

DESCRIPTION

Multilayer, square field, manual collimation system intended for installation on stationary X-ray equipment. This device has been designed and manufactured for skeletal and thoracic investigations.

The X-ray field is defined by six pairs of shutters, four of which are lead-lined. The six pairs of shutters move perpendicularly within the X-ray field. Two pairs of brass shutters are located near the focus, two are located near the entrance window and two are located near the exit window of the X-ray beam from the collimator. The latter shutters serve to accurately define the X-ray field edges.

Shutter movements are manual, controlled by two knobs on the collimator front panel.

CHARACTERISTICS

Mounting Plane at 80 mm (3.14") from the focus.

Continuous Film Coverage from Min: 00 x 00 cm to Max: 48 x 48 cm at 100 cm (40") SID.

Maximum Radiation Leakage: 150 kVp - 4 mA.

High luminosity provided by a **White LED** simulating the X-ray field. The light field is controlled by an electronic timer.

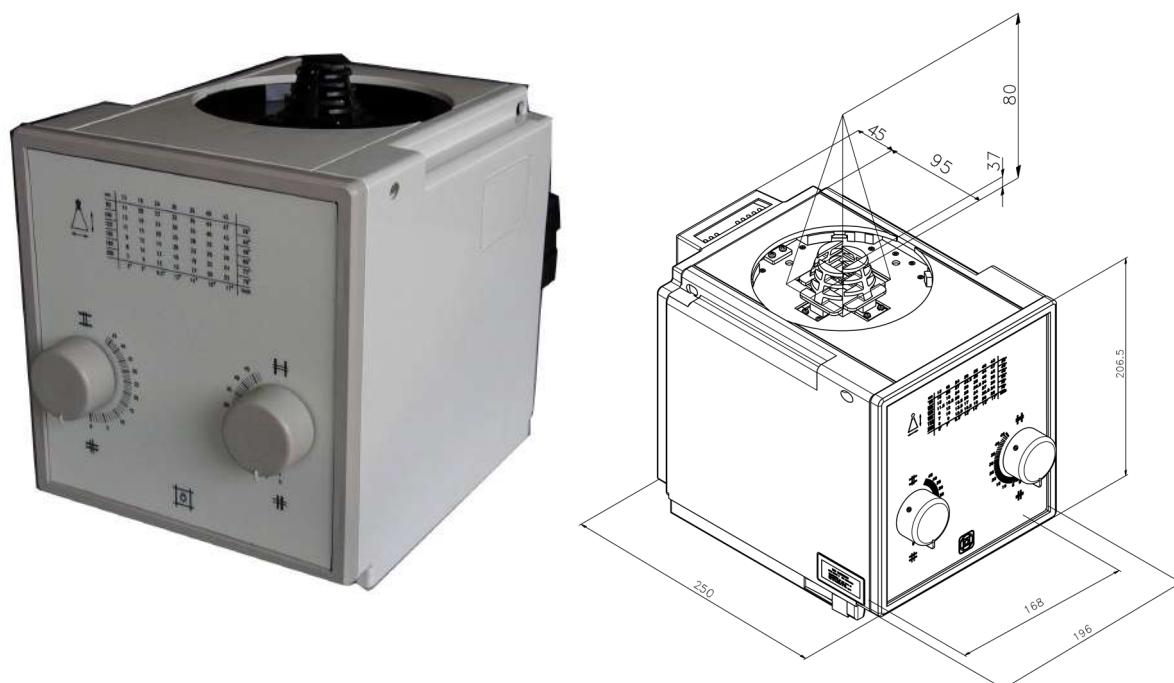
Minimum Inherent Filtration: 2 mm aluminium equivalent.

Accessory Guides are used for accessories and additional filtration.

GC-LED-4A timer board for light source supply and operation.

Potentiometers used for shutter positioning control.

Fig. R 302/A - R302/A DHHS with Exterior Dimensions



This collimator may have the following optional items; a detailed description is provided in the chapter **OPTIONAL ITEMS**.

RO	DESCRIPTION
RO 001/A	Metal fixed mounting flange: 20mm thickness, 136mm diameter
RO 002	Iron mounting flange spacer: 1.5mm thickness
RO 012/B	Retractable measuring tape
RO 041	Mylar mirror with minimum internal inherent filtration: 0.3mm Al equivalent
RO 051	Metal rotating mounting flange, 18mm thickness, +/- 90° with mechanical stop, 136mm diameter (not available with RO 202 or RO 318)
RO 055/B	Metal fixed mounting flange: 18mm thickness, 136mm diameter (not available with RO 202 or RO 318)
RO 063	Final quality test report documentation (Light field, luminosity, light to X-ray field correspondence, light field border contrast ratio, x-ray leakage, control of general functions)
RO 074	External housing and guide rails in customized color
RO 077	Light centering device to align collimator with detector
RO 082	Glass mirror with minimum internal inherent filtration: 1mm Al equivalent
RO 096	Wiring customization
RO 107	Knob color customization
RO 109	Front panel frame color customization
RO 111	Front panel customization
RO 161	External accessory guide rail spacers painted in standard housing color (unless RO 074 selected)
RO 185/A	Metal fixed flange, 20mm thickness, 136mm diameter with countersunk mounts (only available with RO 202)
RO 202	Self-centering top-cover bracket: Milled to 136mm diameter (mounting flange not included)
RO 203	Self-centering top-cover bracket for Siemens X-ray tube only (mounting flange provided by Siemens only)

MTR 302/A - R 302/A DHHS - Description

RO	DESCRIPTION
RO 222/A	Metal rotating mounting flange, 18mm thickness, +/-90° mechanical stop, 136mm diameter with countersunk mounts (not available with RO 318)
RO 240	Focal-spot to skin spacer
RO 242/1	Single laser line to align collimator and detector center: Class 2
RO 242/2	Two lasers (one mounted externally) forming a crosshair to center the patient to the detector: Class 2
RO 253	Accessory guide rail spacers painted in standard housing color (unless RO 074 selected)
RO 258	Additional variable filtration - manual selection. 4 position rotating wheel with selectable filters (clockwise): (1) empty or (2) 0.1mm Cu+1mm Al or (3) 0.2mm Cu+1mm Al or (4) 2mm Al
RO 258/1	Additional variable filtration - manual selection. 4 position rotating wheel with selectable filters (clockwise): (1) empty or (2) 0.1mm Cu or (3) 0.2mm Cu or (4) 0.3mm Cu
RO 271	Substitution of LED light field with a 24V 150W halogen lamp, GC338 timer board and cooling fan
RO 318	Self-centering top-cover bracket; Resin rotating mounting flange: 20mm thickness, 0° detent, 140mm diameter
RO 339	Two lasers forming a single line at 1-meter SID: Class 2
RO 441	Resin rotating mounting flange: 20mm thickness, +/-50° detent, 140mm diameter (only available with RO 318)
RO 442	Resin rotating mounting flange: 20mm thickness, +/-90° detent, 140mm diameter (only available with RO 318)
RO 445	Metal rotating mounting flange, 20mm thickness, +/-90° mechanical stop, 140mm diameter (only available with RO 318)
RO 452	Asymmetric longitudinal shutters ("stitching" application)
RO 489	Resin rotating mounting flange: 20mm thickness, +/-45° detent, 140mm diameter (only available with RO 318)
RO 495	Camera assembled internally for patient monitoring: IP Ethernet interface
RO 500	Field replacement packaging

MTR 302/A - R 302/A DHHS - Description

RO	DESCRIPTION
RO 525	Knob customization
RO 586	Single laser line to align collimator and detector center: Class 1
RO 587/1	Two lasers forming a single line at 1-meter SID: Class 1
RO 587/2	Two lasers (one mounted externally) forming a crosshair to center the patient to the detector: Class 1
RO 602	Substitution of LED light field with a 24V 100W halogen lamp and GC338 timer board

OPTIONAL ITEMS

This collimator may have the following optional items; a detailed description is provided in this chapter.

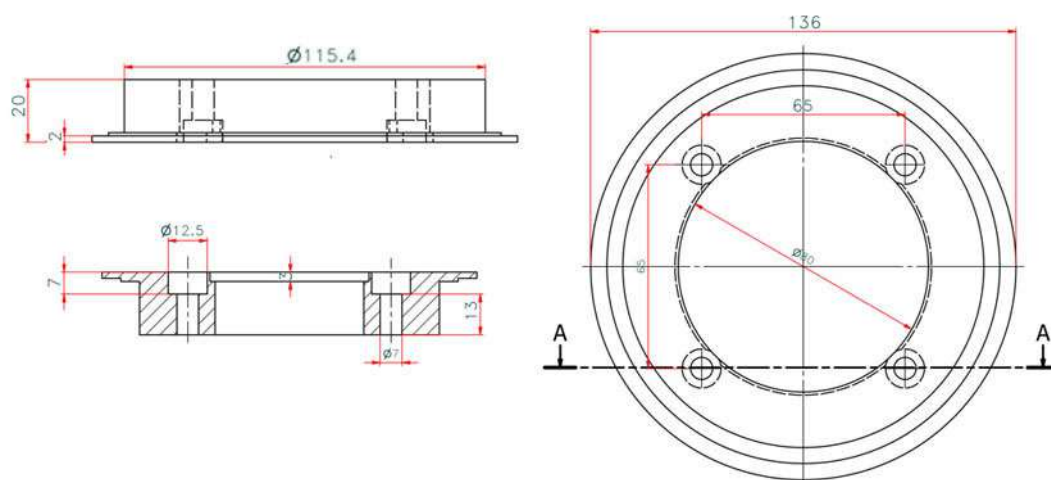
RO 001/A Metal Fixed Mounting Flange

This optional item is included as a standard feature.

Metal fixed mounting flange:

- 20mm thickness
- 136mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.



When the collimator is assembled check the collimator to Focal Spot Alignment (Primary Shutter Cut-Off).

Inspect the four images of the four collimator shutters which form the edges of the x-ray field. A definitely indistinct edge indicates that the primary shutter, close to the focal spot, is the one forming the line, rather than the outermost shutter.

To correct the condition, use the four mounting/centering adjustment screws to shift the collimator in the direction of the indistinct line. Repeat the test film exposure after making the adjustment.

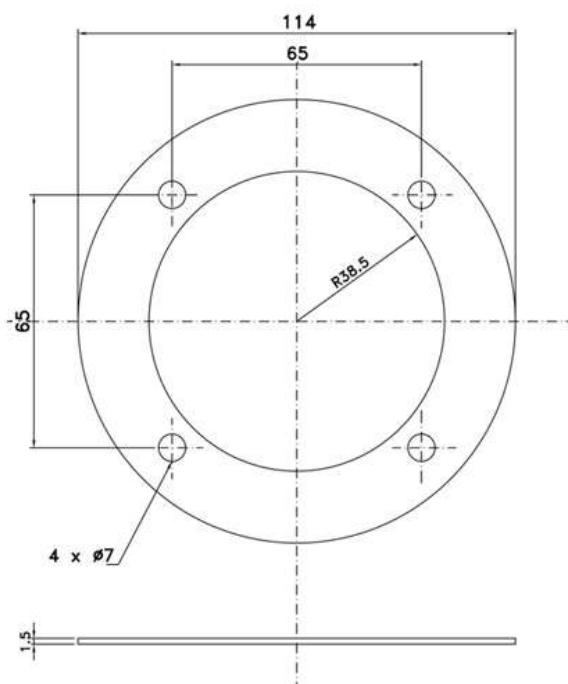
NOTE



THE HEEL EFFECT WILL CAUSE THE FIELD TOWARD THE CATHODE TO BE SLIGHTLY LESS SHARP THAN ON THE OTHER THREE SIDES. THIS IS NORMAL AND CANNOT BE CORRECTED BY ADJUSTMENT. IN ADDITION, AN X-RAY TUBE OF 12° OR LESS TARGET ANGLE WILL PRODUCE AN ASYMMETRICALLY SHAPED FIELD WHEN A LARGE FIELD SIZE IS USED AT SHORT SID, BECAUSE OF ANODE CUT-OFF EFFECT. THIS IS NORMAL AND MAY NOT BE CORRECTED BY ADJUSTMENT.

RO 002 Iron Mounting Flange Spacer

This accessory is used for the mounting flange; 1.5 mm thickness.



RO 012/B Retractable Measuring Tape

Mounted on a radiological unit, measures the distance between the focus and the patient.

NOTE



USE OF THE RETRACTABLE TAPE MEASURE IN COLLIMATORS WITH THIS FEATURE:
THE TYPE OF TAPE MEASURE USED IS A STANDARD TAPE MOUNTED ON A RADIOLOGICAL UNIT. THE TAPE STARTS WITH VALUES THAT CORRESPOND TO THE FOCUS/COLLIMATOR LOWER EDGE DISTANCE; MAXIMUM RADIOLOGICAL MEASUREMENT WITH THE TAPE IS 2 M MAX EVEN THOUGH, FOR PURELY MECHANICAL REASONS, MAXIMUM TAPE EXTENSION IS 3 M MAX. STOP IS EVIDENT IMMEDIATELY AFTER THE MAXIMUM MECHANICAL VALUE.

FORCING AND/OR EXTENDING THE TAPE BEYOND THIS POINT WILL CAUSE THE FOLLOWING INCONVENIENCES:

BREAKAGE OF THE TAPE OR,

DISTORTION OF THE TAPE OR,

IMPOSSIBILITY OF RETRACTING THE TAPE INTO ITS LODGING BECAUSE THE GRIP OF THE SPRING HAS BEEN FORCED AND HOOK-UP IS CONSEQUENTLY DISTORTED.

NOTE: DO NOT EXTEND THE TAPE BEYOND THE INDICATION OF STOP.

RO 041 Mylar Mirror

Mylar mirror, internal filtration equivalent at minimum 0.3 mm Al.



RO 051 Metal Rotating Mounting Flange

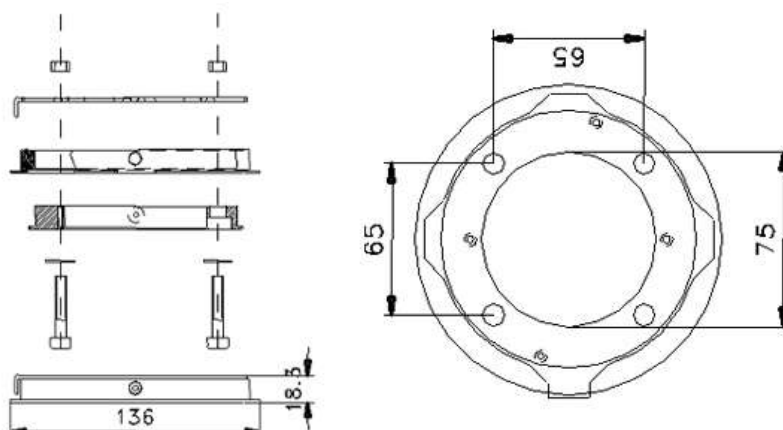
Metal rotating mounting flange:

- 18 mm thickness
- $\pm 90^\circ$ with mechanical stop
- 136 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.*

*

- flange release force: 5.5 kg (± 1 kg)
- flange rotation force: 2.8 kg (± 1 kg)



When the collimator is assembled check the collimator to Focal Spot Alignment (Primary Shutter Cut-Off).

Inspect the four images of the four collimator shutters which form the edges of the X-ray field. A definitely indistinct edge indicates that the primary shutter, close to the focal spot, is the one forming the line, rather than the outermost shutter.

To correct the condition, use the four mounting/centering adjustment screws to shift the collimator in the direction of the indistinct line. Repeat the test film exposure after making the adjustment.

NOTE



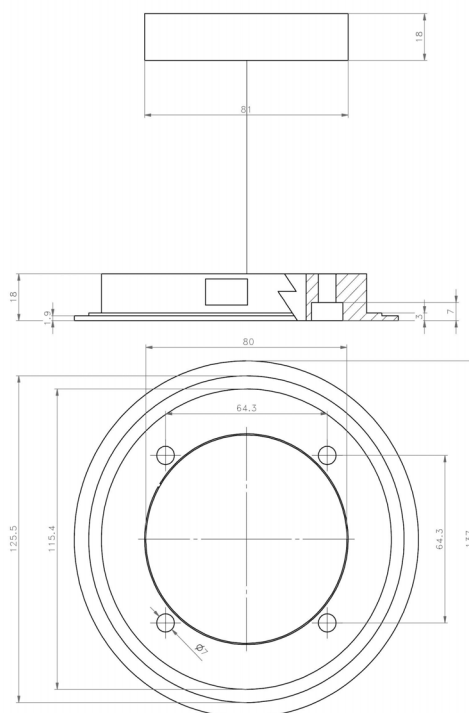
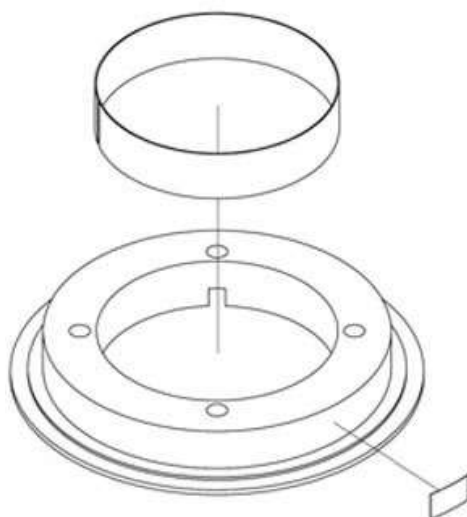
THE HEEL EFFECT WILL CAUSE THE FIELD TOWARD THE CATHODE TO BE SLIGHTLY LESS SHARP THAN ON THE OTHER THREE SIDES. THIS IS NORMAL AND CANNOT BE CORRECTED BY ADJUSTMENT. IN ADDITION, AN X-RAY TUBE OF 12° OR LESS TARGET ANGLE WILL PRODUCE AN ASYMMETRICALLY SHAPED FIELD WHEN A LARGE FIELD SIZE IS USED AT SHORT SID, BECAUSE OF ANODE CUT-OFF EFFECT. THIS IS NORMAL AND MAY NOT BE CORRECTED BY ADJUSTMENT.

RO 055/B Metal Fixed Mounting Flange

Metal fixed mounting flange:

- 18 mm thickness
- 136 mm diameter

Please refer to the chapter **INSTALLATION** in this Instruction Manual for the correct flange/collimator mounting instructions.



RO 063 Final Quality Test Report Documentation

This test provides higher control to check 100% of the production lot to verify product quality from beginning to end of the production cycle.

Final tests include:

- Light field illumination intensity (if applicable),
- Light field to X-ray field alignment (if applicable),
- X-ray leakage test,
- Edge contrast (if applicable),
- Operation and electronic check up.

RO 074 External housing and guide rails in customized color

The customer can specify a collimator cover color. Ralco's standard color is RAL9003.

RO 077 Light Centring Device to align collimator to detector (only available with RO 604)

This centring device of the Potter Bucky (BL). Reflects the lamp light to form a bright line to align collimator to Potter Bucky.

Adjustment

- Remove the collimator rear cover to gain access to the point of adjustment, see Chapter **COVER REMOVAL**.
- The line is to fall on a perpendicular bisector line constructed against the anti-dust plastic panel toward the control face of the collimator.
- To adjust the position of the line, shift the light support group as required. Note that the support group and bracket are inside the collimator frame and cannot be seen, but may be controlled by the two securing screws **A**, see **Fig. Centering Device Adjustment**.

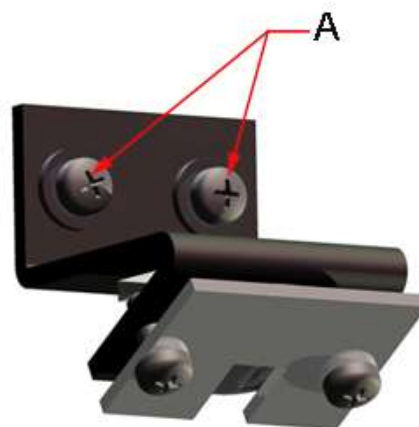


Fig. Centering Device Adjustment

RO 082 Glass Mirror

Glass mirror, 0.8 mm thickness, inherent filtration 1 mm Al equivalent. With this mirror, the collimator equivalent filtration value of 2 mm Al is reduced to 1 mm Al.

RO 096 Wiring Customization

Customized electrical wiring. If ordered please refer to the **PERSONALIZATIONS**, annex included with this Instruction Manual, Chapter – Installation, paragraph **Wiring Diagram**.

RO 107 Knob Color Customization

The customer can specify the required knob color.

RO 109 Front panel frame color customization

The customer can specify the required frame color.

RO 111 Front panel customization

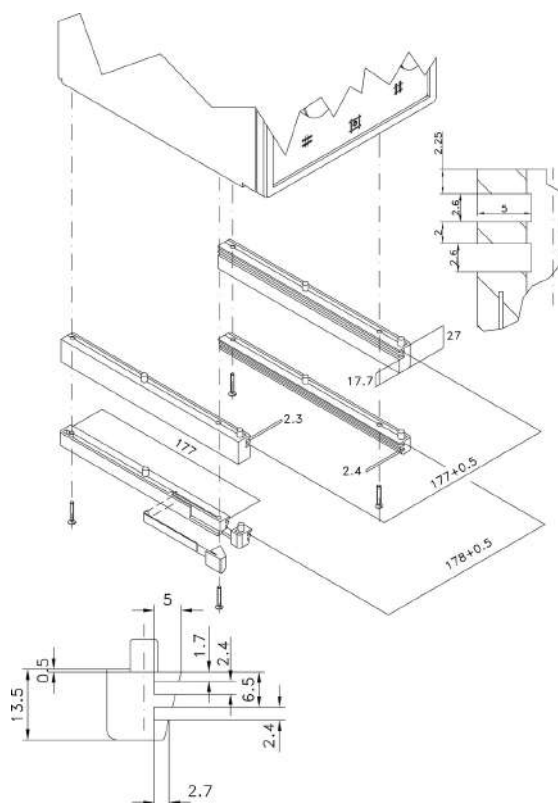
The customer can customize the front panel adding, for example, the Company Logo and/or the Company colors.

RO 161 External accessory guide rail spacer in standard housing color

Pair of plastic rail guides (RAL 9002) designed to protect the ionization chamber and allow the insertion of other accessories.



CAUTION
PAY ATTENTION TO THE DISTANCE OF LOWER GUIDES THAT COULD BE GREATER THAN THE DISTANCE OF UPPER GUIDES.

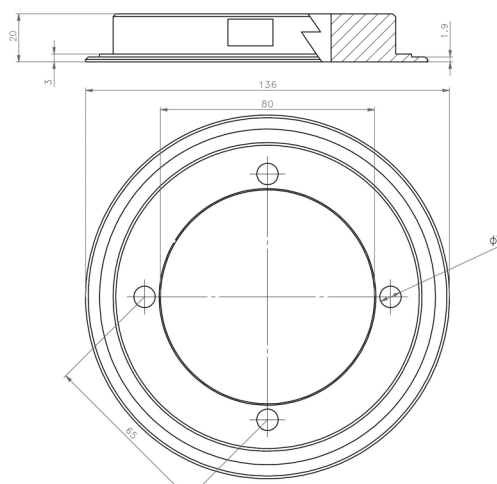
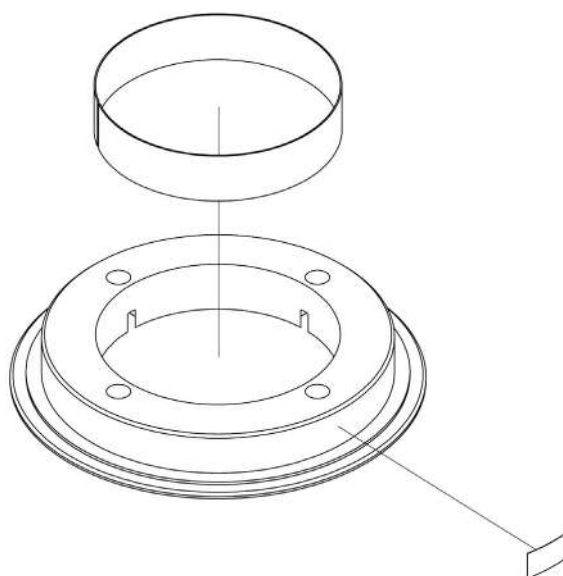


RO 185/A Metal Fixed Flange

This accessory is used to install the collimator to the X-Ray tube.

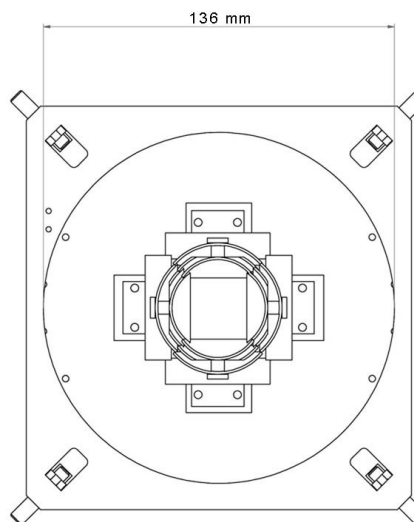
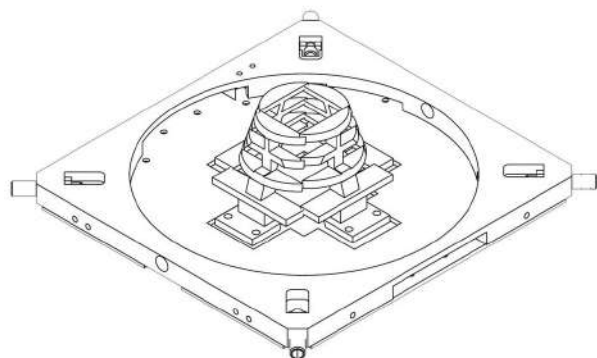
- 20 mm thickness
- 136 mm diameter

Please refer to section **RO 202 Self-centering top-cover bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



RO 202 Auto-Centering Top-Cover Bracket

This accessory is designed to precisely install the collimator with a 136 mm diameter metal flange (not included) to the X-Ray tube.



Installation

TUBE COMPUTABILITY

1. Using the dimensions in **Fig. Tube Compatibility** below, ensure the near port shutters of the collimator are placed in the X-Ray tube port without interference.
2. The distance between the X-Ray tube focus and the flange mounting plane (collimator upper plate) must be: 80 mm (3.14"), tolerance ± 1 mm (0.04 ").

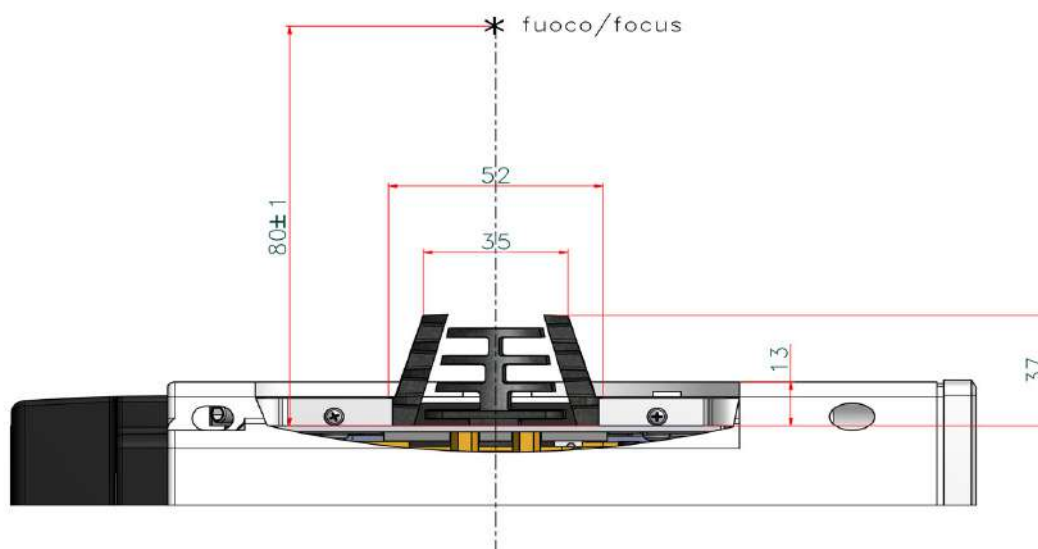
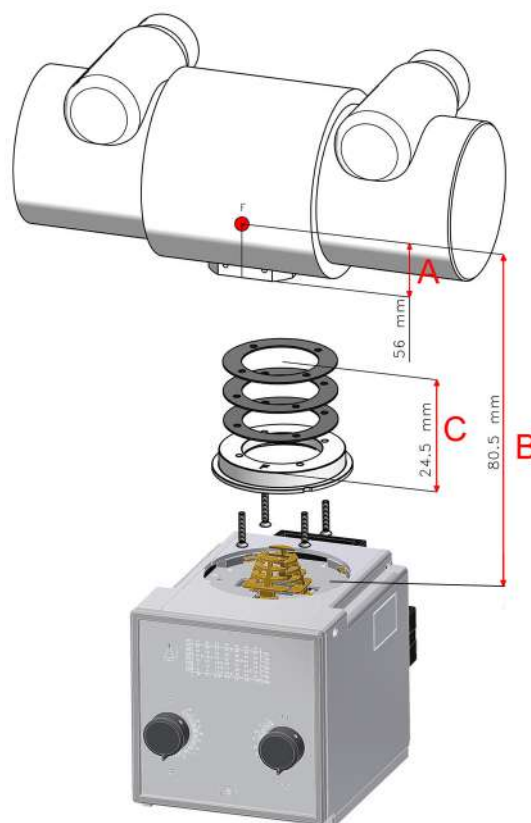


Fig. Tube Compatibility

3. Carefully remove the collimator and the mounting flange (if purchased) from their packaging.
4. Use the X-Ray tube housing datasheet to determine the distance (A) from the focal spot to the X-Ray tube port, see **Fig. Collimator Installation**.
5. Subtract the resulting distance from the source flange distance (B) and determine the number of spacers (1.5 mm) which, combined with the thickness of the mounting flange, will make up the difference (C). Allowable tolerance is 1 mm. (0.04"), see **Fig. Collimator Installation**.
6. Once the mounting plane distance has been confirmed, continue with the mounting flange installation to the X-Ray tube.



**The flange fixing screws and the spacers of the previous flange may be reused if the flange thickness is the same.*

Fig. Collimator Installation
*illustrative purpose only

Mounting the Flange to the X-ray Tube

NOTE



THE FOLLOWING MOUNTING INSTRUCTIONS ARE ONLY APPLICABLE FOR FLANGES COMPATIBLE WITH THIS OPTIONAL ITEM. IF YOU ARE UNSURE THE MOUNTING FLANGE YOUR COLLIMATOR IS EQUIPPED WITH IS COMPATIBLE, PLEASE CONSULT YOUR PERSONALIZATION PAGE PROVIDED WITH THIS MANUAL TO LOCATE THE FLANGE PART NUMBER (RO REFERENCE). FOLLOW THE MOUNTING INSTRUCTIONS SET FORTH UNDER THE SPECIFIC RO REFERENCE IN THIS MANUAL.

WARNING



FLANGES MAY BE PROVIDED BY RALCO OR BY THE SYSTEM MANUFACTURER. FLANGES MAY NOT BE INTERCHANGEABLE. ONLY THE FLANGE PROVIDED WITH THE COLLIMATOR BEING INSTALLED WITH A SPECIFIC PART CODE MAY BE UTILIZED. ANY PRE-EXISTING FLANGES MAY NOT TO BE USED. IF THERE ARE ANY QUESTIONS REGARDING COMPATIBILITY, PLEASE CONTACT RALCO.

CAUTION



RALCO CANNOT GUARANTEE COMPLIANCE WITH RADIATION STANDARDS CONCERNING SAFETY IF THIS CONTROL HAS BEEN OMITTED.

1. Place the flange on the X-Ray tube port, see **Fig. Flange Installation**.
2. Mount the mounting flange and spacers (optional) to the X-Ray tube port using 4 screws.**

*****Please ensure no conflicting information nor dangerous conditions exist due to adhering to these instructions or those provided by the X-Ray tube manufacturer. When in doubt please contact X-ray tube manufacturer and/or Ralco.***

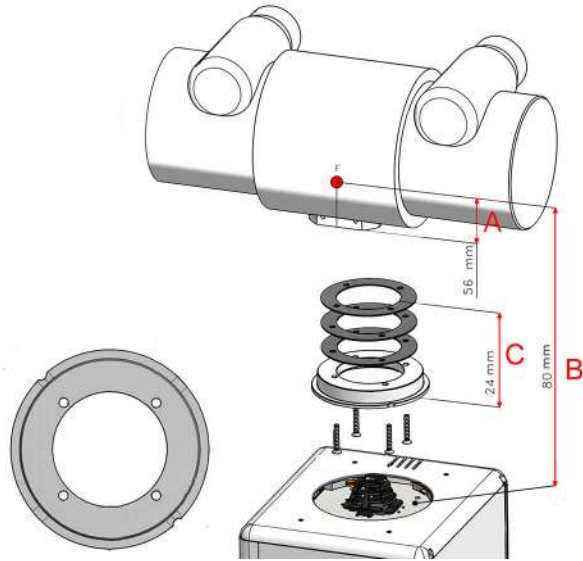


Fig. Flange Installation
*illustrative purpose only

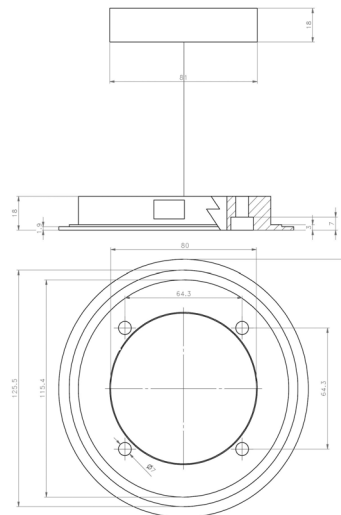
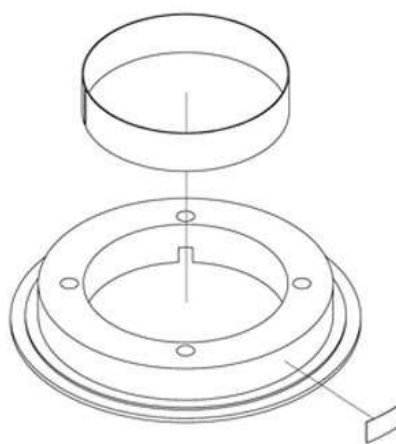


Fig. Mounting Flange
*illustrative purpose only

CAUTION



ENSURE THE SCREW HEAD IS INDEED CORRECT FOR THE FLANGE SELECTED. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE ALL SAFETY MEASURES ARE IMPLEMENTED TO ENSURE THE SCREWS ARE OPTIMALLY TIGHTENED INCLUDING THE USE OF APPROPRIATE LOCKTITE.



TIGHTEN THE 4 SCREWS TO THE X-RAY TUBE HEAD SECURELY, STRICTLY ACCORDING TO THE INSTRUCTIONS OF THE X-RAY TUBE MANUFACTURER. DO NOT EXCEED 0.45 NM OF FORCE.

ALIGNMENT OF X-RAY TUBE FOCUS AND COLLIMATOR

Ralco guarantees the correct collimator functionality, format compliance and light/X-Ray field alignment only if the mounting flange and the collimator have been installed exactly in the centre of the X-Ray beam.

All Ralco collimators are aligned on our test bench utilizing specific references/values for our X-Ray tube focus, detector and Source to Image Detector Distance (SID). The customer must know and verify all known variables which may influence the X-Ray tube focus and collimator alignment. These may include, the X-Ray tube focus position tolerance, distance from X-Ray tube focus to collimator mounting plane, or the SID.

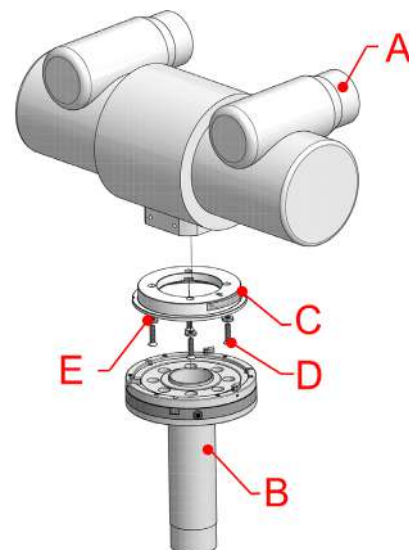
Alignment Device

This device is used to ensure the collimator mounting flange is correctly aligned to the X-ray beam. The X-ray tube manufacturer provides a tolerance for the placement of X-ray tube focus.

Ralco recommends to use the Focal Alignment Device (jig) to ensure the correct flange alignment with the centre of the X-Ray beam, see **Fig. Focal Alignment Device**. By making an exposure, it is possible to verify the perpendicularity and concentricity using fixed references on the X-Ray image.

Once the mounting flange is aligned the collimator light/X-ray field should also be aligned (within specific tolerances).

Please consult the technical specifications of your X-Ray tube to find the maximum tolerance for the position of the focus. Should the use of an alignment device not be possible, Ralco collimators allow for the regulation of the light field.



A - X-Ray Tube, B - Focal Adjustment Device
C - Mounting Flange, D - Screw, E - Washer

Fig. Focal Alignment Device

Mounting the Collimator to the Flange

NOTE



THE MOUNTING FLANGE PROVIDED (IF PURCHASED) WITH THE COLLIMATOR IS SUBJECTED TO TESTING PURSUANT TO ALL APPLICABLE STANDARDS.



MOUNTING BRACKET TABS CONFORM TO EN60601.

WARNINGS



PURSUANT TO APPLICABLE STANDARDS, RALCO HAS TESTED THE COLLIMATOR AND FLANGE APPLYING STATIC LOADS. RALCO IS NOT IN A POSITION TO KNOW THE DYNAMIC FORCES OF ALL END-USER SYSTEMS. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE DYNAMIC FORCES OF THE SYSTEM DO NOT CREATE A DANGEROUS CONDITION.



IT IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER TO ENSURE AND MITIGATE ANY DANGEROUS CONDITIONS WHICH MAY OCCUR DUE TO THE DYNAMIC FORCES CREATED BY THE SYSTEM. THE END-USER MUST PERFORM A SYSTEMATIC AND STRUCTURAL ANALYSIS DURING THE INSTALLATION AND USUAL MAINTENANCE.



SHOULD ANY DAMAGE TO THE COLLIMATOR OR FLANGE OCCUR A RISK ANALYSIS AND DAMAGE ASSESSMENT NEEDS TO BE CONDUCTED IMMEDIATELY. CONTACT RALCO IMMEDIATELY SHOULD THIS OCCUR. RALCO IS NOT LIABLE FOR RESULTANT PROPERTY DAMAGE OR HARM DUE TO AN UNREPORTED INCIDENT.



RALCO HAS DESIGNED AND TESTED THE COLLIMATOR FOR A LIFETIME OF 10 YEARS. AFTER THIS TIME PERIOD, IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE THE PROPER FUNCTIONING OF THE COLLIMATOR AND FLANGE. LIABILITY FOR ANY DANGEROUS CONDITIONS WHICH MAY BE PRESENT AFTER THE 10YEAR LIFETIME OF THE COLLIMATOR AND FLANGE RESTS WITH THE END-USER.



TO ENSURE THE SAFETY OF THE COLLIMATOR AND FLANGE AFTER 10 YEARS OF USE, RALCO HAS INSTITUTED A PROGRAM TO ASSESS THE SAFETY OF THE COLLIMATOR AND FLANGE. AFTER APPLYING A CHECK LIST OF QUALITY CONTROLS AND REFURBISHMENT ACTIVITIES (AT END-USER EXPENSE), RALCO MAY CERTIFY THE COLLIMATOR AND FLANGE FOR ADDITIONAL YEARS OF USE.

1. Prepare the collimator to be installed by unscrewing the 4 hexagonal socket screws until the four tabs are completely withdrawn from the collimator top mounting plane, see **Fig. 4 Mounting Screws**.
2. If installing a manual collimator, adjust the collimator shutters to the fully open position using both knobs.

CAUTION



WHEN UNSCREWING THE HEXAGONAL SOCKET SCREW WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,45 NM. UNSCREW WITH CARE SO AS NOT TO DAMAGE THE HEXAGONAL SCREW HEAD AND TABS.

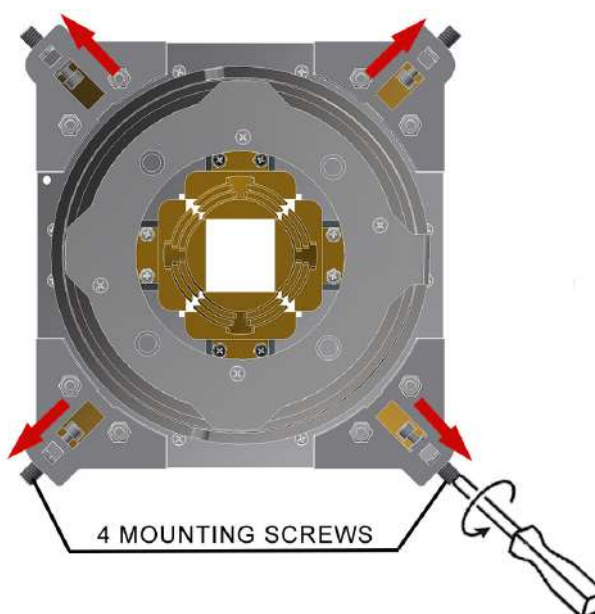


Fig. 4 Mounting Screws

3. With the tabs fully retracted, the hexagonal socket screws of the mounting bracket must be tightening equally up to the end stroke with 0.45 Nm torque (at least 7 turns), see **Fig. Mounting Bracket**.
4. The 4 tabs of the hexagonal socket screws overlap on the flange outer ring in the same manner.
5. The collimator tabs adhere to the flange outer ring. Depending on the optional flange purchased, the collimator may rotate or be fixed (no rotation).
6. Once the collimator is coupled to the flange in the method described above, verify the distance between the collimator housing and the mounting flange is equal in all directions and the collimator face is parallel to the axis of the table. Loosen the screws and adjust as necessary.
7. The collimator should be coupled to the flange firmly. If the collimator is loose, please repeat the above mounting instructions, and if issues persist, please contact Ralco.

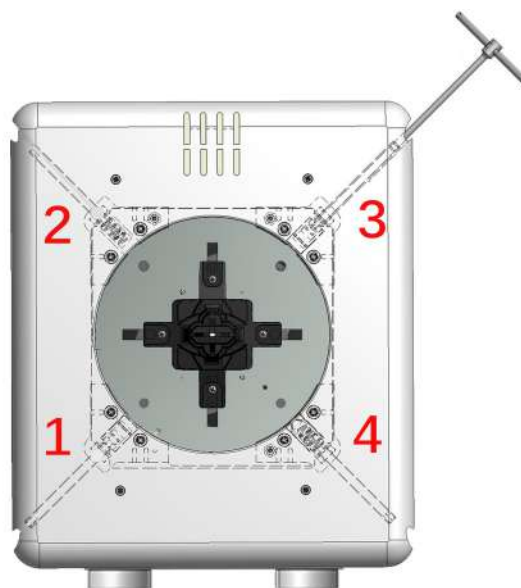


Fig. Mounting Bracket
*illustrative purpose only

VERIFICATION OF CORRECT INSTALLATION

WARNING



IT IS THE DUTY OF THE INSTALLER TO ENSURE NO RISK OF THE COLLIMATOR FALLING EXISTS. ENSURE THE FOLLOWING, AS IN EACH SCENARIO BELOW SERIOUS RISK OF INJURY AND PROPERTY DAMAGE MAY EXIST DUE TO NON-ADHERENCE.

1. The 4 tabs should overlap the flange outer ring, see **Fig. Correct Overlap**.
2. Ensure the mounting flange is flat against the collimator mounting plane, see **Fig. Correct Overlap**.
3. Ensure the 4 tabs are not in contact with only the mounting flange edge, see **Fig. Incorrect Overlap**.
4. Once the collimator is mounted, if not already, return the collimator/tube head to the intended use position. Rotate and/or gently pull the collimator to ensure correct coupling.
5. If the collimator is loose, something is incorrect. Repeat above mounting instructions, and if issues persist, please contact Ralco.

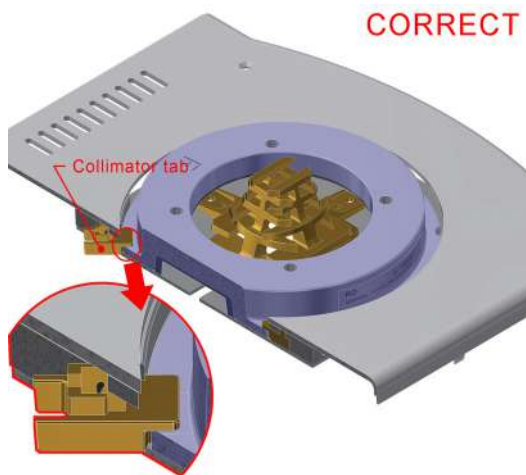


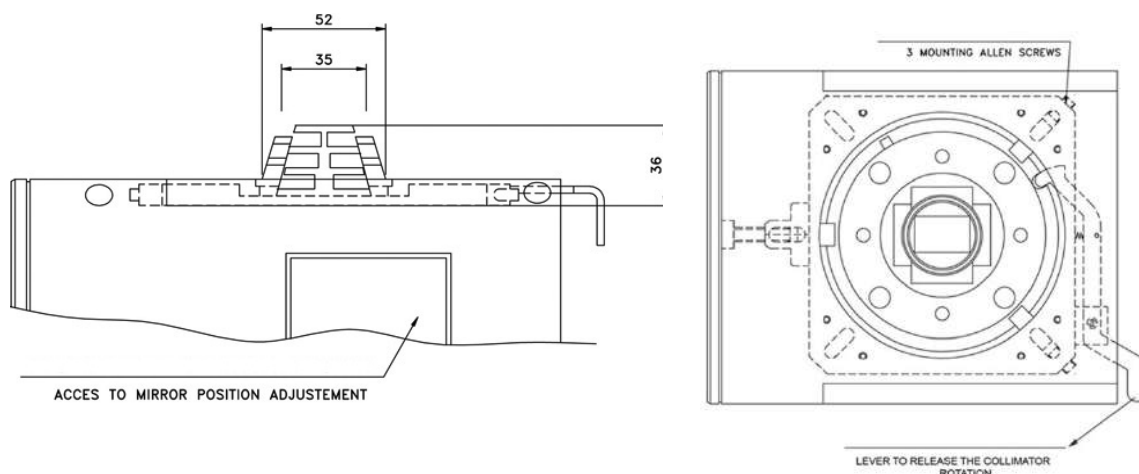
Fig. Correct Overlap



Fig. Incorrect Overlap

RO 203 Self-centering top-cover bracket for Siemens X-Ray tube

This bracket is designed for Siemens X-Ray tube only (flange provided by Siemens only).



NOTE

RALCO RECOMMENDS FOLLOWING THE BELOW PROCEDURE, DURING THE INSTALLATION OF THE COLLIMATOR EQUIPPED WITH THE SIEMENS TOP COVER TO THE X-RAY TUBE. THE CORRECTLY PERFORMED PROCEDURE ALLOWS THE COLLIMATOR TO ROTATE FREELY.

PROCEDURE:

1. REMOVE THE COLLIMATOR FROM ITS PACKAGING AND PLACE IT ON A FLAT SURFACE,
2. UNSCREW ALL 3 FIXING SCREWS OF THE COLLIMATOR, SEE **FIG. 1**,
3. INSTALL THE COLLIMATOR ONTO THE FLANGE PREVIOUSLY MOUNTED TO THE X-RAY TUBE.
4. TIGHTEN ALL 3 SCREWS COMPLETELY, SO THAT THE TABS WILL TOUCH THE FLANGE SLIGHTLY,
5. ONCE THE SCREWS ARE COMPLETELY TIGHTENED LOOSEN ONE BY ONE ABOUT 1/2 TURN (180°) TO ALLOW THE COLLIMATOR TO ROTATE FREELY. SEE **FIG. 2**.

Fig. 1

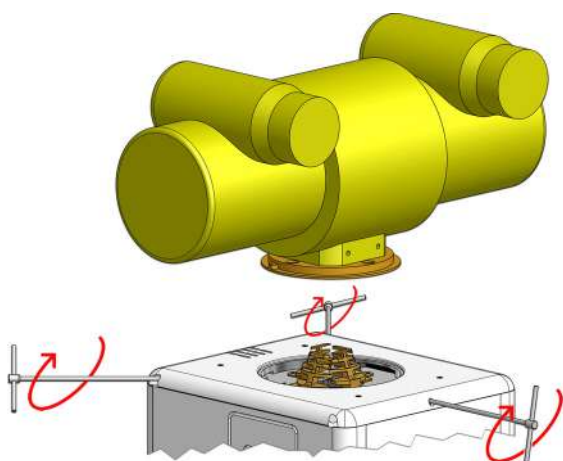
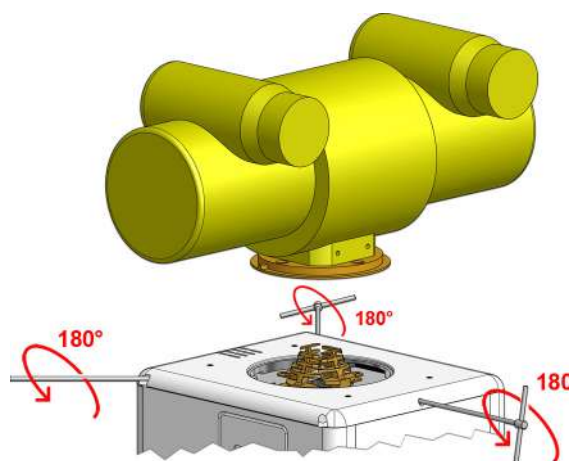


Fig. 2

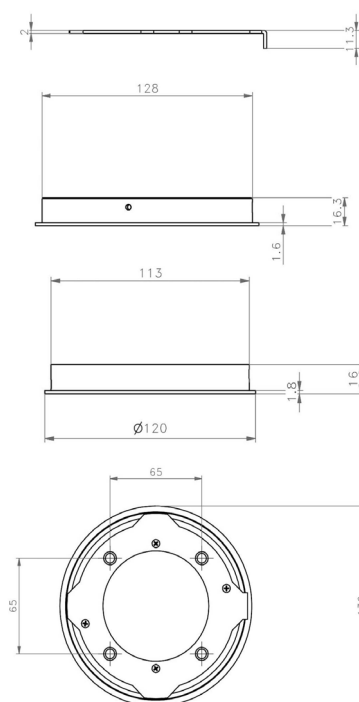
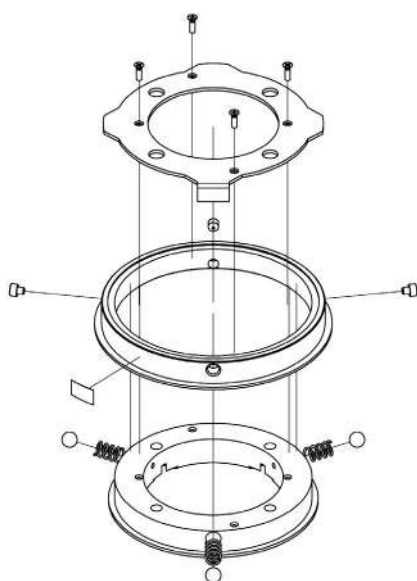


RO 222/A Metal Rotating Mounting Flange

This customized accessory is used to rotate the collimator assembled to the X-Ray tube.

- 136 mm diameter
- 18 mm thickness

Please refer to section **RO 202 Self-centering top-cover bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.

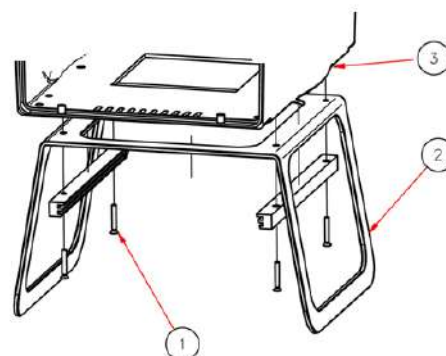


RO 240 Focal-spot to skin spacer

This accessory ensures a minimum safety distance (309.5 mm) between the X-ray focus and the patient.



THIS ACCESSORY DEALS WITH PREVENTING THE USE OF INAPPROPRIATE SMALL FOCUS/ SKIN DISTANCES IN ORDER THAT THE DOSE EQUIVALENT TO THE PATIENT BE KEPT AS LOW AS REASONABLY POSSIBLE.



1 - Countersunk Screws, 2 - Focus-Skin Distance Spacers, 3 - Collimator Cover.

RO 242/1 Single Laser Line to align collimator and detector center: Class 2

The collimator laser is classified as Class 2 (1 m W - wavelength = 645 nm +/- 10 nm); used for collimator/image receptor center alignment, see **Fig. Laser Line**.

WARNING



CAUTION: CLASS 2
LASER SYSTEM DO NOT
STARE INTO THE BEAM

Laser Adjustment

- Remove part of the cover to access the point of adjustment, see Chapter-**COVER REMOVAL**.
- The line is to fall on a perpendicular cross-line on the plastic anti-dust panel near the collimator controls, see **Fig. Laser Line**.
- Adjust the position of the line by rotating or moving the base of the laser system.
 - To rotate the laser system, loosen the Allen screw **A**, see **Fig. Laser Adjustment**.
 - Tighten the Allen screw when the laser beam falls on or is parallel to the bisector line drawn on the anti-dust panel.
- Shift the laser system by loosening the two **B** screws holding the laser system base to the beam limiting device front plate.
 - Move the base until the laser beam falls over the perpendicular bisector line on the anti-dust panel, see **Fig. Laser Alignment**.
 - Tighten the two **B** screws.

WARNING



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

Substitution

- Disconnect supply.

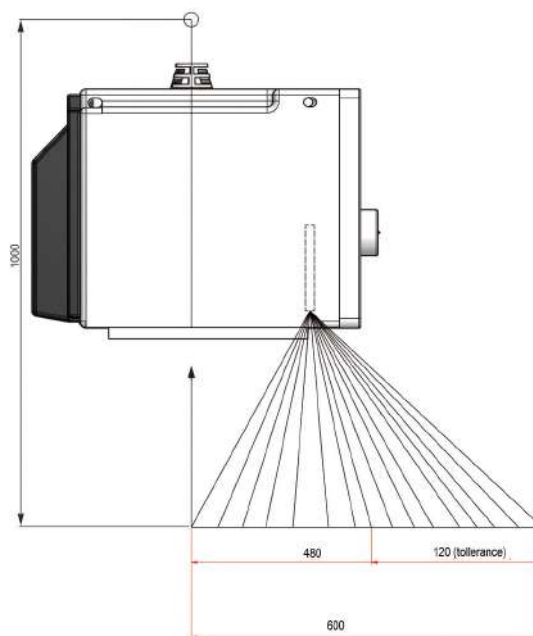


Fig. Laser Line

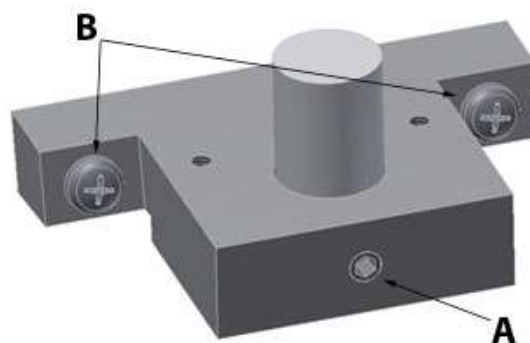


Fig. Laser Adjustment

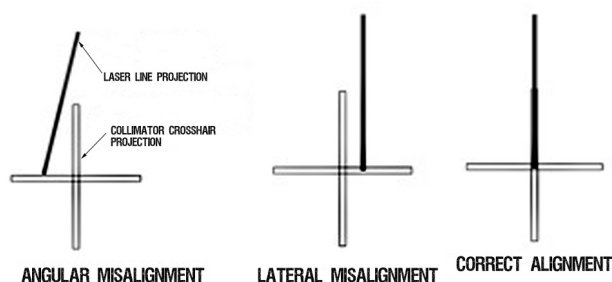
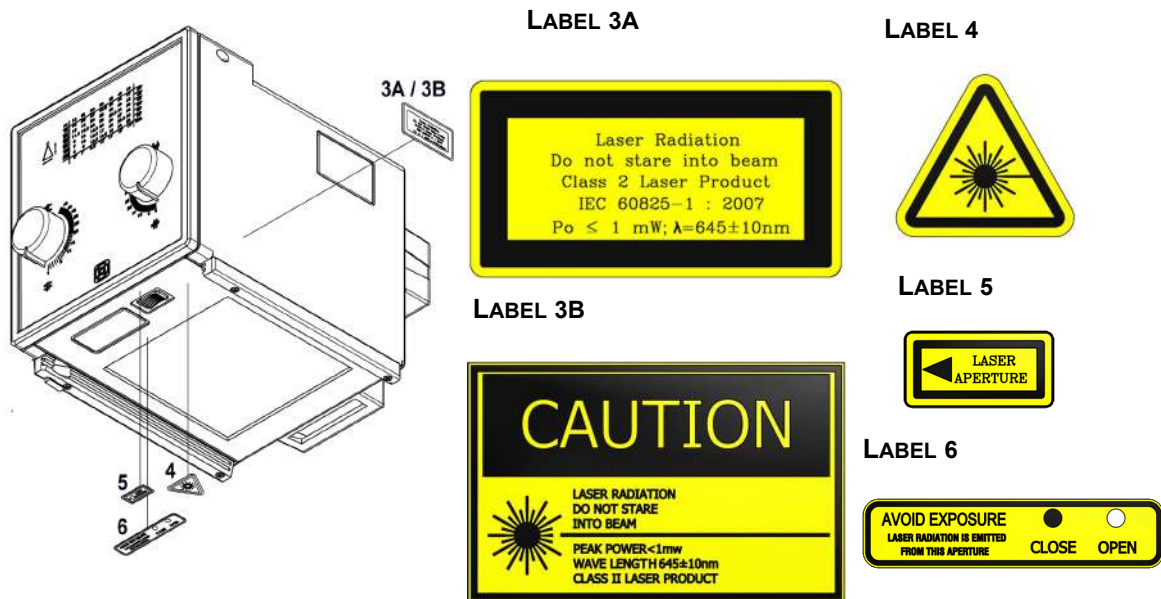


Fig. Laser Alignment

- Remove the cover, see Chapter- **COVER REMOVAL**.
- Unscrew the fixing Allen screws **A**, see **Fig. Laser Adjustment**.
- Disconnect the timer cables from the terminal board - white 0 V, red 5 V.
- Remove the laser and substitute with an identical item.
- Tighten the screws.
- Check the laser alignment, see Chapter- **ADJUSTMENTS**.
- Remount the cover, see Chapter- **COVER REMOVAL**.

Classification EN 60825-1 par. 1 -5: Class 2 laser product => Red laser line.



RO 242/2 Two lasers (one mounted externally) forming a crosshair to center the patient to the collimator: Class 2

Second laser which serves to center the patient using the cross projection.

The collimator lasers are classified as Class 2 (1 m W - wavelength = 645 nm, +/- 10 nm) and are used for collimator/image receptor center alignment.



CAUTION: CLASS 2 LASER SYSTEM DO NOT STARE INTO THE BEAM.

CALIBRATION CONTROL

- Draw a cross (two lines at 90°) on a sheet of paper and use this as reference.
- Switch the light ON and set the sheet of paper at 1 m from the focus.
- Make sure the cross on the paper coincides exactly with the two lines silk-screened on the plastic window.

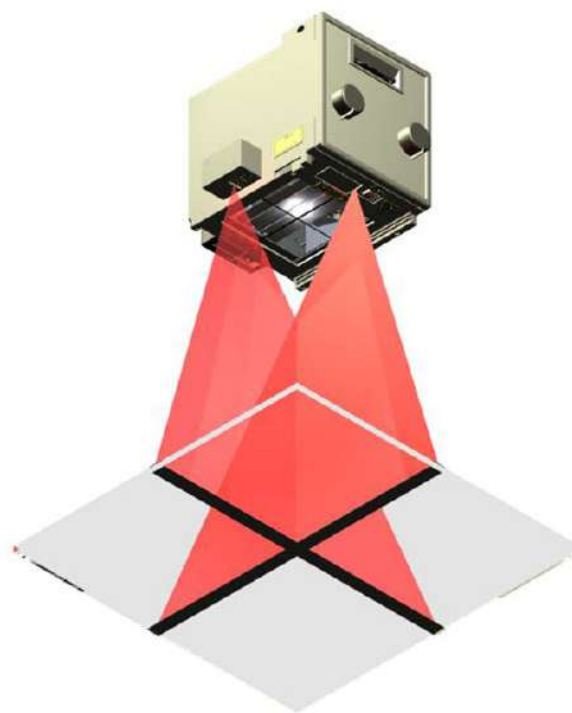


Fig. Laser Lines

- Examine the laser projections on the paper: the laser is correctly calibrated when the projections coincide with the lines drawn on the paper, otherwise an adjustment will be necessary.

ADJUSTMENT

Horizontal

- Disconnect power supply.
- Remove the laser cover located on the collimator cover by unscrewing the two screws **A**, see **Fig. Horizontal Laser**.
- To correct horizontal misalignment, loosen the screws **B**, see **Fig. Horizontal Laser** and move the laser support until the projected laser line coincides with the cross on the sheet of paper. Tighten screws **B**.

Vertical

- Disconnect power supply.
- Remove the knobs and front panel, see Chapter- **COVER REMOVAL**.

- To correct vertical misalignment, loosen the Allen screw **A**, see **Fig. Vertical Laser** on the laser support; rotate the laser and align the laser line over the cross on the sheet of paper.
- To move laterally the laser loosen the screws **B** and shift the laser support until the projected laser line coincides with the cross on the sheet of paper.

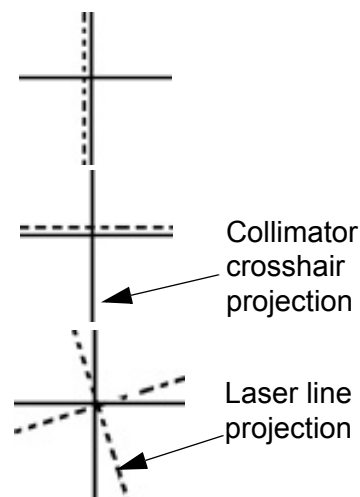


Fig. Laser Projections

- Tighten **B** screw s.

WARNINGS



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

SUBSTITUTION

Horizontal

- Disconnect supply.
- Remove the laser cover located on the collimator cover by unscrewing the two screws **A**, see **Fig. Horizontal Laser**.
- Disconnect the timer cables from the terminal board - white 0 V, red 5 V.
- Remove the laser and substitute with an identical item.
- Tighten the screws.
- Check the laser alignment, see paragraph **ADJUSTMENT**.
- Remount the laser cover.

Vertical

- Disconnect supply.
- Remove the knobs and front panel, see Chapter- **COVER REMOVAL**.
- Loosen the Allen screw **A**, see **Fig. Vertical Laser** on the laser support.
- Disconnect the timer cables from the terminal board - white 0 V, red 5 V.
- Remove the laser and substitute with an identical item.
- Tighten the Allen screw.
- Check the laser alignment, see paragraph **ADJUSTMENT**.
- Remount the laser cover.

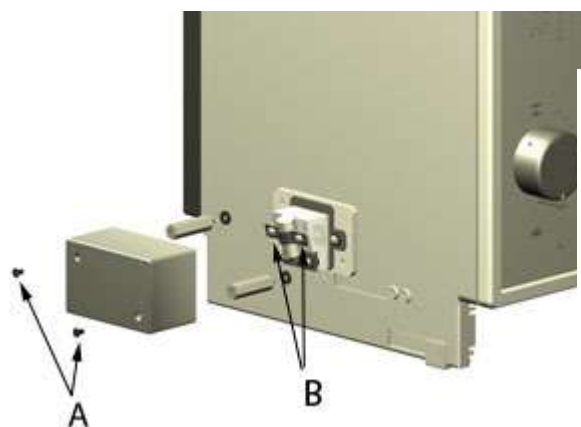


Fig. Horizontal Laser

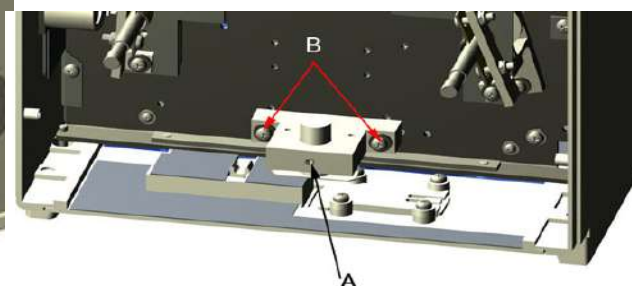
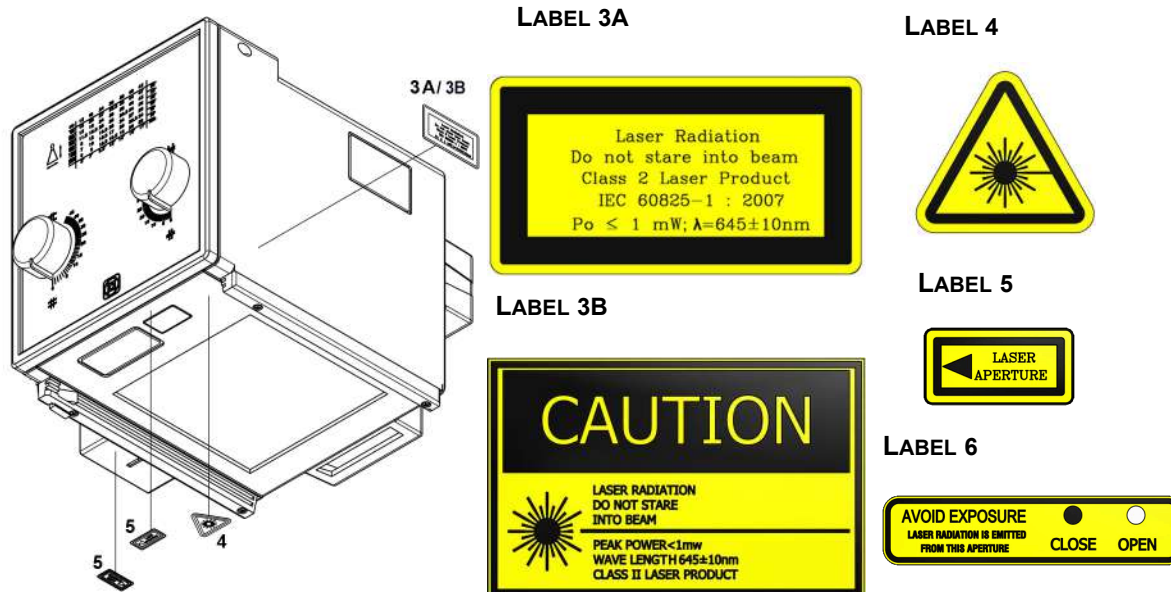


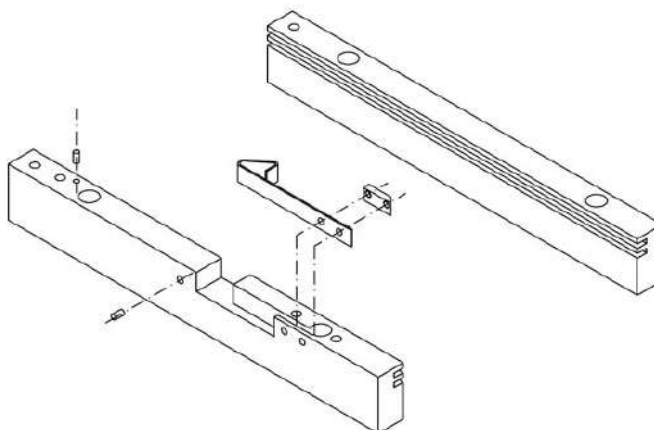
Fig. Vertical Laser

Classification EN 60825-1 par. 1 -5: Class 2 laser product => Red laser line.



RO 253 Accessory guide rail spacers in standard housing color

A pair of plastic rail guides complete (RAL 9003) with support (unless RO 074 is selected) designed to accommodate the ionization chamber and ensure its lateral protection.



RO 258 Additional Variable Filtration - Manual Selection

Additional variable filtration with manual settings may be optionally added to the minimum collimator filtration in the form of a disk, 1 mm thickness. The disk features a hole for the passage of X-rays and accommodates the following three filters:

- 0: no filtration.
- 0,1 mm Cu 1 mm Al (Al eq. 3.5 mm)
- 0,2 mm Cu + 1 mm Al (Al eq. 6.0 mm)
- 1 mm Al + 1 mm Al (Al eq. 2 mm)

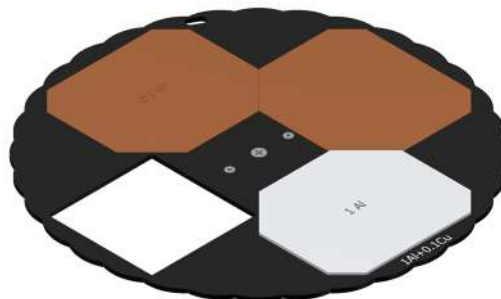


Fig. Additional Variable Filtration

Setup of Filters

- Rotate the aluminium disc that protrudes from the filter opening on the front panel.
- Indication of the filtration value is provided on the upper part and lower rim of the disc; this value refers to the additional filtration in the X-ray beam.

Filter Substitution

- Disconnect the power supply.
- Remove the knobs and the front panel, see **Fig. 1/Fig. 2** and Chapter - **COVER REMOVAL**.



Fig. 1



Fig. 2

- Unscrew the 2 screws **A** holding the filter system on the front plate, see **Fig. 3** and **Fig. 4**.
- Slide the filter system out from the collimator body.
- Substitute with an identical filter group.
- Check that disc rotation is uniform.
- Insert the filter system into the collimator body.
- Tighten the 2 screws **A**.
- Remount in reverse order.

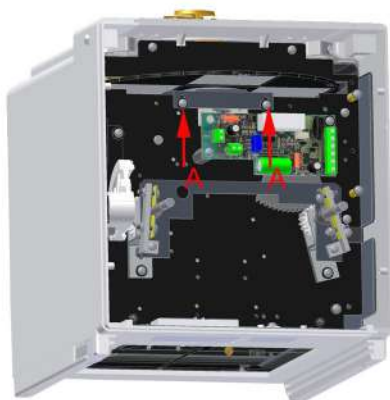


Fig. 3

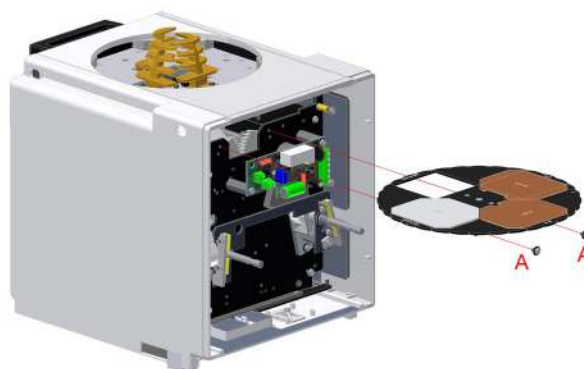


Fig. 4

RO 258/1 Additional Variable Filtration - Manual Selection

Additional variable filtration with manual settings may be optionally added to the minimum collimator filtration in the form of a disk, 1 mm thickness, controlled manually from the front panel. The disk features a hole for the passage of X-rays and accommodates the following three filters:

- 0: no filtration
- 0,1 mm Cu (Al eq. 2,5 mm)
- 0,2 mm Cu (Al eq. 5 mm)
- 0,3 mm Cu (Al eq. 7.5 mm)

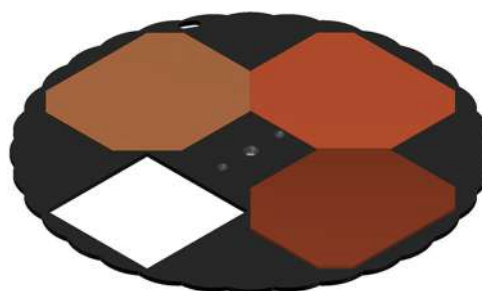


Fig. RO 258/1

To adjust and/or to change the filter see **RO 258 Additional Variable Filtration** description in this Chapter.

RO 271 Substitution of LED light field

System lamp for high luminosity. This Lamp is complete with a cooler system kit which includes: fan, thermo probe, and timer board to limit lamp ON cycles.

Power Supply: 24 V 150 W - 8 A

Fuse for power supply protection collimator: T 10 A (not supplied by Ralco).



1 - Fan, 2 - Heat sink

RO 318 Self-centering Top-Cover Bracket

This mounting bracket allows for the coupling of a flange with a diameter of 140mm. Included in this optional item is a resin rotating mounting flange:

- 20mm thickness,
- +/- 0° detent,
- 140mm diameter (unless substituted with another compatible optional item flange).

Installation

WARNINGS



THE COLLIMATOR MUST BE INSTALLED TO THE X-RAY TUBE THROUGH A MOUNTING FLANGE. RALCO PROVIDES VARIOUS FLANGE OPTIONS WHICH MAY NOT BE INTERCHANGEABLE. ONLY FLANGES PROVIDED WITH THE COLLIMATOR MAY BE UTILIZED. THE END-USER MAY INSTALL THEIR OWN FLANGE, HOWEVER RALCO CANNOT GUARANTEE COMPATIBILITY. ANY PREEXISTING FLANGE ON THE END-USER SYSTEM MUST NOT BE USED.



WHEN A FLANGE IS PROVIDED WITH THE COLLIMATOR BEARING A MATCHING SERIAL NUMBER, ENSURE THEY ALWAYS REMAIN COUPLED. IT IS MANDATORY THEY REMAIN TOGETHER AND THE CORRECT FLANGE PART NUMBER IS USED.



THE CONTENTS OF THE INSTRUCTIONS BELOW SHOULD BE STRICTLY ADHERED TO. RALCO IS NOT LIABLE FOR ANY PROPERTY DAMAGE OR RESULTING HARM IF NON-RALCO COMPONENTS OR NON-COMPATIBLE RALCO COMPONENTS ARE USED DURING THE INSTALLATION PROCESS.

TUBE COMPATIBILITY

- Using the dimensions in **Fig. Tube Compatibility** below, ensure the near port shutters of the collimator are placed in the X-Ray tube port without interference.

7. The distance between the X-Ray tube focus and the flange mounting plane (collimator upper plate) must be: 80 mm (3.14"), tolerance ± 1 mm (0.04 ").

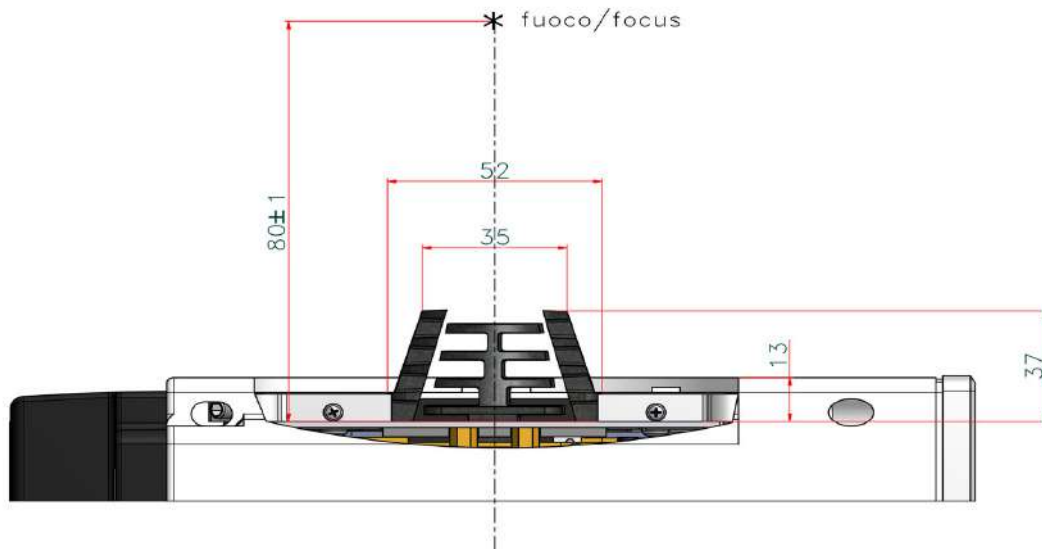
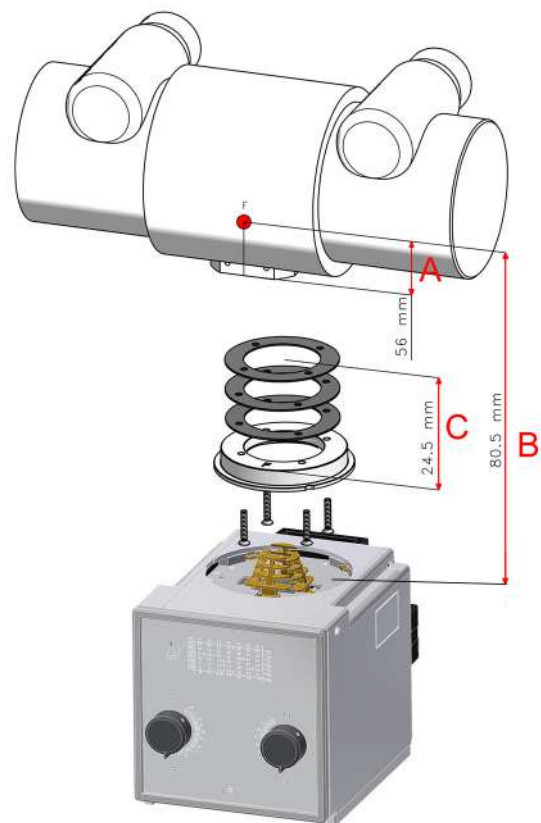


Fig. Tube Compatibility

8. Carefully remove the collimator and the mounting flange from their packaging.
9. Use the X-Ray tube housing datasheet to determine the distance (**A**) from the focal spot to the X-Ray tube port, see **Fig. Collimator Installation**.
10. Subtract the resulting distance from the source flange distance (**B**) and determine the number of spacers (1.5 mm) which, combined with the thickness of the mounting flange, will make up the difference (**C**). Allowable tolerance is 1 mm. (0.04"), see **Fig. Collimator Installation**.
11. Once the mounting plane distance has been confirmed, continue with the mounting flange installation to the X-Ray tube.



**The flange fixing screws and the spacers of the previous flange may be reused if the flange thickness is the same.*

Fig. Collimator Installation
**illustrative purpose only*

Mounting the Flange to the X-ray Tube

NOTE



THE FOLLOWING MOUNTING INSTRUCTIONS ARE ONLY APPLICABLE FOR COMPATIBLE FLANGES WITH THIS OPTIONAL ITEM. IF YOU ARE UNSURE THE MOUNTING FLANGE YOUR COLLIMATOR IS EQUIPPED WITH IS COMPATIBLE, PLEASE CONSULT YOUR PERSONALIZATION PAGE PROVIDED WITH THIS MANUAL TO LOCATE THE FLANGE PART NUMBER (RO REFERENCE). FOLLOW THE MOUNTING INSTRUCTIONS SET FORTH UNDER THE SPECIFIC RO REFERENCE IN THIS MANUAL.

WARNING



FLANGES MAY BE PROVIDED BY RALCO OR BY THE SYSTEM MANUFACTURER. FLANGES MAY NOT BE INTERCHANGEABLE. ONLY THE FLANGE PROVIDED WITH THE COLLIMATOR BEING INSTALLED WITH A SPECIFIC PART CODE MAY BE UTILIZED. ANY PRE-EXISTING FLANGES MAY NOT TO BE USED. IF THERE ARE ANY QUESTIONS REGARDING COMPATIBILITY, PLEASE CONTACT RALCO.

CAUTION



RALCO CANNOT GUARANTEE COMPLIANCE WITH RADIATION STANDARDS CONCERNING SAFETY IF THIS CONTROL HAS BEEN OMITTED.

1. Place the flange on the X-Ray tube port, see **Fig. Flange Installation**.
2. Mount the mounting flange and spacers (optional) to the X-Ray tube port using 4 screws. **

****Please ensure no conflicting information nor dangerous conditions exist due to adhering to these instructions or those provided by the X-Ray tube manufacturer. When in doubt please contact X-Ray tube manufacturer and/or Ralco.**

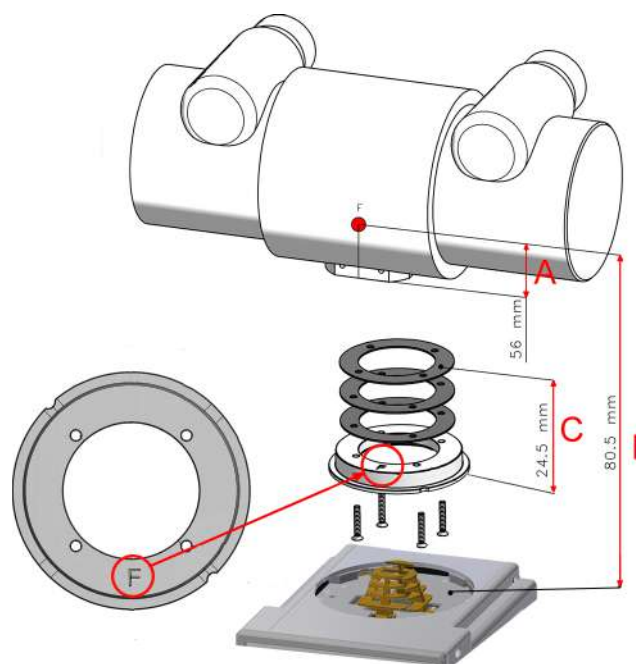


Fig. Flange Installation

**illustrative purpose only*

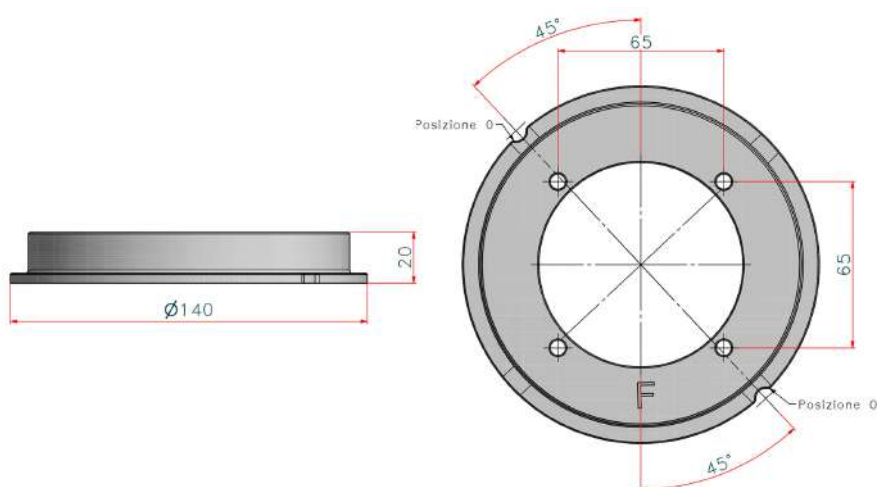


Fig. Mounting Flange

**illustrative purpose only*

CAUTION



THE FLANGE MUST BE PLACED WITH THE LETTER "F" FACING TOWARD THE X-RAY TUBE PORT. INCORRECT POSITION MAY CAUSE THE COLLIMATOR AND FLANGE TO MALFUNCTION.

CAUTION



ENSURE THE SCREW HEAD IS INDEED CORRECT FOR THE FLANGE SELECTED. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE ALL SAFETY MEASURES ARE IMPLEMENTED TO ENSURE THE SCREWS ARE OPTIMALLY TIGHTENED INCLUDING THE USE OF APPROPRIATE LOCKTITE.



TIGHTEN THE 4 SCREWS TO THE X-RAY TUBE HEAD SECURELY, STRICTLY ACCORDING TO THE INSTRUCTIONS OF THE X-RAY TUBE MANUFACTURER. DO NOT EXCEED 0.45 NM OF FORCE.

Alignment of X-Ray Tube Focus and Collimator

Ralco guarantees the correct collimator functionality, format compliance and light/X-Ray field alignment only if the mounting flange and the collimator have been installed exactly in the centre of the X-Ray beam.

All Ralco collimators are aligned on our test bench utilizing specific references/values for our X-Ray tube focus, detector and Source to Image Detector Distance (SID). The customer must know and verify all known variables which may influence the X-Ray tube focus and collimator alignment. These may include, the X-Ray tube focus position tolerance, distance from X-Ray tube focus to collimator mounting plane, or the SID.

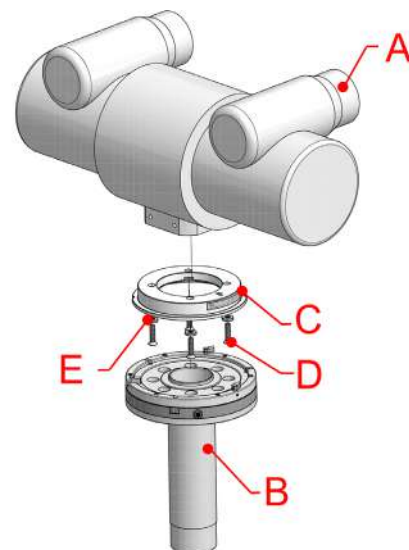
ALIGNMENT DEVICE

This device is used to ensure the collimator mounting flange is correctly aligned to the X-ray beam. The X-ray tube manufacturer provides a tolerance for the placement of X-ray tube focus.

Ralco recommends to use the Focal Alignment Device (jig) to ensure the correct flange alignment with the centre of the X-Ray beam, see **Fig. Focal Alignment Device**. By making an exposure, it is possible to verify the perpendicularity and concentricity using fixed references on the X-Ray image.

Once the mounting flange is aligned the collimator light/X-ray field should also be aligned (within specific tolerances).

Please consult the technical specifications of your X-Ray tube to find the maximum tolerance for the position of the focus. Should the use of an alignment device not be possible, Ralco collimators allow for the regulation of the light field.



A - X-Ray Tube, B - Focal Adjustment Device
C - Mounting Flange, D - Screw, E - Washer

Fig. Focal Alignment Device

Mounting the Collimator to the Flange

NOTE



THE MOUNTING FLANGE PROVIDED (IF PURCHASED) WITH THE COLLIMATOR IS SUBJECTED TO TESTING PURSUANT TO ALL APPLICABLE STANDARDS.



MOUNTING BRACKET TABS CONFORM TO EN60601.

WARNINGS



PURSUANT TO APPLICABLE STANDARDS, RALCO HAS TESTED THE COLLIMATOR AND FLANGE APPLYING STATIC LOADS. RALCO IS NOT IN A POSITION TO KNOW THE DYNAMIC FORCES OF ALL END-USER SYSTEMS. IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE DYNAMIC FORCES OF THE SYSTEM DO NOT CREATE A DANGEROUS CONDITION.



IT IS THE RESPONSIBILITY OF THE SYSTEM MANUFACTURER TO ENSURE AND MITIGATE ANY DANGEROUS CONDITIONS WHICH MAY OCCUR DUE TO THE DYNAMIC FORCES CREATED BY THE SYSTEM. THE END-USER MUST PERFORM A SYSTEMATIC AND STRUCTURAL ANALYSIS DURING THE INSTALLATION AND USUAL MAINTENANCE.



SHOULD ANY DAMAGE TO THE COLLIMATOR OR FLANGE OCCUR A RISK ANALYSIS AND DAMAGE ASSESSMENT NEEDS TO BE CONDUCTED IMMEDIATELY. CONTACT RALCO IMMEDIATELY SHOULD THIS OCCUR. RALCO IS NOT LIABLE FOR RESULTING PROPERTY DAMAGE AND/OR HARM DUE TO AN UNREPORTED INCIDENT.



RALCO HAS DESIGNED AND TESTED THE COLLIMATOR FOR A LIFETIME OF 10 YEARS. AFTER THIS TIME PERIOD, IT IS THE RESPONSIBILITY OF THE END-USER TO ENSURE THE PROPER FUNCTIONING OF THE COLLIMATOR AND FLANGE. LIABILITY FOR ANY DANGEROUS CONDITIONS WHICH MAY BE PRESENT AFTER THE 10YEAR LIFETIME OF THE COLLIMATOR AND FLANGE RESTS WITH THE END-USER.



TO ENSURE THE SAFETY OF THE COLLIMATOR AND FLANGE AFTER 10 YEARS OF USE, RALCO HAS INSTITUTED A PROGRAM TO ASSESS THE SAFETY OF THE COLLIMATOR AND FLANGE. AFTER APPLYING A CHECK LIST OF QUALITY CONTROLS AND REFURBISHMENT ACTIVITIES (AT END-USER EXPENSE), RALCO MAY CERTIFY THE COLLIMATOR AND FLANGE FOR ADDITIONAL YEARS OF USE.

The mounting bracket has 2 tabs with springs in positions 2 and 4, while the 2 tabs in position 1 and 3 cover the surface of the outer ring of the flange, see **Fig. Mounting Bracket**.

1. Prepare the collimator to be installed by unscrewing the 4 hexagonal socket screws until the four tabs are completely withdrawn from the collimator top mounting plane, see **Fig. 4 Mounting Screws**.
2. If installing a manual collimator, adjust the collimator shutters to the fully open position using both knobs.

CAUTION



WHEN UNSCREWING THE HEXAGONAL SOCKET SCREW WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,45 NM. UNSCREW WITH CARE SO AS NOT TO DAMAGE THE HEXAGONAL SCREW HEAD AND TABS.

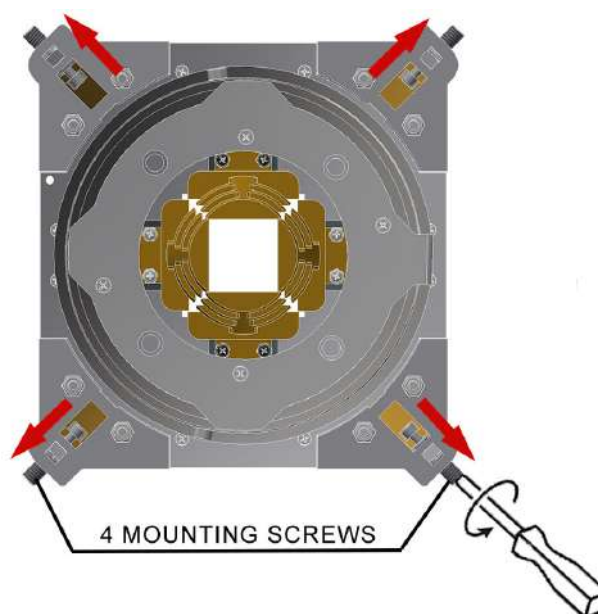


Fig. Collimator Mounting Bracket

3. With the tabs fully retracted, tabs in position 1 and 3 which overlap the outer ring must be tightened equally up to the end stroke with 0.45 Nm torque (at least 7 turns). See **Fig. Mounting Bracket**.
4. With the tabs fully retracted, the tabs in position 2 and 4 have an integrated adjustable spring and can be tightened in two different ways allowing the flange to be fixed or to rotate, see **Fig. Mounting Bracket**.

FIXED (NO ROTATION)

With the tabs fully retracted, tighten all tabs up to the end stroke with 0.45Nm torque at least 7 turns (if you are not able to respect the turns something is incorrect, repeat above instructions, if issues persist, please contact Ralco).

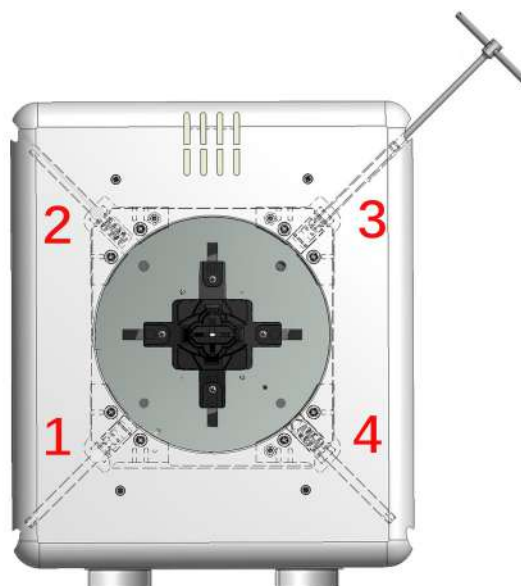


Fig. Mounting Bracket
*illustrative purpose only

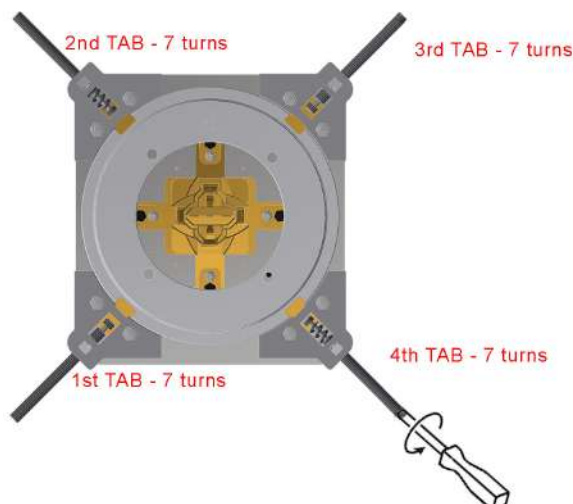


Fig. Mounting Bracket (Fixed)

WITH ROTATION

With the tabs fully retracted, tighten tabs in the following sequence (if you are not able to respect the turns something is incorrect, repeat above instructions, if issues persist, please contact Ralco):

- Tabs 1 and 3 - minimum of 7 turns
- Tabs 2 and 4 – exactly 5 ½ turns.



Fig. Mounting Bracket (Rotating)

The collimator tabs glide on the flange outer ring and the collimator rotates towards the X- Ray tube axis. If, however:

- The release force from the position 0° and the collimator rotation is too low, the two tabs of the tab 2 and 4 need to be tighten ½ turn.
- The release force from the position 0° and the collimator rotation is too high, the two tabs of the tab 2 and 4 need to be loosened ½ turn.

Verification of Correct Installation

WARNING



IT IS THE DUTY OF THE INSTALLER TO ENSURE NO RISK OF THE COLLIMATOR FALLING EXISTS. ENS URE THE FOLLOWING, AS IN EACH SCENARIO BELOW SERIOUS RISK OF INJURY AND/OR PROPERTY DAMAGE MAY EXIST DUE TO NON-ADHERENCE.

1. The 4 tabs should overlap the flange outer ring, see **Fig. Correct Overlap**.
2. Ensure the mounting flange is flat against the collimator mounting plane, see **Fig. Correct Overlap**.
3. Ensure the 4 tabs are not in contact with only the mounting flange edge, see **Fig. Incorrect Overlap**.
4. Once the collimator is mounted, if not already, return the collimator/tube head to the intended use position. Rotate and/or gently pull the collimator to ensure correct coupling.
5. If the collimator is loose, something is incorrect. Repeat above mounting instructions, and if issues persist, please contact Ralco.

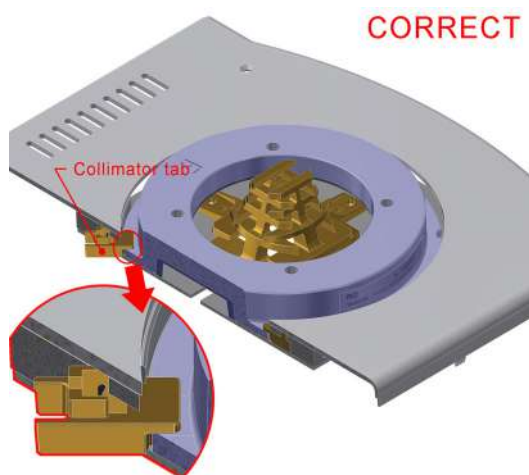


Fig. Correct Overlap



Fig. Incorrect Overlap

RO 339 Two lasers forming a single line at 1-meter SID: Class 2

The collimator has two lasers which serve for the optical definition of the prefixed SID. The lasers are mounted behind the front panel. Two laser lines must measure 60 cm (+/-1) at 1 m (+/- 0.5 cm) and projected at 10 cm (+/-1) from the centre of the light/X-ray field. The projection of a single line signifies that the two lines overlap and consequently the lasers are correctly focussed at the set SID, which can be adjusted from 90 to 200 cm. The projection of two laser lines signifies the SID value has not been entered correctly. See fig. **Laser Line**.

WARNINGS



CAUTION: CLASS II LASER SYSTEM
DO NOT STARE INTO THE BEAM.

Laser Adjustment

- Remove part of the cover to access the point of adjustment, see Chapter- **COVER REMOVAL**.
- The line is to fall on a perpendicular cross-line on the plastic anti-dust panel near the collimator controls, see **Fig. Laser Line**.
- Adjust the position of the line by rotating or moving the base of the laser system.
 - To rotate the laser system, loosen the Allen screw **A**, see **Fig. Laser Adjustment**.
 - Tighten the Allen screw when the laser beam falls on or is parallel to the bisector line drawn on the anti-dust panel.

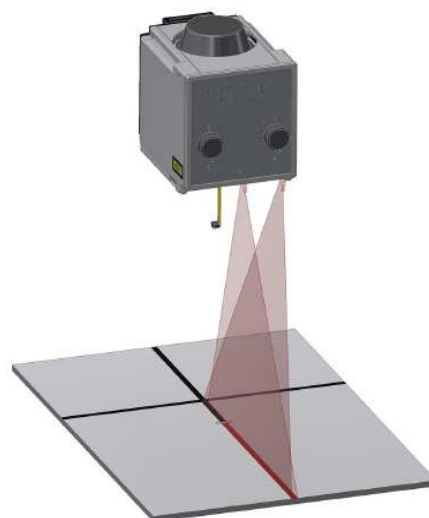


Fig. Laser Line

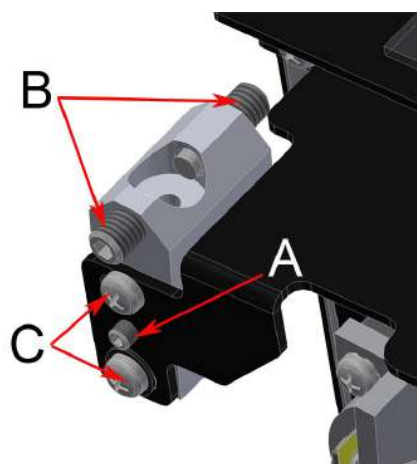


Fig. Laser Adjustment

WARNINGS



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT CIRCUIT THE LASER.

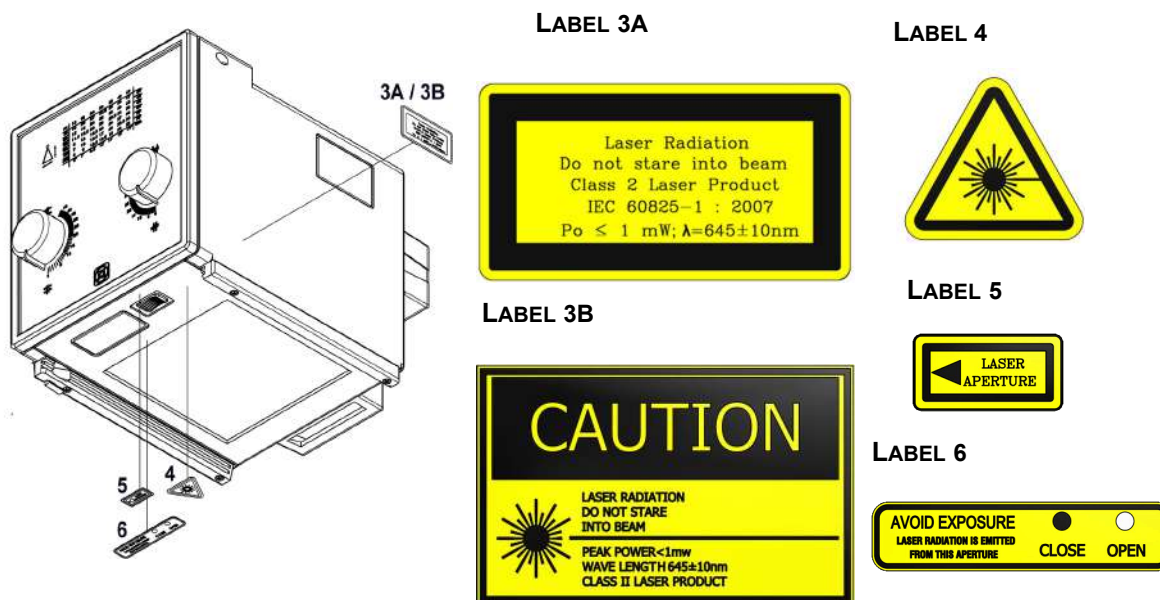
- Adjust the length of the laser line by screwing or unscrewing the screws **B**. See **Fig. Laser Adjustment**.

- Shift the laser system by loosening the two **C** screws holding the laser system base to the beam limiting device front plate.
 - Move the base until the laser beam falls over the perpendicular bisector line on the anti-dust panel, see **Fig. Laser Adjustment**.
 - Tighten the screws **C**.

Substitution

- Disconnect supply.
- Remove the cover, see Chapter- **COVER REMOVAL**.
- Unscrew the fixing Allen screws **A**, see **Fig. Laser Adjustment**.
- Disconnect the timer cables from the terminal board - white 0 V, red 5 V.
- Remove the laser and substitute with an identical item.
- Tighten the screws.
- Check the laser alignment, see Chapter- **ADJUSTMENTS**.
- Remount the cover, see Chapter- **COVER REMOVAL**.

Classification EN 60825-1 par. 1 -5: Class 2 laser product => Red laser line.

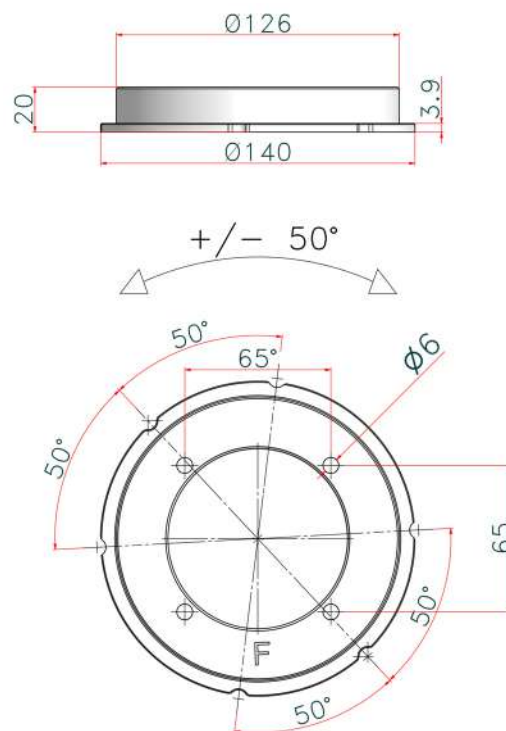


RO 441 Resin Rotating Mounting Flange

Resin rotating mounting flange:

- 20 mm thickness
- $\pm 50^\circ$ detent
- 140 mm diameter

Please refer to section **RO 318 Adjustable Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.

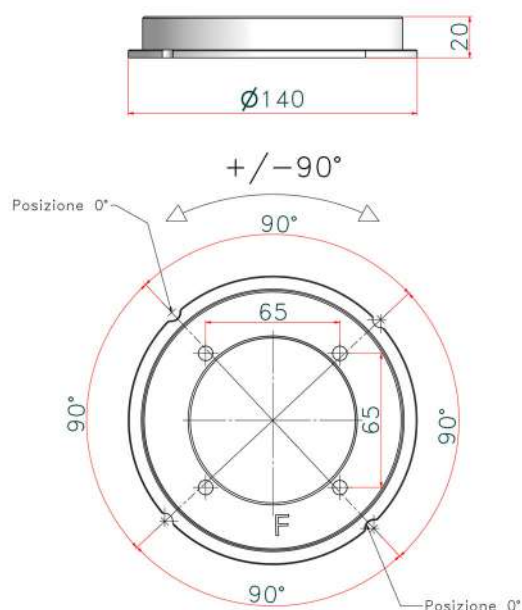


RO 442 Resin Rotating Mounting Flange

Resin rotating mounting flange:

- 20 mm thickness
- $\pm 90^\circ$ detent
- 140 mm diameter

Please refer to section **RO 318 Adjustable Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.

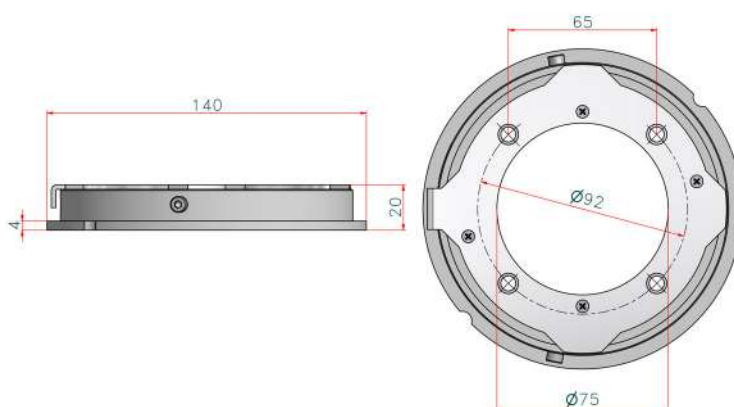


RO 445 Metal Rotating Mounting Flange

Metal rotating mounting flange:

- 20 mm thickness
- +/- 90° mechanical stop
- 140 mm diameter

Please refer to section **RO 318 Adjustable Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



When the collimator is assembled check the collimator to Focal Spot Alignment (Primary Shutter Cut-Off).

Inspect the four images of the four collimator shutters which form the edges of the X-ray field. A definitely indistinct edge indicates that the primary shutter, close to the focal spot, is the one forming the line, rather than the outermost shutter.

To correct the condition, use the four mounting/centering adjustment screws to shift the collimator in the direction of the indistinct line. Repeat the test film exposure after making the adjustment.

NOTE



THE HEEL EFFECT WILL CAUSE THE FIELD TOWARD THE CATHODE TO BE SLIGHTLY LESS SHARP THAN ON THE OTHER THREE SIDES. THIS IS NORMAL AND CANNOT BE CORRECTED BY ADJUSTMENT. IN ADDITION, AN X-RAY TUBE OF 12° OR LESS TARGET ANGLE WILL PRODUCE AN ASYMMETRICALLY SHAPED FIELD WHEN A LARGE FIELD SIZE IS USED AT SHORT SID, BECAUSE OF ANODE CUT-OFF EFFECT. THIS IS NORMAL AND MAY NOT BE CORRECTED BY ADJUSTMENT.

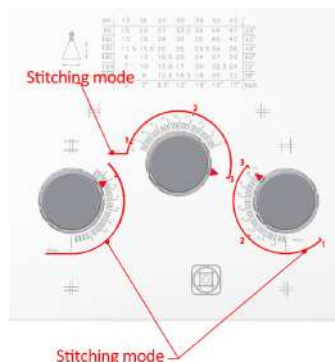
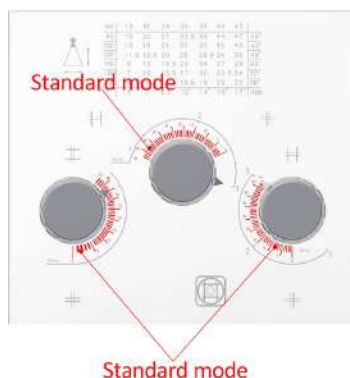
RO 452 Asymmetric Longitudinal Shutters ("stitching" application)

Each single Long shutter is moving through a knob on the front panel. This specialized system allows the user to manually adjust and fine-tune the stitch position. During the manual-stitching process, alignment of the Potter Bucky with the X-Ray beam is manually performed for each exposure.

The X-Ray tube remains stationary throughout the entire process. The acquired number of exposures is 3 at 100 cm SID. See **Fig. Stitching process**.



THE FRONT PANEL SHOWS THE 2 INDEX SCALES THAT ALLOWS THE COLLIMATOR TO OPERATE EITHER IN THE STANDARD OR STITCHING MODE. SEE **FIG. INDEX SCALE - STANDARD MODE** AND **FIG. INDEX SCALE - STITCHING MODE**.
THE MAXIMUM COLLIMATOR APERTURE IN THE STITCHING MODE IS 43 X 43 CM AT 100 CM SID.



To use the collimator (with 3 knobs) in standard mode:

At the desired SID the operator has to select the proper field using the references in the silk screen board on the front panel.

e.g., if the operator wants to set an X-Ray field of 35 x 43 cm where 35 cm is given by the Cross shutter and 43 cm is given by the Long shutters, at SID 100 cm, the operator has to position the Cross knob (the knob on the left) on the value of the scale that indicates 35 and both the two Long knobs (the knob in the middle and the knob on the right) on the value of the scale that indicates 43. See **Fig. Index scale 35 x 43 cm**.



DO NOT USE A SINGLE LONG KNOB. YOU MUST ALWAYS USE BOTH LONG KNOBS TOGETHER, AND BOTH LONG KNOBS POSITIONED ON THE SAME DESIRED APERTURE (FIELD).

A single Long knob gets half the aperture selected. If you select the two Long knobs with different aperture, long field is misaligned with respect to the centre of the field (the centre of the cassette). To get an aligned field you must always use both Long knobs positioned on the same aperture (field) desired.

e.g., at SID 100 cm, to have an X-Ray field 43 cm (Cross) x 15cm (Long), the Cross knob must be positioned at 43 and both the 2 Long knobs must be positioned at 15. See **Fig. Index scale 43 x 15 cm**.

e.g., at SID 100 cm, to have an X-Ray field 35 cm (Cross) x 20 cm (Long), the Cross knob must be positioned on 35 and both the 2 Long knobs must be positioned on 20. See **Fig. Index scale 43 x 20 cm**

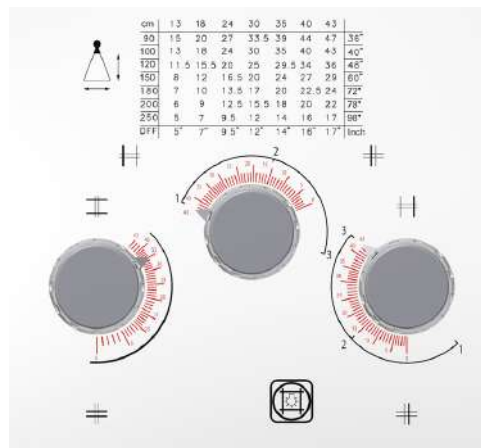


Fig. Index scale 35 x 43 cm

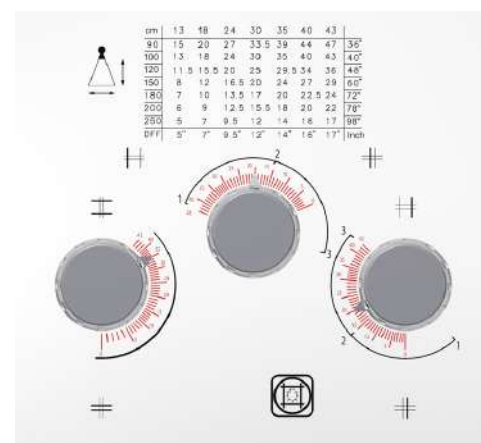


Fig. Index scale 43 x 15 cm

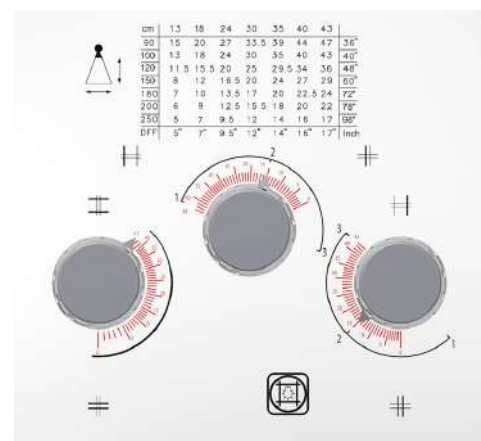


Fig. Index scale 43 x 20 cm

To use the collimator in stitching mode:

The maximum aperture of the X-Ray field is 43 x 43 cm at SID 100 cm.

The stitching mode can be used at different SID.

This mode permits to subdivide the X-Ray field in 3 sections and to make 3 exposures, one for each section.

To set the stitching mode at the desired SID, the Cross knob (the knob on the left) has to be positioned on the value of the scale in reference to the silk screen board on the front panel. The two Long knobs (the knob in the middle and the knob on the right) both have to be positioned on the setting 1, 2 or 3 indicated on the scale following the stitching desired field.

Field 1

Cross left knob - aperture 35 cm

Long central knob - position 1

Long right knob - position 1

See **Fig. Field 1**.

Field 2

Cross left knob - aperture 35 cm

Long central knob - position 2

Long right knob - position 2

See **Fig. Field 2**.

Field 3

Cross left knob - aperture 35 cm

Long central knob - position 3

Long right knob - position 3

See **Fig. Field 3**.

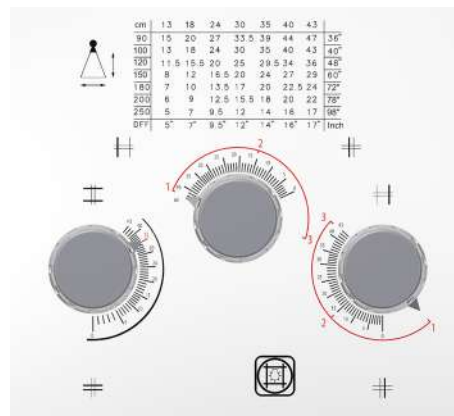


Fig. Field 1

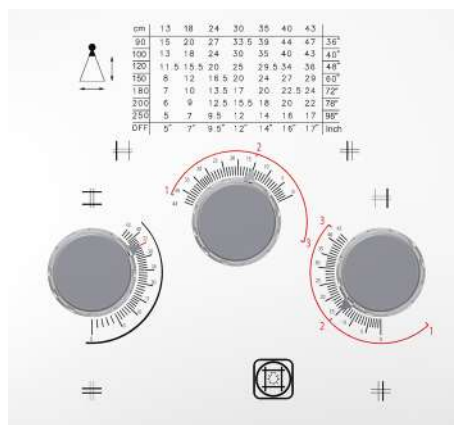


Fig. Field 2

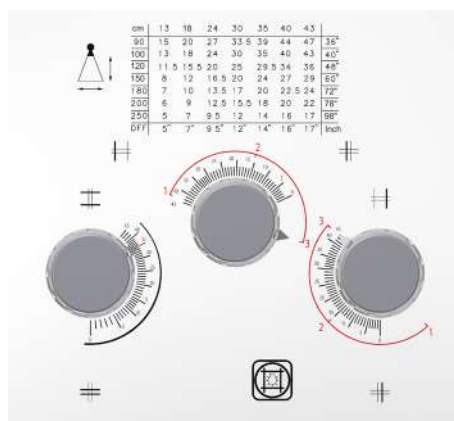


Fig. Field 3

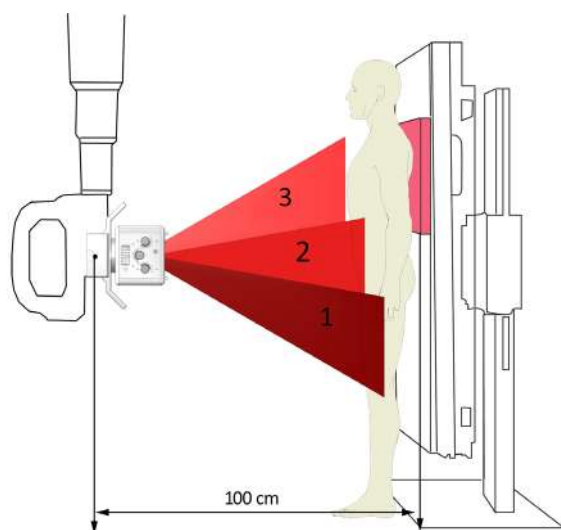
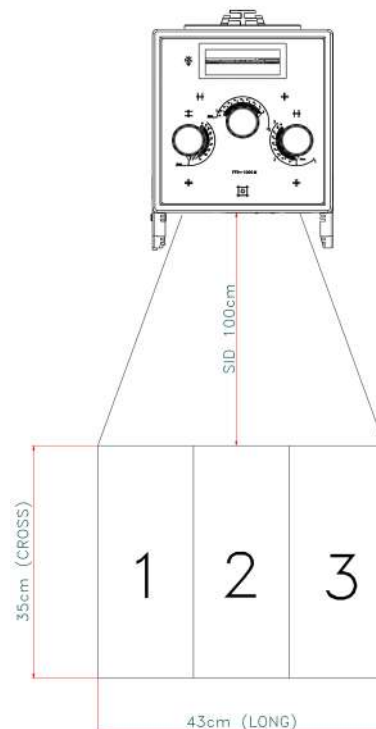


Fig. Stitching process

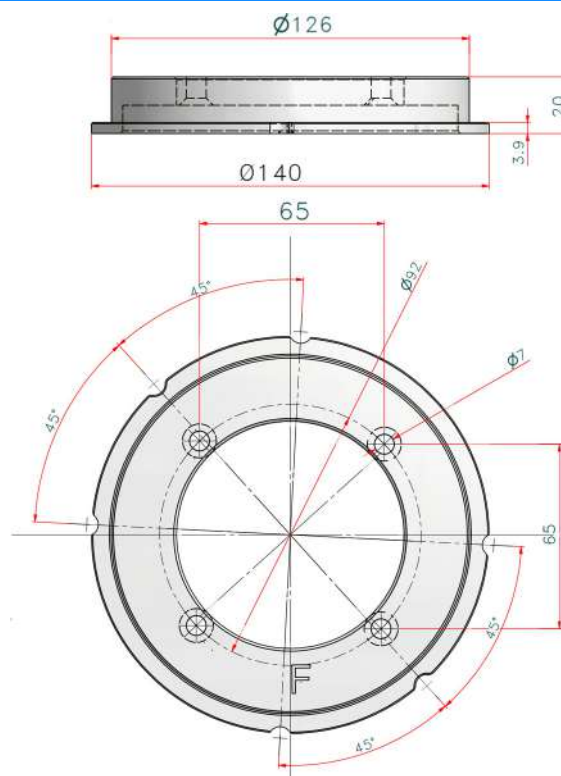


RO 489 Resin Rotating Mounting Flange

Resin rotating mounting flange:

- 20 mm thickness
- +/- 45° detent
- 140 mm diameter

Please refer to section **RO 318 Adjustable Top-Cover Bracket** in this chapter of the Instruction Manual for the correct flange/collimator mounting instructions.



RO 495 Camera assembled internally for patient monitoring

An IP ethernet interface is a type of digital camera commonly employed for surveillance, and which, unlike analog closed circuit television (CCTV) cameras, can send and receive data via a computer network and the Internet.

Substitution of the Video Camera

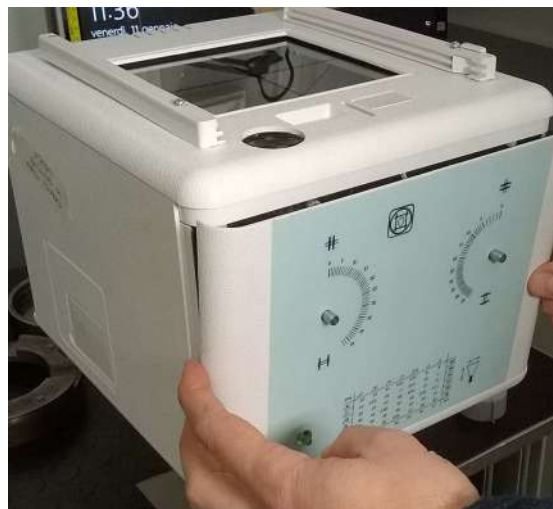
- Remove the knobs by unscrewing the 2 screws per knob.



- Unscrew the 4 screws placed on the rails.



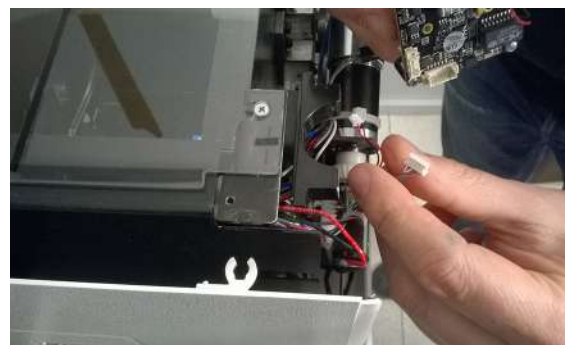
- Remove carefully the snap-on front panel and detach the connectors:
A for the push button
B for the front panel LED (if present).



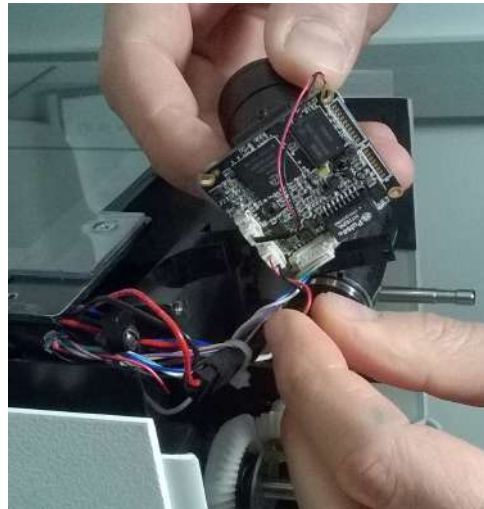
- Remove the lower cover.
- Remove the 2 lateral covers, if necessary.
- Remove the video camera with its support by unscrewing the fixing screws (C).



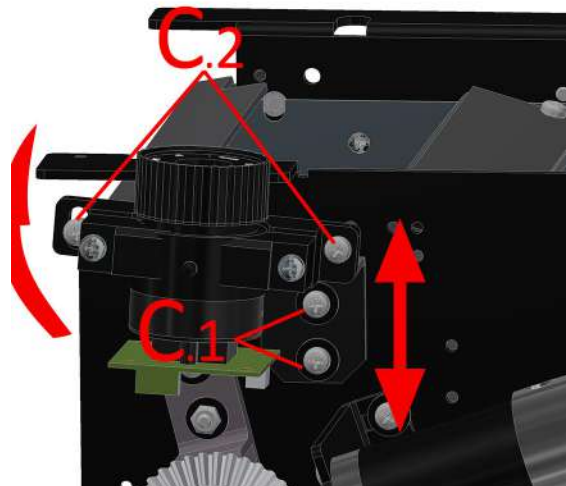
- Detach the connectors from the video camera, as shown in the photos.



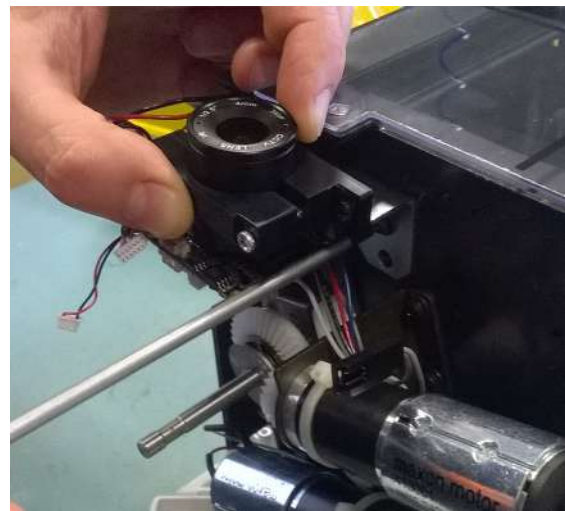
- Remount the video camera with its support by connecting the connectors and then fixing the support to the collimator housing.



- The video camera can be adjusted vertically (C.1) or be tilted (C.2) whenever it is necessary.



- Power up the collimator and check if the video camera is calibrated.



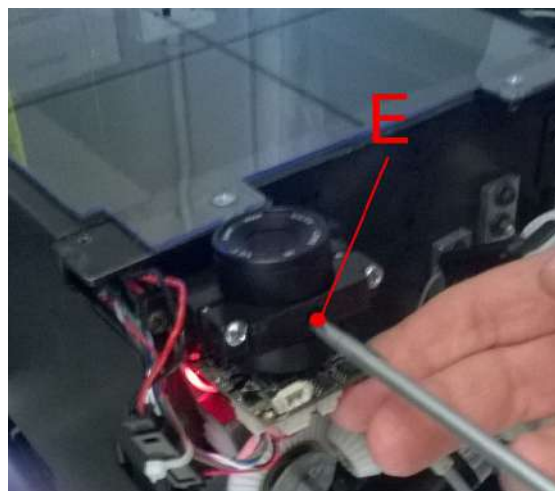


THE VIDEO CAMERA IS ALREADY WELL-FOCUSED IN THE FACTORY. PLEASE FOLLOW THE BELOW PROCEDURE TO READJUST THE FOCUS.

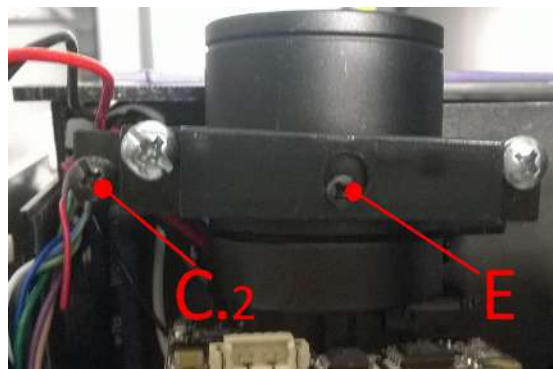
- If necessary, loosen the 2 screws **(D)** and rotate the whole video camera to calibrate it.



- Loosen the screw **E** placed on the video camera support.
- Adjust the focus by rotating the lens.



- Loosen the screw **F** and adjust the video camera inclination, if necessary.
- Tighten the screws **E** and **F**.
- Remount the collimator cover in reverse order.



RO 500 Field replacement packaging

Additional packaging on the customer request.

RO 525 Customized Knob design

The customer can specify the knob design.

RO 586 Single laser line to align collimator and detector center: Class 1

The collimator laser is classified as Class 1 (1 m W - wavelength = 645 nm, +/- 10 nm); used for collimator/image receptor center alignment, see **Fig. Laser Line**.

WARNINGS



CAUTION: CLASS 1 LASER SYSTEM DO NOT STARE INTO THE BEAM.

Laser Adjustment

- Remove part of the cover to access the point of adjustment, see Chapter-**COVER REMOVAL**.
- The line is to fall on a perpendicular cross-line on the plastic anti-dust panel near the collimator controls, see **Fig. Laser Line**.
- Adjust the position of the line by rotating or moving the base of the laser system.
 - To rotate the laser system, loosen the Allen screw **A**, see **Fig. Laser Adjustment**.
 - Tighten the Allen screw when the laser beam falls on or is parallel to the bisector line drawn on the anti-dust panel.
- Shift the laser system by loosening the two **B** screws holding the laser system base to the beam limiting device front plate.
 - Move the base until the laser beam falls over the perpendicular bisector line on the anti-dust panel, see **Fig. Laser Alignment**.
 - Tighten the two **B** screws.

WARNINGS



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

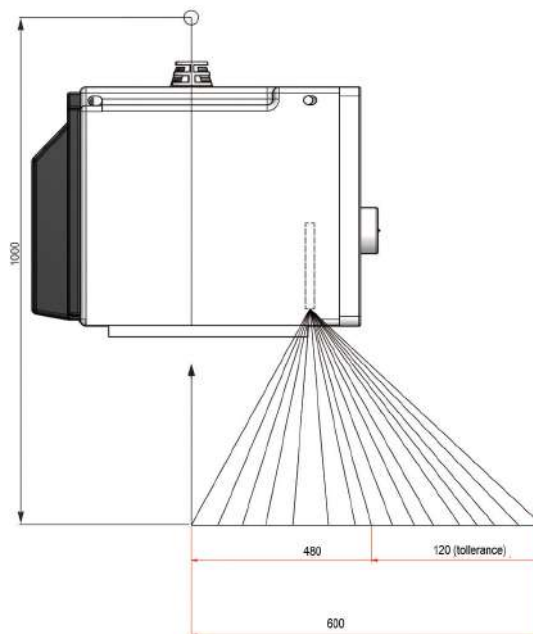


Fig. Laser Line

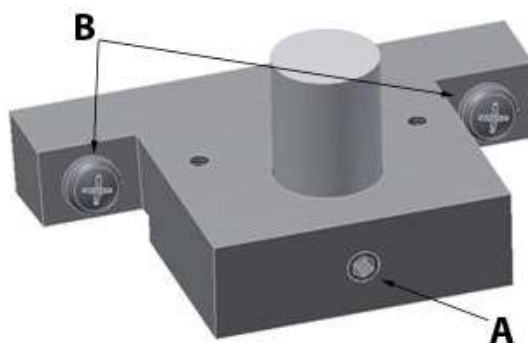


Fig. Laser Adjustment

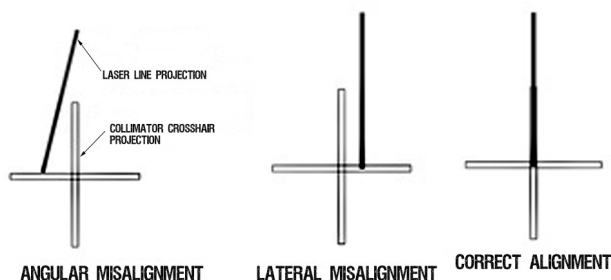


Fig. Laser Alignment

Substitution

The Laser Substitution Kit is composed of the following components: the laser (A), the extension cable (B) and the laser label (C) pictured below in **Fig. Laser Substitution Kit**. This Kit is designed to substitute any laser Ralco provides.

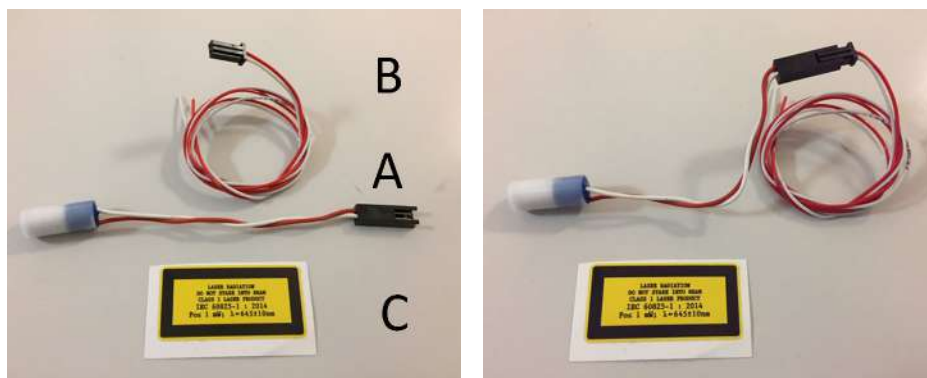


Fig. Laser Substitution Kit

Prior to replacing the laser, confirm which version of laser is installed on your collimator which will ensure the substitution is performed correctly.

- The previous laser version is connected to the board via 2 cables (red and white), see **Fig. Previous Laser Version** below.

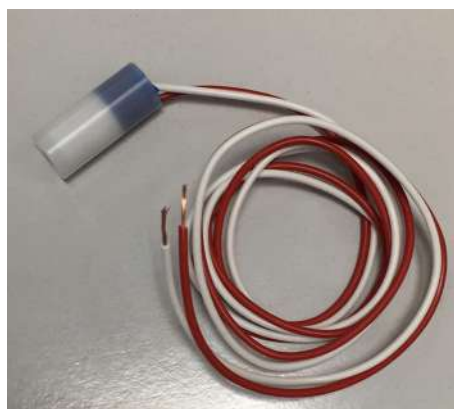


Fig. Previous Laser Version

- The new laser is connected to the board via the connector, see **Fig. New Laser Version** below..



Fig. New Laser Version

Replacing the Previous Laser Version

To replace the previous version of laser, all components of the Laser Substitution Kit (A, B and C) must be used.

To substitute the laser, proceed as follows:

6. Disconnect the collimator supply.
7. Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
8. Prior to disconnecting the laser cables from the board, identify the cables and their position on the terminal board, see Chapter **INSTALLATION**, paragraph **Wiring Diagram** in the Instruction Manual for your specific model.
9. Carefully remove the laser, the extension cable and the label from their packaging.
10. Ensure the extension cable (**B**) is firmly connected to the laser (**A**), see **Fig. Laser Substitution Kit** above.
11. Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
12. Adjust the length of the extension (**B**) cable by cutting the 2 cables (red/white).
13. Connect both cables to the board.
14. Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
15. Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEMS** in the Instruction Manual for your specific model.

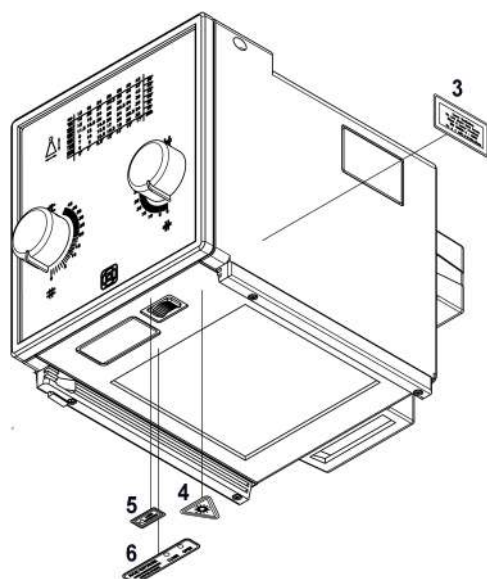
Replacing the New Laser Version

To replace the new laser version, only part **A** and **C** of the Kit must be used.

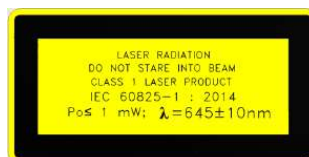
To substitute the laser, proceed as follows:

- Disconnect the collimator supply.
- Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
- Detach the connector of the faulty laser from the collimator wiring.
- Carefully remove the laser, the extension cable and the label from their packaging.
- Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
- Connect the new laser to the collimator wiring.
- Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
- Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEM** in the Instruction Manual for your specific model.

Classification EN 60825-1 par. 1 -5: Class 1 laser product => Red laser line.



LABEL 3



LABEL 4



LABEL 5



LABEL 6



RO 587/1 Two lasers forming a single line at 1-meter SID: Class 1

The collimator has two lasers which serve for the optical definition of the prefixed SID. The lasers are mounted behind the front panel and they are classified as Class 1 (1 m W - wavelength = 645 nm, +/- 10 nm). Two laser lines must measure 60 cm (+/- 1) at 1 m (+/- 0.5 cm) and projected at 10 cm (+/- 1) from the centre of the light/X-ray field. The projection of a single line signifies that the two lines overlap and consequently the lasers are correctly focussed at the set SID, which can be adjusted from 90 to 200 cm. The projection of two laser lines signifies the SID value has not been entered correctly. See fig. **Laser Line**.



CAUTION: CLASS I LASER SYSTEM DO NOT STARE INTO THE BEAM.

Laser Adjustment

- Remove part of the cover to access the point of adjustment, see Chapter- **COVER REMOVAL**.
- The line is to fall on a perpendicular cross-line on the plastic anti-dust panel near the collimator controls, see **Fig. Laser Line**.
- Adjust the position of the line by rotating or moving the base of the laser system.
 - To rotate the laser system, loosen the Allen screw **A**, see **Fig. Laser Adjustment**.
 - Tighten the Allen screw when the laser beam falls on or is parallel to the bisector line drawn on the anti-dust panel.



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT CIRCUIT THE LASER.

- Adjust the length of the laser line by screwing or unscrewing the screws **B**. See **Fig. Laser Adjustment**.

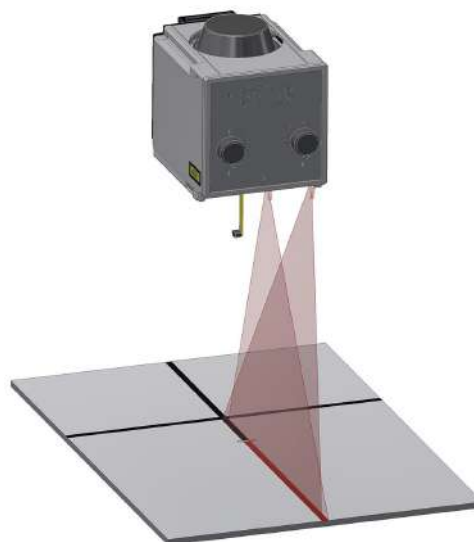


Fig. Laser Line

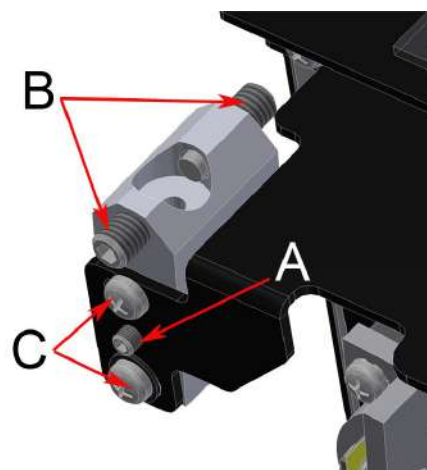


Fig. Laser Adjustment

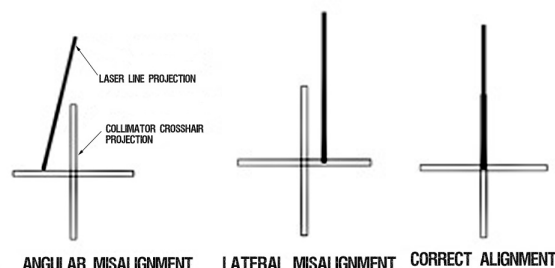


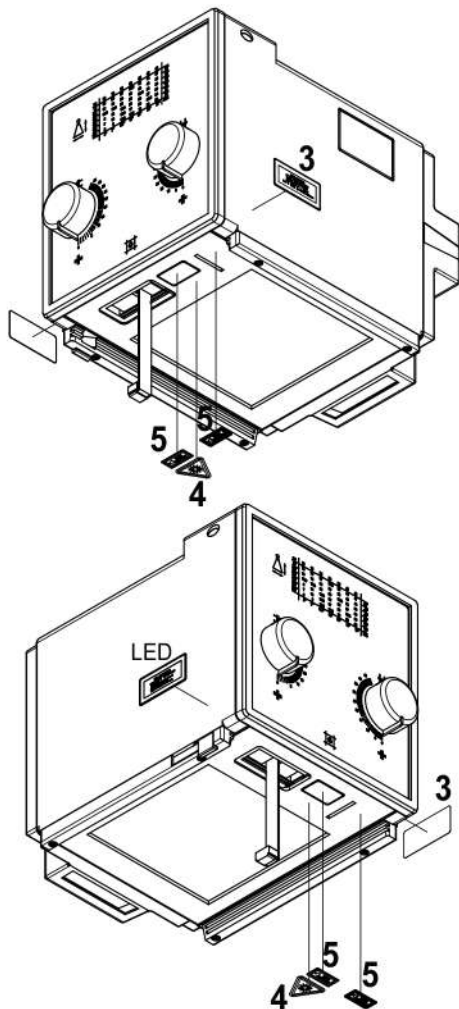
Fig. Laser Alignment

- Shift the laser system by loosening the two **C** screws holding the laser system base to the beam limiting device front plate.
 - Move the base until the laser beam falls over the perpendicular bisector line on the anti-dust panel, see **Fig. Laser Adjustment**.
 - Tighten the screws **C**.

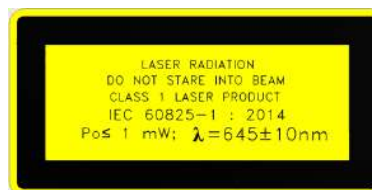
Substitution

- Disconnect supply.
- Remove the cover, see Chapter- **COVER REMOVAL**.
- Unscrew the fixing Allen screws **A**, see **Fig. Laser Adjustment**.
- Disconnect the timer cables from the terminal board - white 0 V, red 5 V.
- Remove the laser and substitute with an identical item.
- Tighten the screws.
- Check the laser alignment, see Chapter- **ADJUSTMENTS**.
- Remount the cover, see Chapter- **COVER REMOVAL**.

Classification EN 60825-1 par. 1 -5: Class 1 laser product => Red laser line.



LABEL 3



LABEL 4



LABEL 5



RO 587/2 Two lasers (one mounted externally) forming a crosshair to center the patient to the collimator: Class 1

Second laser which serves to center the patient using the cross projection.

The collimator lasers are classified as Class 1 (1 m W - wavelength = 645 nm, +/- 10 nm) and are used for collimator/ image receptor center alignment.



CAUTION: CLASS 1 LASER SYSTEM DO NOT STARE INTO THE BEAM.

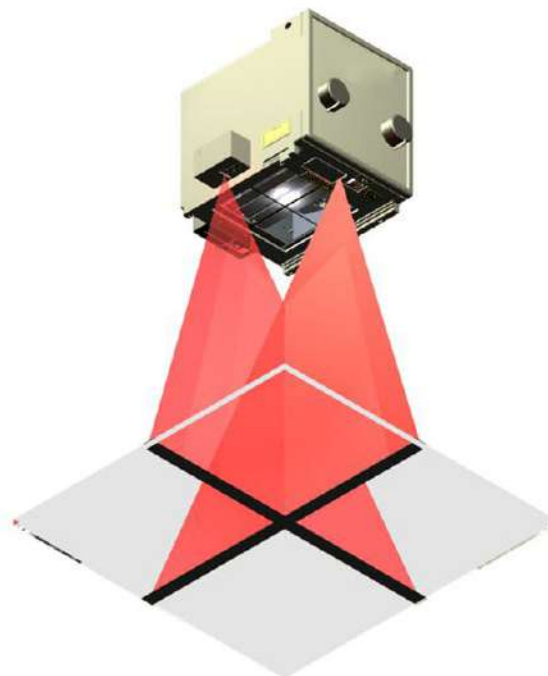


Fig. Laser Line

CALIBRATION CONTROL

- Draw a cross (two lines at 90°) on a sheet of paper and use this as reference.
- Switch the light ON and set the sheet of paper at 1 m from the focus.
- Make sure the cross on the paper coincides exactly with the two lines silk-screened on the plastic window.
- Examine the laser projections on the paper: the laser is correctly calibrated when the projections coincide with the lines drawn on the paper, otherwise an adjustment will be necessary.

ADJUSTMENT

Horizontal

- Disconnect the collimator supply.
- Remove the laser cover located on the collimator cover by unscrewing the two screws **A**, see **Fig. Horizontal Laser**.
- To correct horizontal misalignment, loosen the screws **B**, see **Fig. Horizontal Laser** and move the laser support until the projected laser line coincides with the cross on the sheet of paper. Tighten screws **B**.

Vertical

- Disconnect power supply.
- Remove the knobs and front panel, see Chapter- **COVER REMOVAL**.
- To correct vertical misalignment, loosen the Allen screw **A**, see **Fig. Vertical Laser** on the laser support; rotate the laser and align the laser line over the cross on the sheet of paper.
- To move laterally the laser loosen the screws **B** and shift the laser support until the projected laser line coincides with the cross on the sheet of paper.
- Tighten **B** screw s.

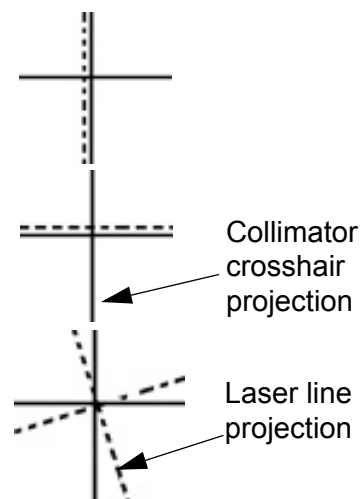


Fig. Laser Projections

WARNINGS



DO NOT APPLY EXCESSIVE FORCE TO THE SCREW. THE LASER SHELL IS IN PLASTIC AND EXCESSIVE PRESSURE COULD CRACK THE PLASTIC AND POSSIBLY SHORT-CIRCUIT THE LASER.

SUBSTITUTION

The Laser Substitution Kit is composed of the following components: the lase (**A**), the extension cable (**B**) and the laser label (**C**) pictured below in **Fig. Laser Substitution Kit**. This Kit is designed to substitute any laser Ralco provides.

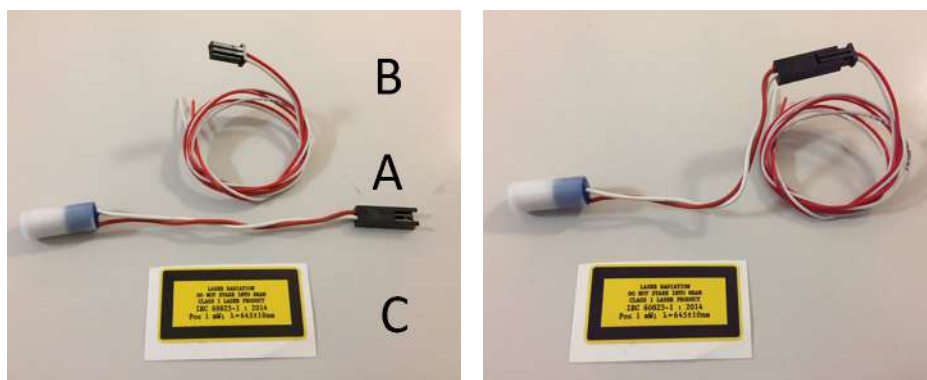


Fig. Laser Substitution Kit

Prior to replacing the laser, confirm which version of laser is installed on your collimator which will ensure the substitution is performed correctly.

- The previous laser version is connected to the board via 2 cables (red and white), see **Fig. Previous Laser Version** below.

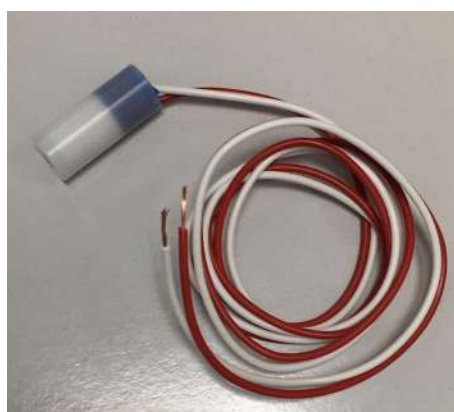


Fig. Previous Laser Version

- The new laser is connected to the board via the connector, see **Fig. New Laser Version** below.



Fig. New Laser Version

Replacing the Previous Laser Version

To replace the previous version of laser, all components of the Laser Substitution Kit (RS 2589) (A, B and C) must be used.

To substitute the laser, proceed as follows:

- Disconnect the collimator supply.
- Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
- Prior to disconnecting the laser cables from the board, identify the cables and their position on the terminal board, see Chapter **INSTALLATION**, paragraph **Wiring Diagram** in the Instruction Manual for your specific model.
- Carefully remove the laser, the extension cable and the label from their packaging.
- Ensure the extension cable (**B**) is firmly connected to the laser (**A**), see **Fig. Laser Substitution Kit** above.
- Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
- Adjust the length of the extension (**B**) cable by cutting the 2 cables (red/white).
- Connect both cables to the board.
- Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
- Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEMS** in the Instruction Manual for your specific model.

Replacing the New Laser Version

To replace the new laser version, only part **A** and **C** of the Kit must be used.

To substitute the laser, proceed as follows:

- Disconnect the collimator supply.
- Remove the cover, see Chapter **COVER REMOVAL** in the Instruction Manual for your specific model.
- Detach the connector of the faulty laser from the collimator wiring.
- Carefully remove the laser, the extension cable and the label from their packaging.
- Substitute the laser with the identical item using component (**A**) of the Laser Substitution Kit, see **Fig. Laser Substitution Kit** above.
- Connect the new laser to the collimator wiring.
- Apply the new laser label (**C**) to the collimator cover, see Chapter **SPARE PARTS** in the Instruction Manual for your specific mode.
- Verify the Laser alignment, see Chapter **ADJUSTMENT** or **OPTIONAL ITEM** in the Instruction Manual for your specific model.

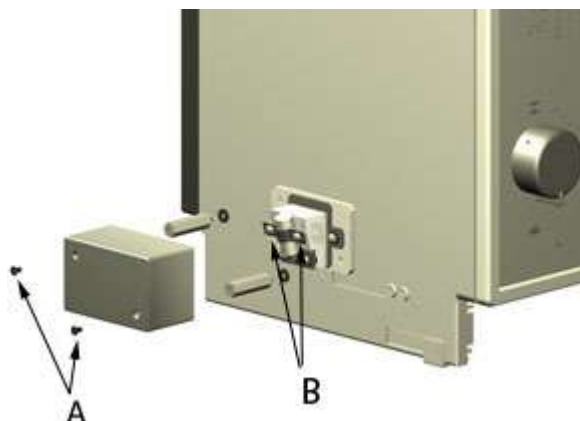


Fig. Horizontal Laser

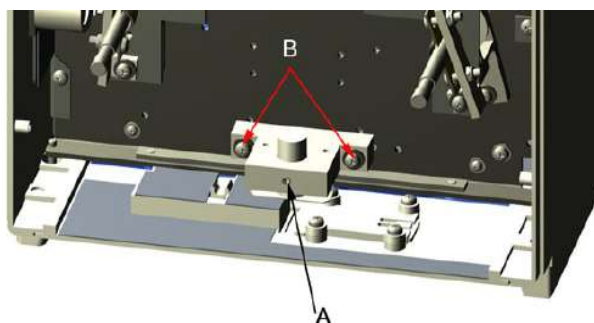
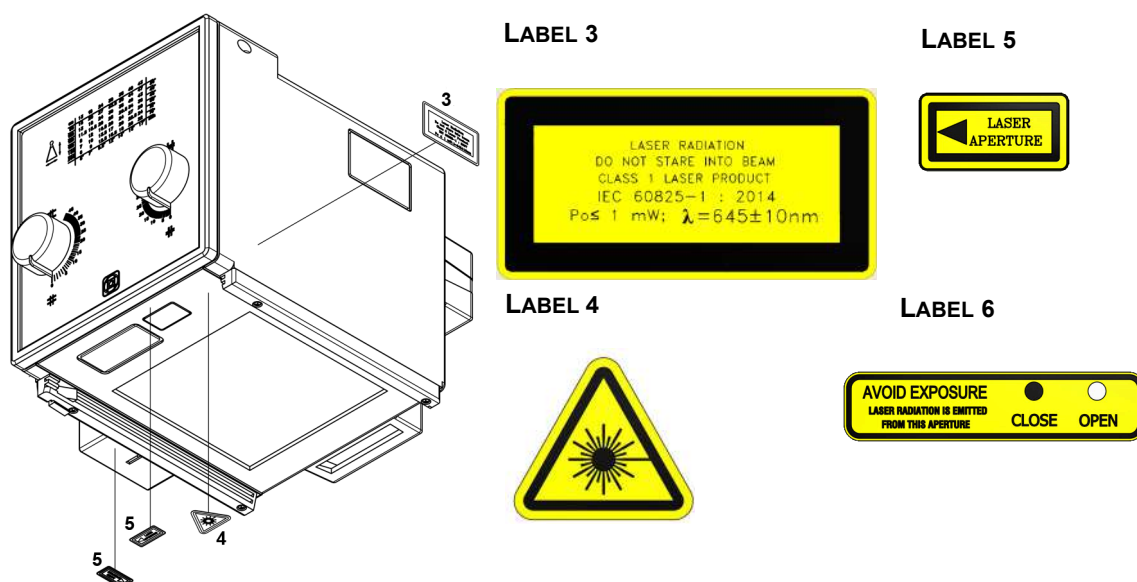


Fig. Vertical Laser

Classification EN 60825-1 par. 1 -5: Class 1 laser product => Red laser line.



RO 602 Substitution of LED light field with 24V 100 W halogen lamp

The light field is provided by 24V 100W halogen lamp with timer board GC338.
It is adjusted vertically, longitudinally and laterally.

NOTE



THIS OPTIONAL ITEM IS NOT AVAILABLE FOR POST-SALES COLLIMATORS.

Light Field Calibration

Longitudinal Calibration (LONG)

WARNINGS



DO NOT TOUCH THE DISSIPATER WITH YOUR HANDS; IT COULD BE HOT AND CAUSE SEVERE BURNS.

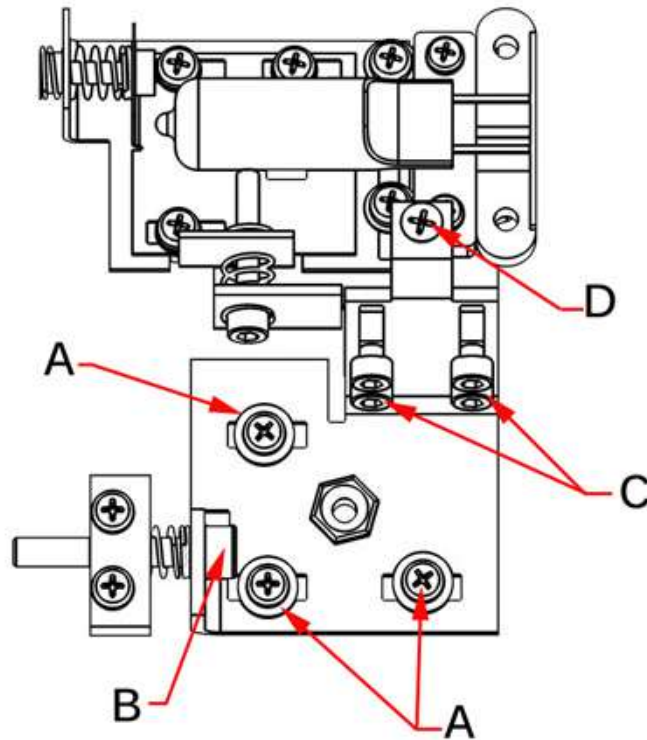
- Remove the part of the cover necessary to access the screws, see Chapter - **COVER REMOVAL**
- Remove the light source protection heatsink by unscrewing the fixing screws . This allows you to access the light source.
- If the light-field needs to be moved laterally, loosen (not remove) the fixing screws **A**.
- Adjust through screw **B**.
- When calibration is terminated, lock the screws **A**.

See the following ***Fig. Light Field Adjustment***

Vertical Alignment

- Remove the part of the cover necessary to access the screws, see Chapter - **COVER REMOVAL**.
- If adjustment is required loosen the two screws **C** holding the light support.
- If the light-field is smaller than the X-ray field, move away the light source by adjusting screw **D**.
- If the light-field is bigger than the X-ray field, move the light source closer by adjusting screws **D**.
- Tighten the two screws **C**. See ***Fig. Light Field Adjustment***

Fig. Light Field Adjustment

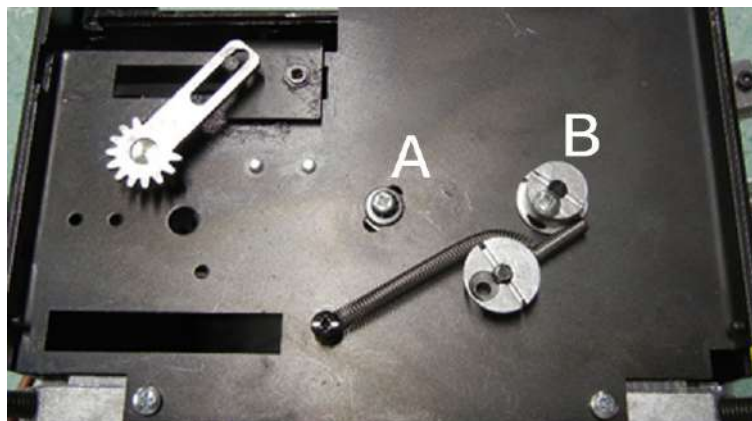


Transversal Calibration (CROSS)

If the light-field needs calibration, the mirror needs to be adjusted as follows:

- Remove the part of the cover necessary to access the screws, see Chapter - **COVER REMOVAL**.
- Loosen the mirror fixing screw **A** (not remove) and rotate the cam **B** to adjust the position of the mirror, see **Fig. Transversal Calibration (CROSS)**.
- Once you have regulated the mirror tighten the screw **A** and remount the cover, see Chapter - **COVER REMOVAL**.

Fig. Transversal Calibration (CROSS)



Substitution of the Halogen Lamp

WARNINGS



DO NOT TOUCH THE DISSIPATER WITH YOUR HANDS; IT COULD BE HOT AND CAUSE SEVERE BURNS.



DO NOT TOUCH THE LAMP, THE SOCKET, OR THE LAMP BRACKET WITH YOUR FINGER. THEY CAN BE VERY HOT AND CAUSE SEVERE BURNS.



DO NOT TOUCH THE LAMP WITH YOUR FINGERS, EVEN WHEN IT IS COLD. OIL FROM YOUR SKIN WILL CAUSE THE LAMP TO CRACK AND POSSIBLY EXPLODE. IF YOU HAVE TOUCHED THE LAMP, WIPE THE SURFACE WITH ALCOHOL, THEN HANDLE THE LAMP WITH A PIECE OF PAPER.

- Disconnect power supply.
- Remove the part of the cover and/or the knobs to access the component, see Chapter- **COVER REMOVAL**.
- Remove the lamp protection heat sink.
- Carefully remove the faulty lamp.
- Substitute the lamp with an identical lamp.
- Make sure that the lamp pins are completely inserted in the lamp-holder.
- Verify the Light field/X-ray field correspondence.
- If necessary remove the lamp, rotate it 180° axially and reinsert.

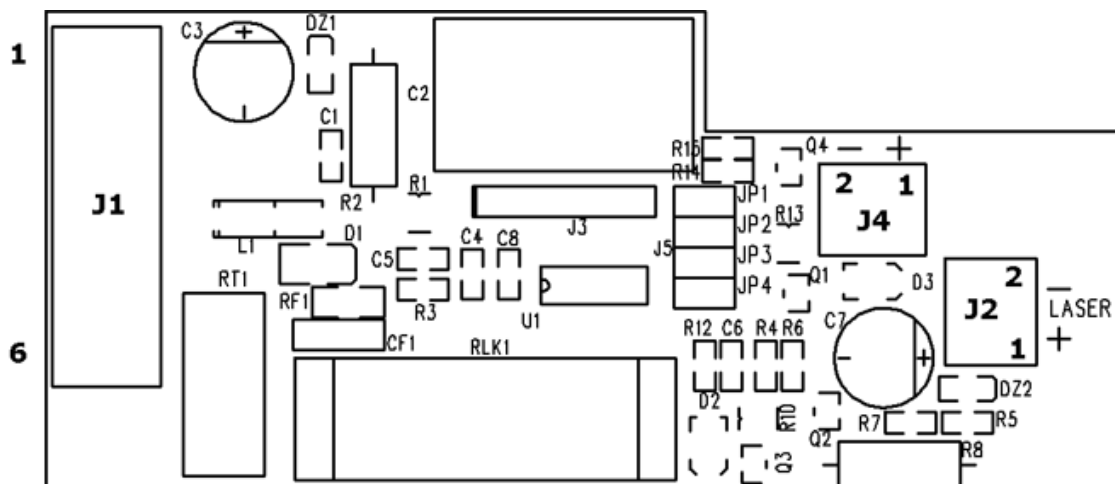
Substitution of the Electronic Timer

- Disconnect power supply.
- Remove part of the cover to access the component.
- Remove the two screws holding the electronic timer, see **Fig. Timer GC 338**.
- Identify the cables and their position on the terminal board.
- Disconnect the cables from the terminal board.
- Install the new timer by proceeding in a reverse order; pay particular attention to the connection of the cables on the 4 or 6-way electric terminal depending in the model.



Fig. Timer GC 338

Timer Board GC338



GC 338 Timer Connectors

J1 POWER SUPPLY AND OUTPUTS	16.Lamp output (max 9 A) 17.Push button input 18.Power Supply +12/24 V DC o 12-24 V AC/V DC A 19.Shared Lamp 20.Power Supply –12/24 V DC o 12-24 V AC/V DC B 21.Shared push button										
J2 LASER POWER SUPPLY 5VDC	1. +Laser Power Supply (5 V) 2. GND Laser										
J3 PROGRAMING CONNECTOR	1. V pp 2. +5 V 3. GND 4. PGD 5. PGC 6. NC										
J4 – FAN POWER SUPPLY 12V DC	1. +Fan Power Supply (max 200 mA) 2. – Fan Power Supply										
JUMPERS	OFF - no jumper ON - jumper										
JP1, JP2 – LAMP TIME SELECTION	<table border="1"> <thead> <tr> <th data-bbox="630 1659 997 1704">JP1</th><th data-bbox="997 1659 1396 1704">JP2</th></tr> </thead> <tbody> <tr> <td data-bbox="630 1704 997 1749">OFF - 30 s</td><td data-bbox="997 1704 1396 1749">OFF - 30 s</td></tr> <tr> <td data-bbox="630 1749 997 1794">ON - 45 s</td><td data-bbox="997 1749 1396 1794">OFF - 45 s</td></tr> <tr> <td data-bbox="630 1794 997 1839">OFF - 60 s</td><td data-bbox="997 1794 1396 1839">ON - 60 s</td></tr> <tr> <td data-bbox="630 1839 997 1856">ON - 120 s</td><td data-bbox="997 1839 1396 1856">ON - 120 s</td></tr> </tbody> </table>	JP1	JP2	OFF - 30 s	OFF - 30 s	ON - 45 s	OFF - 45 s	OFF - 60 s	ON - 60 s	ON - 120 s	ON - 120 s
JP1	JP2										
OFF - 30 s	OFF - 30 s										
ON - 45 s	OFF - 45 s										
OFF - 60 s	ON - 60 s										
ON - 120 s	ON - 120 s										

JP3, JP4 – OPERATION MODE SELECTION	JP3	JP4
	OFF - Timer ON - Timer reset by pressing the button OFF - Power Supply ON - Fan ON for 90 seconds longer than the lamp	OFF - Timer OFF - Timer reset by pressing the button ON - Power Supply ON - Fan ON for 90 seconds longer than the lamp