 11 Yoke bushing | ASTM B150 - C62300 | ASTM B150 - C62300 | ASTM B150 - C62300 |
| 12 Handwheel | Carbon steel | Carbon steel | Carbon steel |
| 14 Disk pad | ASTM A182 F6 | Stainless steel + treatment | Stainless steel + treatment |
| 15 Handwheel nut | Carbon steel | Carbon steel | Carbon steel |
| 15A Bolt nut | ASTM A194 2H | ASTM A194 2H | ASTM A194 Gr. 8 |
| 20 Name plate | Stainless steel | Stainless steel | Stainless steel |
| 23 Antirotation / indicator | Carbon steel. + Zincplating | Carbon steel. + Zincplating | Stainless Steel |
| 39 Locking ring | ASTM A105 | ASTM A105 | ASTM A105 |
| 42 Retaining ring | Alloy steel | Alloy steel | Alloy steel |
| 43 Antifriction washer | Carbon steel C70 | Carbon steel C70 | Carbon steel C70 |
| 46 Backseat ring | ASTM A564 T.630 | ASTM A564 T.630 | ASTM A564 T.630 |
| 48 Gasket | Graphite | Graphite | Graphite |
| 70 Connecting ring | Stellite | Stellite | Stellite |
| 80 Safety ball | ASTM A479 T.316 | ASTM A479 T.316 | ASTM A479 T.316 |
| 81 Bottom taper plug for ball | ASTM A105 | ASTM A479 T.316 | ASTM A479 T.316 |
| 82 Top taper plug for ball | ASTM A105 | ASTM A479 T.316 | ASTM A479 T.316 |
| 83 Welded nipple | ASTM A105 | ASTM A479 T.316 | ASTM A479 T.316 |
| 84 Connecting flange | ASTM A105 | ASTM A105 | ASTM A479 T.316 |
| 85 Lenticular joint ring | ASTM A479 T.316 | ASTM A479 T.316 | ASTM A479 T.316 |
| 86 Joint ring | Graphite | Graphite | Graphite |

Set of Valves type G51, G52, G55 suitable for ASME 2500 and PN 400

Connection to the gauge body

Can be:

- type **G51** (Fig. 861, 857): flanged on the side of the gauge body,
- type **G52** (Fig. 862, 858, 859): flanged on the axis of the gauge body,
- type **G55** (Fig. 863, 860): flanged with the interposition of a water column,
- different connections can be delivered, according to customer prescription.

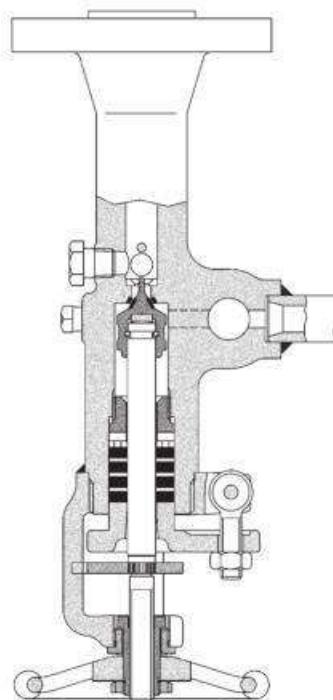
Connection to the drum

Can be:

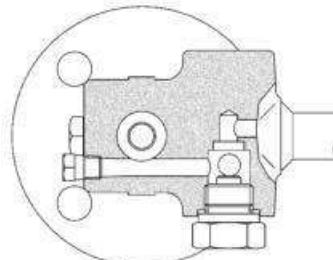
- **Flanged:**
 - The flange is always welded to the valve body.
Please specify Standard, Rating and Size
- **SW:**
 - Please specify Standard, Rating and Size
- **BW:**
 - Please specify Standard, Rating and Size
- **Screwed:**
 - Please specify Standard, Rating and Size

Fig. 863 Type G55

Top Valve



Bottom Valve



Optionals (see also page 29)

Following optionals can be supplied:

- Vent valve on top valve,
- Safety ball-check on bottom valve, vertical,
- Safety ball-check on top valve, horizontal with removal device.

Material Schedules (see Fig. 867)

Material Schedules currently manufactured on Fig. 867.

Other materials on request.

Maintenance

These sets of valves do not need particular maintenance.

We would suggest to use good quality packings in the stuffing-box and to follow up the bolts of the packing gland from time to time.

Fig. 861 Type G51

Top and bottom Valve

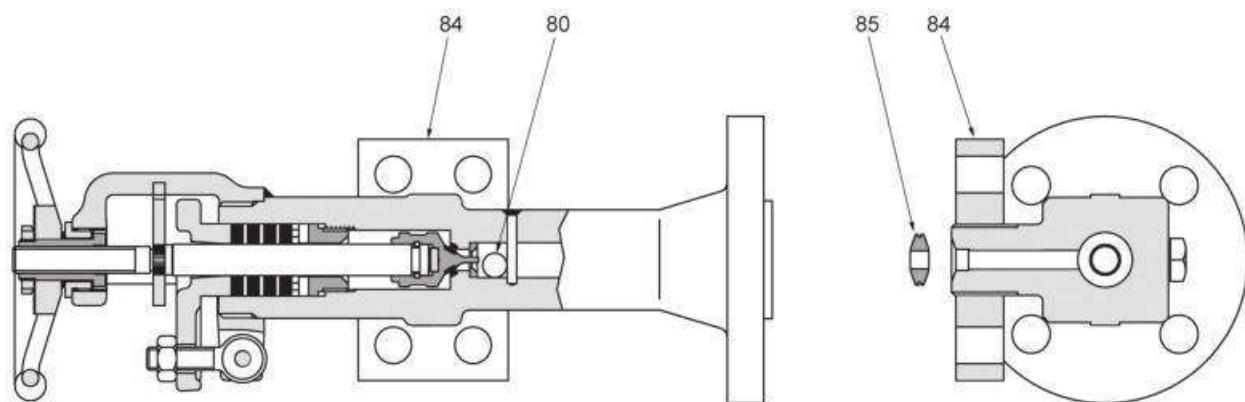
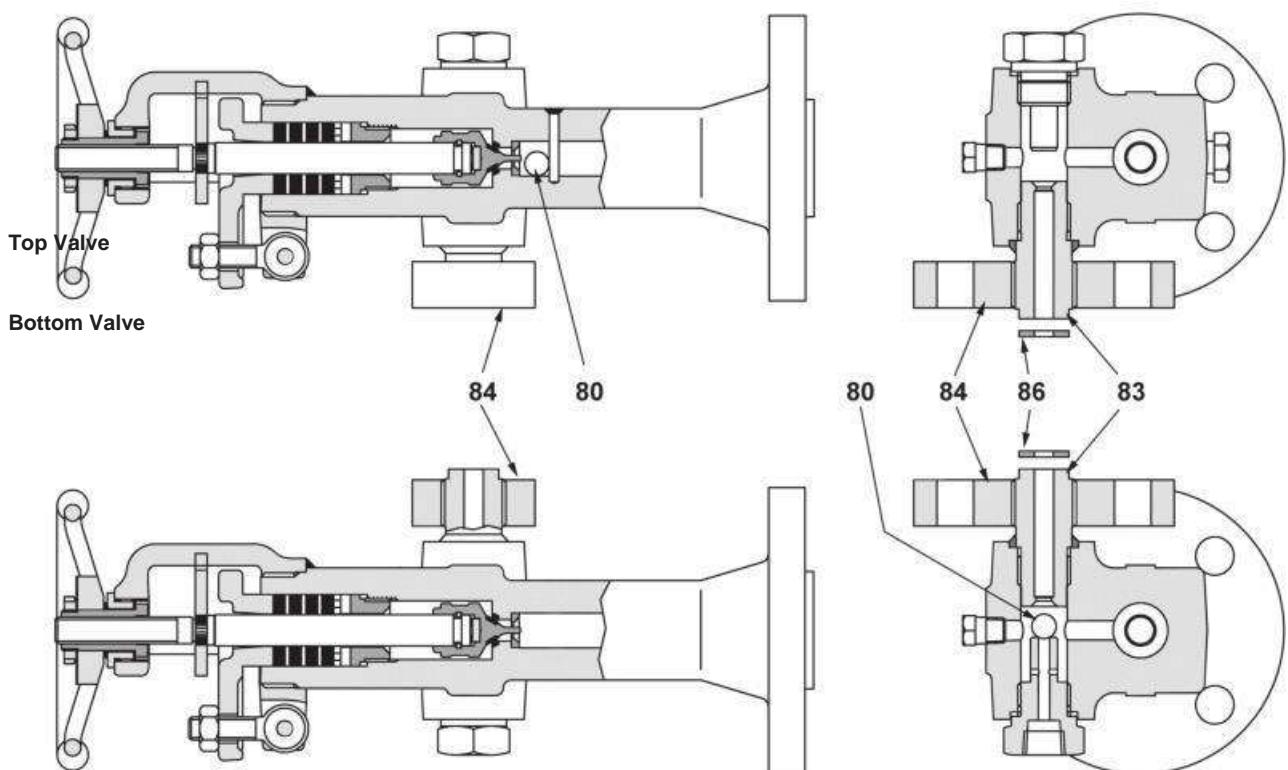


Fig. 862 Type G52



BONETTI Level Gauges

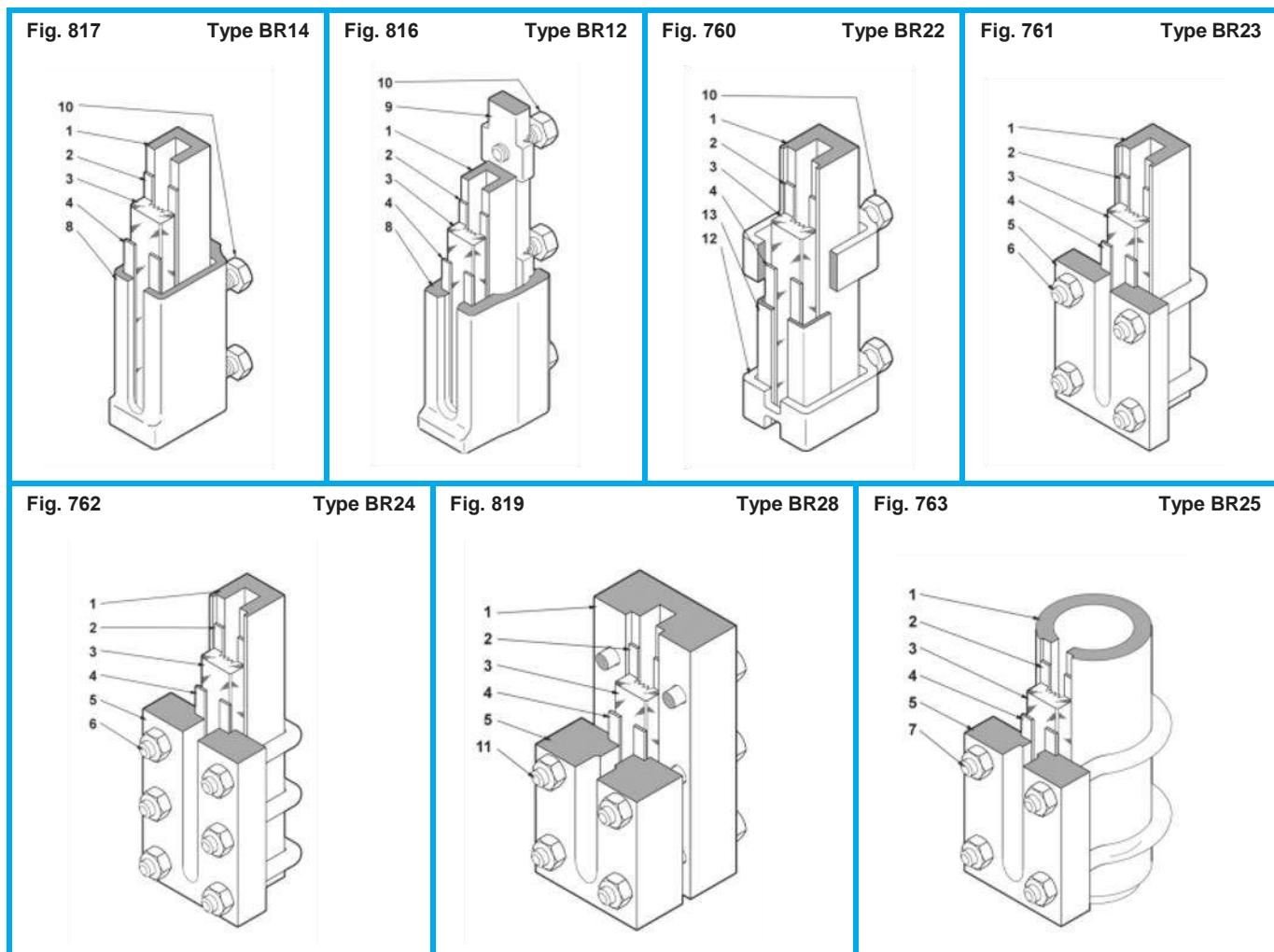
Reflex Gauge Bodies

Description and Maintenance Instructions

Bolting torques

| | | | | | |
|-------------|-------|------------------|-------|-----------------|--------------------|
| - Type BR14 | 30 Nm | - Type BR24 | 40 Nm | 1 Centre piece | 8 Gauge body |
| - Type BR12 | 50 Nm | - Type BR25 | 40 Nm | 2 Sealing joint | 9 Wedge piece |
| - Type BR22 | 30 Nm | - Type BR26-BR27 | 40 Nm | 3 Reflex glass | 10 Tightening bolt |
| - Type BR23 | 40 Nm | - Type BR28 | 50 Nm | 4 Cushion joint | 11 Bolt with nut |

| | |
|-------------------------|------------------|
| 5 Cover plate | 12 Clamp |
| 6 U stud bolt with nuts | 13 Angular piece |
| 7 O stud bolt with nuts | |



Service maintenance

Before putting in service, check the bolting torque as recommended on top of this page. Tighten the bolts alternatively, starting from centre of gauge. To avoid glass thermal shocks during start-up, the gauge temperature must gradually increase in order to allow both the metallic structure and the glass to reach the operating temperature. Proceed as follows: close bottom shut-off valve, completely open drain, partially open top shut-off valve to allow a **minimum flow** outlet of steam. Maintain flow outlet until proper temperature is reached, then close drain valve; the condensate coming through top valve will fill the gauge column. At this step completely open **very slowly** bottom shut-off valve, then completely open top shut-off valve.

In case during operation fluid impurities affect glass, proceed to gauge washing as above described

Important notice

Maintenance must be made immediately when:

- leakage appears, even if very small. In this case: shut off and cool down the gauge. Tighten the gauge nuts at the recommended bolting torque;
- the glass appears opaque or slightly white specially in the steam area;
- grooves of the reflex glass show sign of corrosion and/or erosion and the reading of the level is not clear.

The lack of maintenance and the lack of replacement of the deteriorated parts can cause the breakage of the glass with all the relevant consequences.

Dismantling

- Shut off the valves, let out the pressure and remove the level gauge body from the valves.

- Loosen the tightening bolts and remove all component pieces.
- Clean the sealing and cushion surfaces very carefully, making sure that they are clear of any remnants of joints.
- Smear the threads of the tightening bolts with a thin layer of graphite grease;

Reassembling

- Fit in a new glass with new joints (never re-use joints which have already been in service!); remember that the sealing joint must be placed on the side where the grooves are.
- Reassemble all the components in the right sequence. Tighten the bolts alternatively, starting from centre of gauge.
- Never grip the level gauge body in a vice during the reassembling, but put it on a plane surface.
- Never use adhesive or hermetic mastic. Remember that all surfaces must be perfectly clean.

Spare parts

- When ordering spare parts please state:
 - type and size of the gauge body
 - item number of the spare part, as shown in the above list
 - construction material.
- As regards reflex glasses and their joints, please remember that:
 - each type BR12, BR14 gauge is fitted with 1 reflex glass type A (section 30x17 mm),
 - each type BR22, BR23, BR24, BR25, BR28 gauge is fitted with 1 reflex glass type B (section 34x17 mm).

For type BR13, separate instructions on request.

BONETTI Level Gauges

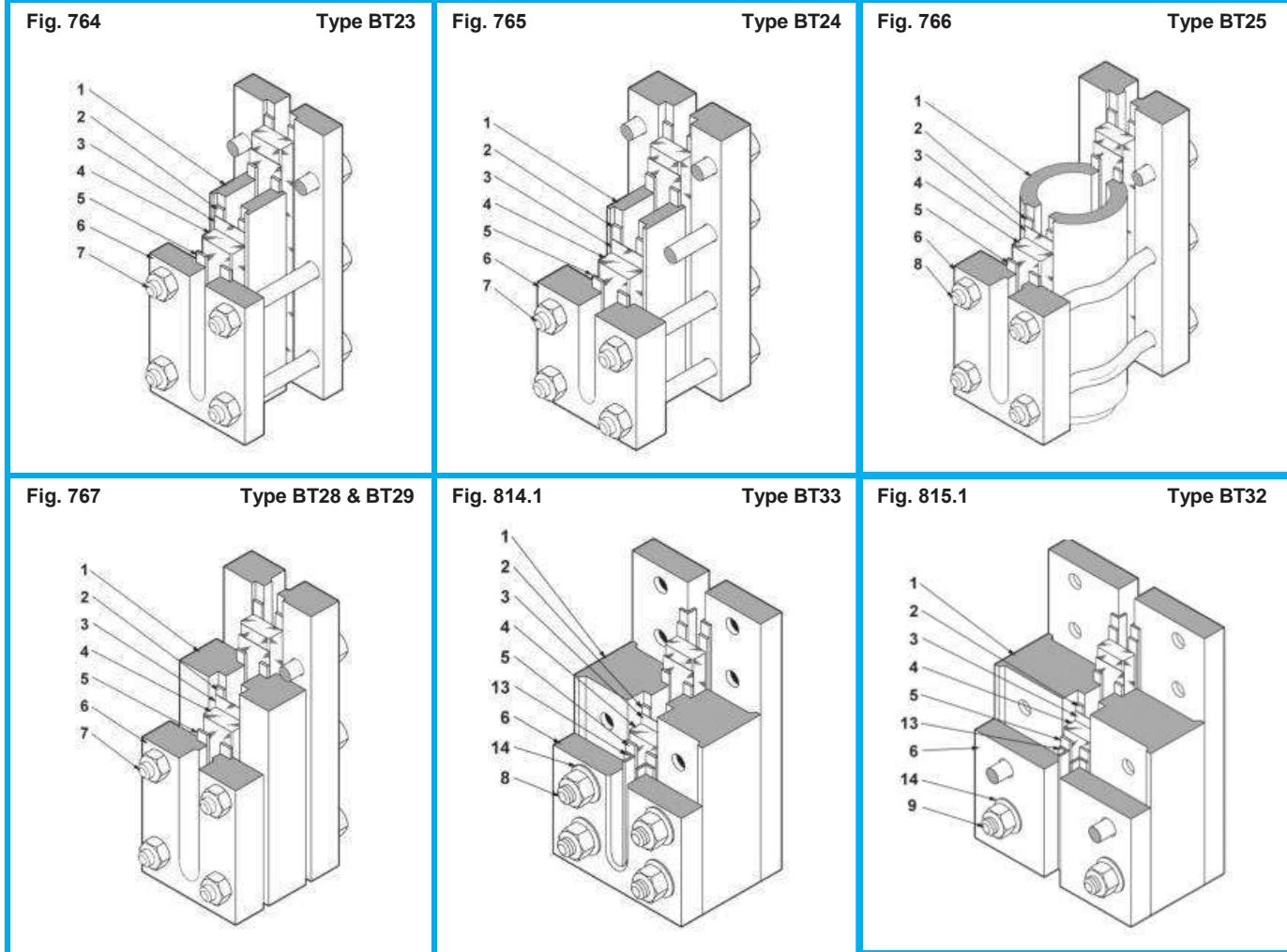
Transparent Gauge Bodies

Description and Maintenance Instructions

Bolting torques

| | | | |
|------------------|-------|------------------|-------|
| - Type BT23-BC23 | 40 Nm | - Type BT28-BC28 | 60 Nm |
| - Type BT24-BC24 | 40 Nm | - Type BT29 | 70 Nm |
| - Type BT25 | 40 Nm | - Type BT32-BC32 | 90 Nm |
| - Type BT26-BT27 | 40 Nm | - Type BT33-BC33 | 80 Nm |

| | |
|--|----------------------|
| 1 Centre piece | 6 Cover plate |
| 2 Sealing joint | 7 Bolt with nut |
| 3 Glass protection sheet (where applicable) | 8 Stud bolt with nut |
| 4 Plate glass | 9 Stud with nut |
| 5 Cushion joint | 13 Angular Piece |
| | 14 Belleville Washer |



Service maintenance

Before putting in service, check the bolting torque as recommended on top of this page. Tighten the bolts alternatively, starting from centre of gauge. To avoid glass thermal shocks during start-up, the gauge temperature must gradually increase in order to allow both the metallic structure and the glass to reach the operating temperature. Proceed as follows: close bottom shut-off valve, completely open drain, partially open top shut-off valve to allow a **minimum flow** outlet of steam. Maintain flow outlet until proper temperature is reached, then close drain valve; the condensate coming through top valve will fill the gauge column. At this step completely open **very slowly** bottom shut-off valve, then completely open top shut-off valve.

In case during operation fluid impurities affect glass or protection shield, proceed to gauge washing as above described

Important notice

Maintenance must be made immediately when:

- leakage appears, even if very small. In this case: shut off and cool down the gauge. Tighten the gauge nuts at the recommended bolting torque;
- the glasses appear opaque or slightly white specially in the steam area;
- the reading of the level is not clear.

The lack of maintenance and the lack of replacement of the deteriorated parts can cause the breakage of the glasses with all the relevant consequences.

Dismantling

- Shut off the valves, let out the pressure and remove the level gauge body from the valves.

- Loosen and take out the tightening bolts and remove all component pieces as well.
- Clean the sealing surfaces of the centre piece and the cushion surfaces of the cover plates very carefully, making sure that they are clear of any remnants of joints.
- Smear the threads with a thin layer of graphite grease.

Reassembling

- Fit in new glasses with new joints (never re-use joints which have already been in service!). Remember that the glass protection sheet must be in direct contact with the inner side of the glasses (between the glass and the fluid), and that the sealing joint must be placed on the sealing surface of the centre piece. Reassemble all the other components in the right sequence, and tighten the bolts alternatively, starting from centre of gauge.
- Never grip the level gauge body in a vice during the reassembling, but put it on a plane surface.
- Never use adhesive or hermetic mastic. Remember that all surfaces must be perfectly clean.

Spare parts

- When ordering spare parts please state:
 - type and size of the gauge body
 - item number of the spare part, as shown in the above list
 - construction material.
- As regards plate glasses their joints and protection sheets, remember that each level gauge is fitted with 2 plate glasses type B (section 34x17 mm).

For type BC1 (bicolour), separate instructions on request.

BONETTI Level Gauges

Optionals for Gauge Bodies

Fig. 773-Remark 7

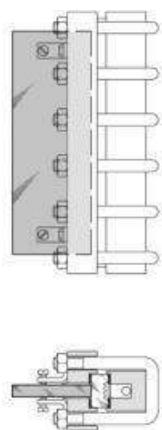


Fig. 776

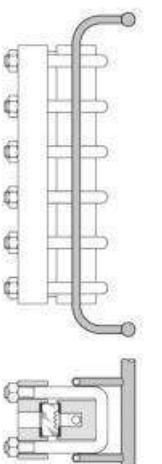


Fig. 826 Illuminator type GSI

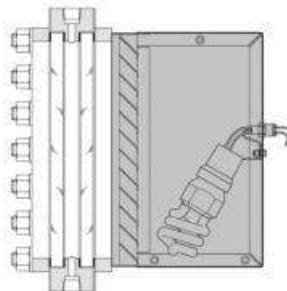


Fig. 827 Illuminator type EXGSI

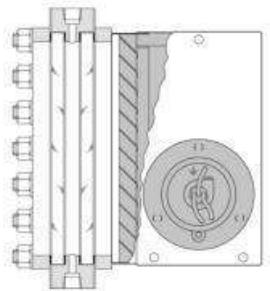


Fig. 828 Illuminator type EXPIN

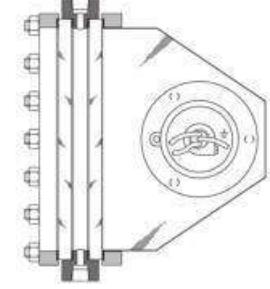


Fig. 870 LED Illuminator type LS & LX

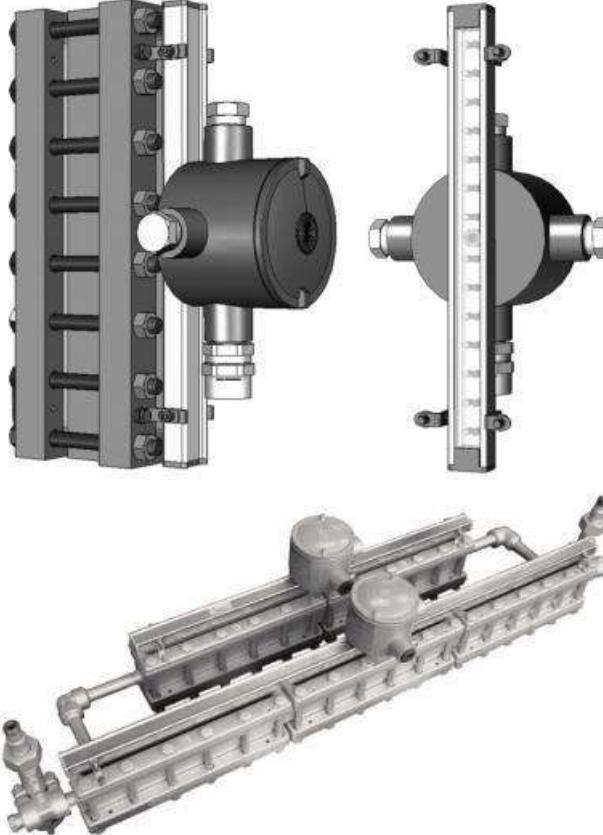


Fig. 870 - LED Illuminators Type LS & LX

Those new illuminators are supplied as standard.

They can be supplied with white light for transparent level gauges or with red & green light for bicolour level gauges. Special colours (as fully blue or fully red or fully green etc.) upon request.

The advantages of such illuminators are:

- competitive price and very low LCC (Life Cycle Cost)
- low energy consumption: <8 W for each meter length
- small size and light weight
- long life (up to 100,000 hours = 10 years of continuous working)
- vibrations proof
- easy wiring: 110/230 Vac @ 50/60Hz or 18/36 Vdc
- approvals:
 - CE (LVD & EMC),
 - ATEX II 2G Ex d mb IIC T6 - II 2D Ex tb IIIC T70 °C IP66 on board transformer:
 - Type LS: 110/230V > 24V - 8W/mt,
 - Type LX: 110/230V > 24V - 8W/mt, ATEX II 2G Ex d mb IIC T6 - II 2D Ex tb IIIC T145 °C IP66,
- junction box EExd with $\frac{3}{4}$ " NPT-F connection
- working temperature from -40 °C up to 80 °C
- IP65 protection as standard - IP66 upon request

Fig. 773 - Non-frosting block for reflex level gauge.

Fig. 776 - Level gauge with external heating or cooling tube. Can be supplied for reflex (as in figure) or transparent level gauges.

Fig. 820 - Combined level gauge with uninterrupted visible length. Reflex (as in figure) or transparent.

Fig. 869 - Calibrated scale. The standard calibrated scale is in stainless steel, with calibration in cm. On request, any different material or calibration can be supplied.

Note: Illuminators Type GSI (Fig. 826 - not explosion-proof), EXGSI (Fig. 827 - explosion-proof), EXPIN (Fig. 828 - for diffused lighting, explosion-proof), EXGSIBC and EXBSIN (explosion proof for bicolour level gauges) are out of production, but can be supplied as spares upon request.

Fig. 820

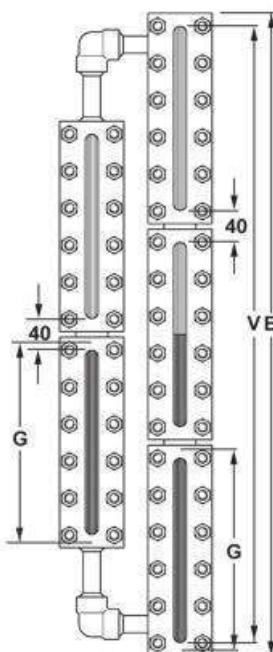
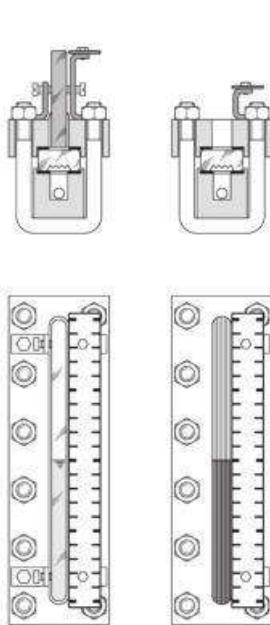


Fig. 869



BONETTI Level Gauges

Optionals for Gauge Bodies - Bolting Torques

Fig. 777

| Type of Gauge | Type of glass | | | | | | Accessories | | | | | | | | | Bolting Torque Nm each Bolt | | | | |
|---------------|---------------|---|--------|-------------|---|------|------------------|----------|-----|---------------------|----|--------------------|----------|------------------------|----|-----------------------------|----------|------------|----|--|
| | Reflex | | | Transparent | | | Glass Protection | | | Non frosting blocks | | Heating or cooling | | Applicable illuminator | | Graduated Scale | | Floats | | |
| | A | B | A-BR13 | Tube | B | Disk | internal | external | | | | | internal | external | | | Remark 9 | Fig. 775 | | |
| BR14 | X | - | - | - | - | - | NA | NA | NA | NA | NA | NA | NA | NA | 1 | AA | NA | NA | 30 | |
| BR 12 | X | - | - | - | - | - | NA | NA | NA | NA | NA | NA | NA | NA | 1 | AA | NA | NA | 50 | |
| BR22 | - | X | - | - | - | - | NA | NA | NA | NA | A | A | 1 | AA | NA | AA | AA | 30 | | |
| BR23 | - | X | - | - | - | - | NA | NA | V V | AA | A | A | 1 | AA | NA | AA | AA | 40 | | |
| BR24 | - | X | - | - | - | - | NA | NA | V V | AA | A | A | 1 | AA | NA | A | 40 | | | |
| BR28 | - | X | - | - | - | - | NA | NA | NA | AA | A | A | 1 | AA | NA | NA | NA | 50 | | |
| BR25 | - | X | - | - | - | - | NA | NA | V V | A | A | A | 1 | AA | NA | NA | NA | 40 | | |
| BR13 | - | - | X | - | - | - | NA | NA | R V | NA | A | NA | 1 | AA | NA | NA | NA | (Remark 8) | | |
| BR26 | - | X | - | - | - | - | NA | NA | V V | AA | A | NA | 1 | AA | NA | -A | 40 | | | |
| BR27 | - | X | - | - | - | - | NA | NA | V V | AA | A | NA | 1 | AA | NA | AA | AA | 40 | | |
| BTV | - | - | - | X | - | - | NA | NA | V V | AA | A | NA | 1 | NA | AA | AA | AA | - | | |
| BT23 | - | - | - | - | X | - | A | A | V V | AA | A | A | 2, 3, 6 | NA | AA | AA | AA | 40 | | |
| BT24 | - | - | - | - | X | - | A | A | NA | A | A | A | 2, 3, 6 | NA | AA | AA | NA | 40 | | |
| BT25 | - | - | - | - | - | X | - | A | A | NA | A | A | 3, 6 | NA | AA | AA | NA | 40 | | |
| BT28 | - | - | - | - | - | X | - | A | A | NA | A | A | 2, 3, 6 | NA | NA | NA | NA | 60 | | |
| BT29 | - | - | - | - | - | X | - | A | A | NA | NA | A | 2, 3, 6 | | NA | NA | NA | 70 | | |
| BT33 | - | - | - | - | - | X | - | A | A | NA | NA | A | A | 2, 3, 6 | | NA | NA | 80 | | |
| BT32 | - | - | - | - | - | X | - | A | A | | NA | A | 2, 3, 6 | | NA | NA | NA | 90 | | |
| BT26 | - | - | - | - | - | X | - | A | A | | | A | NA | 1 | | NA | NA | 40 | | |
| BT27 | - | - | - | - | - | X | - | A | A | | | A | NA | 1 | | NA | | 40 | | |
| BC23 | - | - | - | - | - | X | - | C | NA | | | NA | NA | 4, 5, 6 | | NA | | 40 | | |
| BC24 | - | - | - | - | - | X | - | C | NA | | | NA | NA | 4, 5, 6 | | | | 40 | | |
| BC28 | - | - | - | - | - | X | - | C | NA | | | NA | NA | 4, 5, 6 | | | | 60 | | |
| BC32 | - | - | - | - | - | X | - | C | NA | | | NA | NA | 4, 5, 6 | | | | 90 | | |
| BC 1 | - | - | - | - | - | - | X | C | NA | | | NA | NA | 4, 5, 6 | | | | (Remark 8) | | |

Keys and Remarks to Fig. 777

X Type of glass fitted in the gauge.
 A Applicable.
 C Compulsory.
 NA Not applicable

R Recommended U shape metallic protector (Fig. 720) and/or acrylic resin tube protector sealed by O-Rings to the stuffing box gland (Fig. 721).

V External glass protection (sheet of mica or Kel-F) may be suggested for protecting the glasses from corrosive environmental (see page 38).

- Often not necessary. If necessary any usual lighting apparatus can be utilised. Apply to our Technical Service for details.
- Apparatus for lighting of the meniscus at water level from lower position, not explosion-proof (Fig. 870). Type LED-LS.
- Apparatus for lighting of the meniscus at water level from lower position, explosion-proof (Fig. 870). Type LED-LX.
- Apparatus for lighting bicolour level gauges, not explosion-proof (Fig. 870), Type LED-LS
- Apparatus for lighting bicolour level gauges, explosion-proof (Fig. 870), Type LED-LX
- Illuminators Type GSI (Fig. 826 - not explosion-proof), EXGSI (Fig. 827 - explosion-proof), EXPIN (Fig. 828 - for diffused lighting, explosion-proof) are out of production, but can be supplied as spares upon request.
- Non-frosting blocks:
 - for reflex gauge and for transparent gauge (Fig. 773)
 - for transparent level gauges an illuminator (Fig. 870) can also be fitted.
 Recommended height of blocks, see page 38.
- See specific instructions.

9 Other optionals:

- Engraved scales to customer requirements.
- Mirrors to transmit image below to the observer.
- Closed circuit television equipment, which allows level reading on monitor in the control room and/or transmit a 4,20 mA signal.
- Fibre optic remote viewing device to transmit image in the control room, by means of our Red Cherry System. Ask for peculiar bulletin.
- Specific gravity glass floats can be provided in a transparent level gauge where the interface between two immiscible liquids is to be observed.
- Additional side connected bodies (reflex or transparent) to reach un-interrupted visible length (Fig. 820)
- Heating or cooling tracing tubes for reflex or transparent gauges (Fig. 776).
- For very long C to C distance, an intermediate support (communicating with the vessel) can be fitted to the level gauge body.

Sight Glasses for **BONETTI** Level Gauges

Standards and Quality

Glasses fitted in our level gauges and spare glasses comply with the following Standards:

- DIN 7081 - ONORM M 7354 - MIL G 18498 B
- TGL 7210 - OMV H 2009 - Esso Eng. Spec. 123
- BS 3463 - JIS B 8211 - S.O.D. Spec. 123

Physical and chemical features:

- Resistance to bending strain: >150 N/mm²
- Mean coefficient of linear expansion (30 °C to 300 °C): □5,0 . 10-6 . K-1 - DIN 52328
- Transition temperature: 550 °C - DIN 52324.
- Hydrolytic resistance: Class 1 - DIN 12111 and ISO 719
- Alkali resistance: Class 2 - DIN 52322 and ISO 695
- Acid resistance: Class 1 - DIN 12116

Material is always borosilicate glass pre-stressed and optically tested."Pre-Stressed", "hardened", "extra hard" and similar definitions are perfectly equivalent.

We never use "soda-lime" glasses, since they have quite insufficient features.

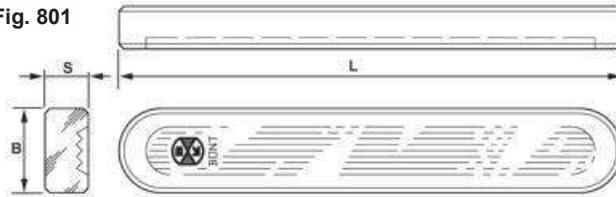
Special attention shall be paid to length, width, thickness and especially flatness tolerances. From the latter point of view BONETTI sight glasses have very strict tolerance values, definitely lower than most of the ones on the market. What above ensures less stress and longer life of glass and joints.

Reflex or transparent glasses

There are two types of sight glasses:

Reflex Glass

Fig. 801



These glasses have one smooth face (external face) and the other face provided with moulded prismatic grooves (internal face).

For application with reflex level gauges.

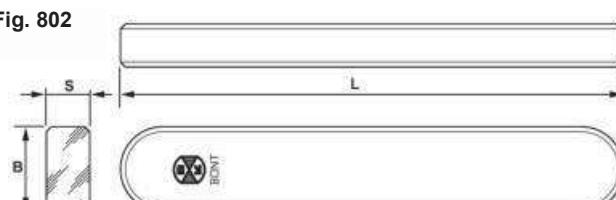
Reflex glasses have following dimensions:

| Size | Type A | | | Type B | | | Type A-BR13 | | |
|------|--------|-------|---------|--------|-------|---------|-------------|-------|---------|
| | Length | Width | Thickn. | Length | Width | Thickn. | Length | Width | Thickn. |
| L | B | S | L | B | S | L | B | S | |
| 1 | 115 | 30 | 17 | 115 | 34 | 17 | 115 | 30 | 17 |
| 2 | 140 | 30 | 17 | 140 | 34 | 17 | 140 | 30 | 17 |
| 3 | 165 | 30 | 17 | 165 | 34 | 17 | 165 | 30 | 17 |
| 4 | 190 | 30 | 17 | 190 | 34 | 17 | 190 | 30 | 17 |
| 5 | 220 | 30 | 17 | 220 | 34 | 17 | 220 | 30 | 17 |
| 6 | 250 | 30 | 17 | 250 | 34 | 17 | 250 | 30 | 17 |
| 7 | 280 | 30 | 17 | 280 | 34 | 17 | 280 | 30 | 17 |
| 8 | 320 | 30 | 17 | 320 | 34 | 17 | 320 | 30 | 17 |
| 9 | 340 | 30 | 17 | 340 | 34 | 17 | 340 | 30 | 17 |

- Sizes of glasses are now indicated by Arabic numerals (1, 2, etc.).
- Former size indication was in Roman numerals (I, II, etc.).
- Former size indication was in Roman numerals (I, II, etc.).

Transparent Glasses

Fig. 802



These glasses have both smooth faces.

For application with transparent level gauges.

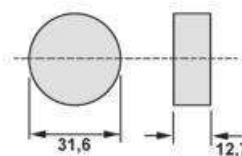
Transparent glasses have following dimensions:

| Size | Type A | | | Type B | | | Type A-BT12 | | |
|------|--------|-------|---------|--------|-------|---------|-------------|-------|---------|
| | Length | Width | Thickn. | Length | Width | Thickn. | Length | Width | Thickn. |
| L | B | S | L | B | S | L | B | S | |
| 1 | 115 | 30 | 17 | 115 | 34 | 17 | - | - | - |
| 2 | 140 | 30 | 17 | 140 | 34 | 17 | - | - | - |
| 3 | 165 | 30 | 17 | 165 | 34 | 17 | 163 | 27,6 | 16,8 |
| 4 | 190 | 30 | 17 | 190 | 34 | 17 | 188 | 27,6 | 16,8 |
| 5 | 220 | 30 | 17 | 220 | 34 | 17 | 218 | 27,6 | 16,8 |
| 6 | 250 | 30 | 17 | 250 | 34 | 17 | 248 | 27,6 | 16,8 |
| 7 | 280 | 30 | 17 | 280 | 34 | 17 | 278 | 27,6 | 16,8 |
| 8 | 320 | 30 | 17 | 320 | 34 | 17 | 318 | 27,6 | 16,8 |
| 9 | 340 | 30 | 17 | 340 | 34 | 17 | 338 | 27,6 | 16,8 |

- Sizes of glasses are now indicated by Arabic numerals (1, 2, etc.).
- Former size indication was in Roman numerals (I, II, etc.).
- Transparent glasses Type A (cross section 30 x 17 mm) are only spare parts for old pattern level gauges manufactured by us before 1945.
- Transparent glasses type A-BT12 are only spare parts for transparent bodies type BT12, no more in production.

A special transparent glass is the round glass for application with high pressure (usually bicolour) level gauges. This glass is a small disc (Fig. 792.4) with very strict tolerances.

Fig. 792.4



Joints for glasses

- Each sight glass is usually supplied with 2 joints (1 sealing joint + 1 cushion joint).
- Length and width of joint are the same as those of the respective glass.
- Reflex glasses type A-BR13 - for fitting in reflex gauges type BR13 - need special sized joints. See maintenance instructions.
- Transparent glasses type A-BT12 - for fitting in transparent gauges type BT12, no more in production - need special sized joints. See maintenance instructions.

Protection for glasses

When glass protection against corrosive fluids is to be taken in consideration (including boiler water pressurized over 35 bar), you must remember that only smooth surfaces can be shielded by smooth sheets having same length and width as sight glass.

Therefore:

- reflex glasses: only external face can be shielded by mica sheets or other materials against corrosive environmental agents,
- transparent glasses: both faces can be shielded by mica or transparent polytrifluorochloroethylene (Kel-F) sheets. Protection of the internal glass face in contact with fluid is usually sufficient.

Mica sheets inside level gauges are always recommended for application with water steam: thickness of mica sheets is usually 0.15 to 0.20 mm.

Non-frosting Blocks

Frost on gauge obstructing level reading could develop when level gauge operates at fairly low temperature.

In such cases non-frosting block of transparent acrylic resin must be fastened and sealed outside the gauge body.

This block shall protrude according to the thickness of the frost (see Fig. 773 and 829).

Recommended protrusion:

| Working temperature of fluid | Protrusion of block |
|------------------------------|---------------------|
| 120 °C through -19 °C | 38 mm |
| -20 °C through -49 °C | 75 mm |
| -50 °C through -99 °C | 150 mm |
| -100 °C and lower | 200 mm |

| | °C | °F | °C | °F | °C | °F | °C | °F | bar | °C |
|--|-------|------|-----|-----|------|------|------|------|-----|-------|
| | -270 | -454 | 165 | 329 | 520 | 968 | 1100 | 2012 | 1,0 | 99,1 |
| | -260 | -436 | 170 | 338 | 525 | 977 | 1120 | 2048 | 1,5 | 110,7 |
| | -250 | -418 | 175 | 347 | 530 | 986 | 1140 | 2084 | 2,0 | 119,6 |
| | -240 | -400 | 180 | 356 | 535 | 995 | 1160 | 2120 | 2,5 | 126,7 |
| | -230 | -382 | 185 | 365 | 540 | 1004 | 1180 | 2156 | 3,0 | 132,8 |
| | -220 | -364 | 190 | 374 | 545 | 1013 | 1200 | 2192 | 3,5 | 138,1 |
| | -210 | -346 | 195 | 383 | 550 | 1022 | 1220 | 2228 | 4,0 | 142,9 |
| | -200 | -328 | 200 | 392 | 555 | 1031 | 1240 | 2264 | 4,5 | 147,2 |
| | -190 | -310 | 205 | 401 | 560 | 1040 | 1260 | 2300 | 5,0 | 151,1 |
| | -180 | -292 | 210 | 410 | 565 | 1049 | 1280 | 2336 | 5,5 | 154,7 |
| | -170 | -274 | 215 | 419 | 570 | 1058 | 1300 | 2372 | 6,0 | 158,0 |
| | -160 | -256 | 220 | 428 | 575 | 1067 | 1320 | 2408 | 6,5 | 161,1 |
| | -150 | -238 | 225 | 437 | 580 | 1076 | 1340 | 2444 | 7,0 | 164,1 |
| | -140 | -220 | 230 | 446 | 585 | 1085 | 1360 | 2480 | 7,5 | 167,1 |
| | -130 | -202 | 235 | 455 | 590 | 1094 | 1380 | 2516 | 8,0 | 169,6 |
| | -120 | -184 | 240 | 464 | 595 | 1103 | 1400 | 2552 | 8,5 | 172,2 |
| | -110 | -166 | 245 | 473 | 600 | 1112 | 1420 | 2588 | 9,0 | 174,5 |
| | -100 | -148 | 250 | 482 | 605 | 1121 | 1440 | 2624 | 9,5 | 176,7 |
| | -95 | -139 | 255 | 491 | 610 | 1130 | 1460 | 2660 | 10 | 179,0 |
| | -90 | -130 | 260 | 500 | 615 | 1139 | 1480 | 2696 | 11 | 183,2 |
| | -85 | -121 | 265 | 509 | 620 | 1148 | 1500 | 2732 | 12 | 187,0 |
| | -80 | -112 | 270 | 518 | 625 | 1157 | 1520 | 2768 | 13 | 190,7 |
| | -75 | -103 | 275 | 527 | 630 | 1166 | 1540 | 2804 | 14 | 194,1 |
| | -70 | -94 | 280 | 536 | 635 | 1175 | 1560 | 2840 | 15 | 197,3 |
| | -65 | -85 | 285 | 545 | 640 | 1184 | 1580 | 2876 | 16 | 200,4 |
| | -60 | -76 | 290 | 554 | 645 | 1193 | 1600 | 2912 | 17 | 203,3 |
| | -55 | -67 | 295 | 563 | 650 | 1202 | 1620 | 2948 | 18 | 206,1 |
| | -50 | -58 | 300 | 572 | 655 | 1211 | 1640 | 2984 | 19 | 208,8 |
| | -45 | -49 | 305 | 581 | 660 | 1220 | 1660 | 3020 | 20 | 211,4 |
| | -40 | -40 | 310 | 590 | 665 | 1229 | 1680 | 3056 | 22 | 216,2 |
| | -35 | -31 | 315 | 599 | 670 | 1238 | 1700 | 3092 | 24 | 220,7 |
| | -30 | -22 | 320 | 608 | 675 | 1247 | 1750 | 3182 | 26 | 225,0 |
| | -25 | -13 | 325 | 617 | 680 | 1256 | 1800 | 3272 | 28 | 228,9 |
| | -20 | -4 | 330 | 626 | 685 | 1265 | 1850 | 3362 | 30 | 232,7 |
| | -17,8 | 0 | 335 | 635 | 690 | 1274 | 1900 | 3452 | 35 | 241,4 |
| | -15 | 5 | 340 | 644 | 695 | 1283 | 1950 | 3542 | 40 | 249,1 |
| | -10 | 14 | 345 | 653 | 700 | 1292 | 2000 | 3632 | 45 | 256,2 |
| | -5 | 23 | 350 | 662 | 710 | 1310 | 2050 | 3722 | 50 | 262,7 |
| | 0 | 32 | 355 | 671 | 720 | 1328 | 2100 | 3812 | 55 | 268,6 |
| | 5 | 41 | 360 | 680 | 730 | 1346 | 2150 | 3902 | 60 | 274,2 |
| | 10 | 50 | 365 | 689 | 740 | 1364 | 2200 | 3992 | 65 | 279,5 |
| | 15 | 59 | 370 | 698 | 750 | 1382 | 2250 | 4082 | 70 | 284,4 |
| | 20 | 68 | 375 | 707 | 760 | 1400 | 2300 | 4172 | 75 | 289,1 |
| | 25 | 77 | 380 | 716 | 770 | 1418 | 2350 | 4262 | 80 | 293,6 |
| | 30 | 86 | 385 | 725 | 780 | 1436 | 2400 | 4352 | 85 | 297,8 |
| | 35 | 95 | 390 | 734 | 790 | 1454 | 2450 | 4442 | 90 | 301,9 |
| | 40 | 104 | 395 | 743 | 800 | 1472 | 2500 | 4532 | 95 | 305,8 |
| | 45 | 113 | 400 | 752 | 810 | 1490 | 2550 | 4622 | 100 | 309,5 |
| | 50 | 122 | 405 | 761 | 820 | 1508 | 2600 | 4712 | 105 | 313,3 |
| | 55 | 131 | 410 | 770 | 830 | 1526 | 2650 | 4802 | 110 | 316,5 |
| | 60 | 140 | 415 | 779 | 840 | 1544 | 2700 | 4892 | 115 | 319,8 |
| | 65 | 149 | 420 | 788 | 850 | 1562 | 2750 | 4982 | 120 | 323,1 |
| | 70 | 158 | 425 | 797 | 860 | 1580 | 2800 | 5072 | 125 | 326,2 |
| | 75 | 167 | 430 | 806 | 870 | 1598 | 2850 | 5162 | 130 | 329,3 |
| | 80 | 176 | 435 | 815 | 880 | 1616 | 2900 | 5252 | 135 | 332,2 |
| | 85 | 185 | 440 | 824 | 890 | 1634 | 2950 | 5342 | 140 | 335,1 |
| | 90 | 194 | 445 | 833 | 900 | 1652 | 3000 | 5432 | 145 | 337,8 |
| | 95 | 203 | 450 | 842 | 910 | 1670 | | | 150 | 340,6 |
| | 100 | 212 | 455 | 851 | 920 | 1688 | | | 155 | 343,2 |
| | 105 | 221 | 460 | 860 | 930 | 1706 | | | 160 | 345,7 |
| | 110 | 230 | 465 | 869 | 940 | 1724 | | | 165 | 348,3 |
| | 115 | 239 | 470 | 878 | 950 | 1742 | | | 170 | 350,6 |
| | 120 | 248 | 475 | 887 | 960 | 1760 | | | 175 | 353,0 |
| | 125 | 257 | 480 | 896 | 970 | 1778 | | | 180 | 355,4 |
| | 130 | 266 | 485 | 905 | 980 | 1796 | | | 185 | 357,5 |
| | 135 | 275 | 490 | 914 | 990 | 1814 | | | 190 | 359,8 |
| | 140 | 284 | 495 | 923 | 1000 | 1832 | | | 195 | 361,9 |
| | 145 | 293 | 500 | 932 | 1020 | 1868 | | | 200 | 364,1 |
| | 150 | 302 | 505 | 941 | 1040 | 1904 | | | 205 | 366,1 |
| | 155 | 311 | 510 | 950 | 1060 | 1940 | | | 210 | 368,1 |
| | 160 | 320 | 515 | 959 | 1080 | 1976 | | | 215 | 370,2 |
| | | | | | | | | | 220 | 372,0 |
| | | | | | | | | | 225 | 374,0 |