Installation guide 873 SmartRadar Antennas

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Preface

This installation guide is intended for technicians involved in the mechanical and electrical installation of the Enraf Series 873 SmartRadar. It describes the antenna installation and shall be read together with the installation guide 873 SmartRadar Control Unit & Antenna Unit.

For commissioning and service of the 873 SmartRadar please refer to the Instruction Manual of the 873 SmartRadar as well as to the Instruction Manuals of the implemented extra functions. Refer also to the list of related publications in Appendix D.

The following antenna types are included in this installation guide:

- 8" Free space planar antenna (chapter 5)
- 6" Free space (hinged) WALP antenna (chapter 6)
- D04 free space RoD antenna (chapter 7)
- 6" to 12" Stilling well planar antennas (chapter 8)
- 4" High pressure horn antenna (chapter 9)
- 2" High pressure planar antenna (chapter 10)

Legal aspects

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- Deviation from any of the prescribed procedures;
- Execution of activities that are not prescribed;
- Neglect of the general safety precautions for handling tools and use of electricity.

EC declaration of conformity

This instrument is in conformity with the protection requirements of EC Council Directive 89/336/EEC. The CE conformity marking fulfills the provisions of

EN 50081-2 Generic Emission Standard
EN 50082-2 Generic Immunity Standard

when installed, maintained and applied according to requirements as specified in this installation guide.

Additional information

Please do not hesitate to contact Enraf or its representative if you require additional information.

Table of contents

1 Introduction

The Enraf 873 SmartRadar is a radar based level gauge for liquid storage tanks.
Level alarms and diagnostic information are incorporated.

The design of the SmartRadar is modular and consists of the following two parts:

- Control Unit
- Antenna Unit

To the antenna unit are connected the tank separator and antenna. Different types of antennas are available for different applications. Free space measurement:

- 8" Planar antenna
- 6" (hinged) WALP antenna
- D04 RoD antenna

Stilling well measurement:

- 6", 8", 10" or 12" Stilling well planar antennas
- 4" High pressure horn antenna
- 2" High pressure planar antenna

The installation of all these antenna types is described in this installation guide.

2 Safety

Refer to the chapter Safety in the installation guide: “873 SmartRadar Control Unit & Antenna Unit”.

3 Storage and unpacking

3.1 Storage

During storage, the SmartRadar antenna shall be kept in its original packing and stored indoors.

3.2 Unpacking

The SmartRadar antenna and tank separator are packed in a shipping carton for protection against damage. Should you find any damage, immediately notify the carrier.
If any of the equipment is missing, or incorrect, notify the Enraf distributer.
Don't through away the packing, it will be of use when further transport on site is needed.

Inventory checklist:

- Antenna
- Tank separator (only when a complete unit is ordered)
- Installation guide 873 SmartRadar Antennas (this installation guide)
- Coding sheet 873 SmartRadar

The tank separator and antenna have been calibrated in the factory as one part and must be kept as one assemble. The calibration data is stored in a SEEPROM in the antenna Unit. Therefore, the Antenna Unit should be kept together with the antenna / tank separator assembly.

4 Adapter plate

An adapter plate has to be prepared for installation of the tank separator for the atmospheric and medium pressure antennas (free space F08, T06, W06, RoD and stilling well S06 - S12).
Any adapter plate of 10 to 30 mm ($^{3}/_{8}$ to $1^{3}/_{16}$") can be used or, alternatively, the counter flange can be prepared.

The steel adapter plate has to be provided with the hole pattern of the roof nozzle flange.
The tank separator requires two holes

one hole with a diameter of 57^{+1} mm ($2^{1}/_{4}{}^{\pm 1/16}$ ") for the M55 threaded tank separator one blind hole of 6 mm ($^{1}/_{4}$") diameter and minimum 7 mm ($^{9}/_{32}$") depth for the locking pin of the tank separator.
Make sure the obliquity of the plate is within 2 degrees.
For mechanical details of the adapter plate, refer to Appendix A.

To comply with the safety approvals, the adapter plate has to be finished to 20 µm over a diameter of 100 mm (4") at the underside of the adapter plate around the tank separator hole. However, for adequate sealing in pressurized applications, it is required to finish the surface at the to 1.6 µm.

5 Installation 8" free space planar antenna

This section explains the mechanical installation of the 8" planar antenna.
The 8" planar antenna can be installed on a 8" (or larger) roof nozzle or on a manhole.
Refer to chapter 4 for information about the adapter plate.

Positioning of the antenna

The antenna can be positioned at any place on the tank roof.
In general it is advised that, for best performance, the antenna is located at a minimum distance of 0.1 x tank height from the tank shell and to choose a position such that the radar beam is free from large reflecting obstacles.

5.1 Field orientation of the 8" planar antenna

For best performance, it is advised to install the planar antenna with the magnetic field (H-field) directed towards the tank shell as indicated in figure 5.1. This determines the position of the locking pin hole.

All locking pins are in the centre line of the H-field. With the H-field in the correct direction, the locking pins are closest to the tank shell.

The antenna unit + antenna assembly is locked against rotation by means of locking pins.

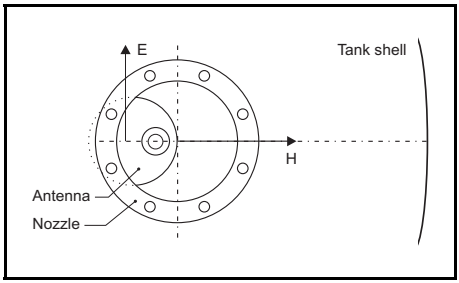


Figure 5.1 Field orientation 8" planar antenna

5.2 Manhole cover preparation

For easy instrument installation it is advised to make an 8" nozzle on the manhole cover.

It should be as low as possible to minimize the antenna stem length. This nozzle could be constructed from an 8", 150 lbs welding neck flange. Refer to figure 5.2.

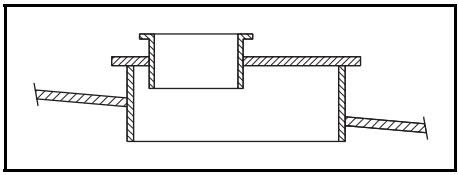


Figure 5.2 Manhole nozzle for SmartRadar

5.3 Installing the tank separator

Refer to figure 5.3.

1) Check if the O-ring (1) on the tank separator is in place.

2) Insert the tank separator (2) from underneath the adapter plate. Mind the locking pin.

3) Place M55 inside star washer (3) over the tank separator.

4) Tighten the tank separator nut (4).

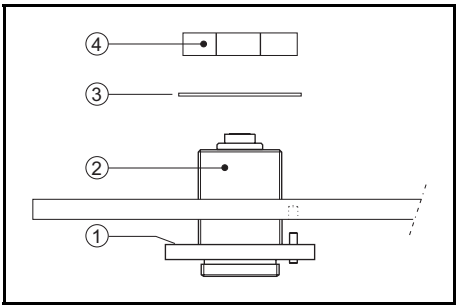


Figure 5.3 Installing the tank separator

5.4 Installing the 8" planar antenna

Refer to figure 5.4.

1) Place and hold antenna lock washer (1).

2) Place the antenna stem (2) into the tank separator (3); align the pin, and tighten the antenna stem nut (4) manually.

3) Bend the antenna lock washer (1) at one side of the antenna stem nut to lock the antenna stem nut.

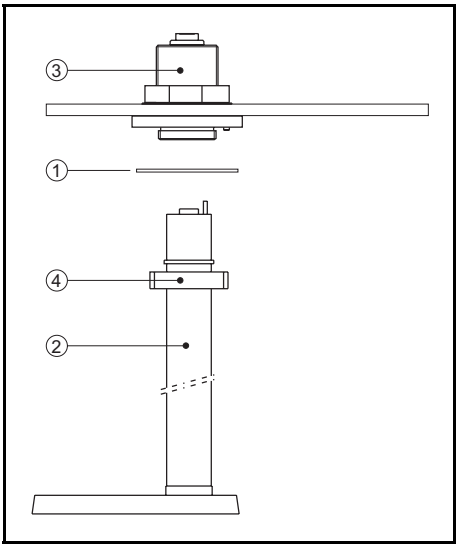


Figure 5.4 Installing the 8" Planar Antenna

5.5 Installing antenna with adapter plate on the nozzle

Refer to figure 5.5.

Place the assembly 8" planar antenna / adapter plate on the roof nozzle.

Place the adapter plate in such a direction, that:

1) the tank separator (1) is located as far as possible from the tank shell;

2) the position of the locking hole (2) on top of the tank separator is directed towards the tank shell.

3) Fix the adapter plate.
The position of the antenna and Antenna Unit is indicated by line (3) in figure 5.5.

Warning

To ensure a good grounding between the adapter plate and the flange, a copper strip must be placed under one of the flange bolts. A shark ring should be placed between flange and strip (see figure 5.6).

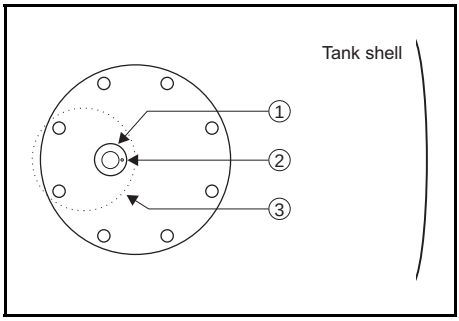


Figure 5.5 Position of antenna assembly on the roof (manhole) nozzle

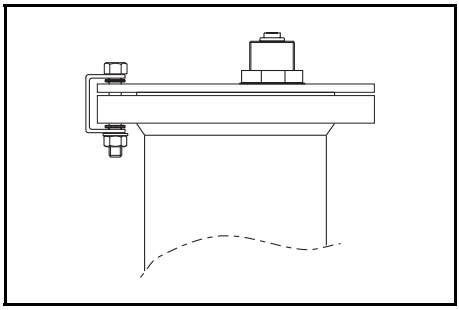


Figure 5.6 Example of flange ground connection

6 Installation free space 6" (hinged) WALP antenna

This section explains the mechanical installation of the 6" WALP and hinged WALP antenna.
Refer to chapter 4 for information about the adapter plate.

The T06 (hinged WALP) antenna will fit through nozzles of 6" and larger.
The W06 (WALP) antenna can be installed on 10" (or larger) roof nozzle with restrictions on the nozzle length (refer to figure 6.1 and table below), or on a manhole.

Nozzle size (D)	Max. nozzle length (L)
10"	200 mm (8")
12"	350 mm (1' 2")
14" or larger	800 mm (2' 7½")

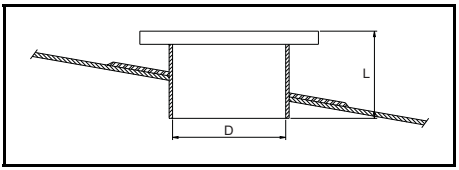


Figure 6.1 Nozzle height for W06 antenna

Positioning of the antenna

The antenna can be positioned at any place on the tank roof.
In general it is advised that, for best performance, the antenna is located at a minimum distance of 0.06 x tank height from the tank shell and to choose a position such that the radar beam is free from large reflecting obstacles.
As an alternative, the antenna can be installed *very* close to the tank shell. Distance antenna side to tank shell shall not be more than 5 cm (2"). Refer to figure 6.2.

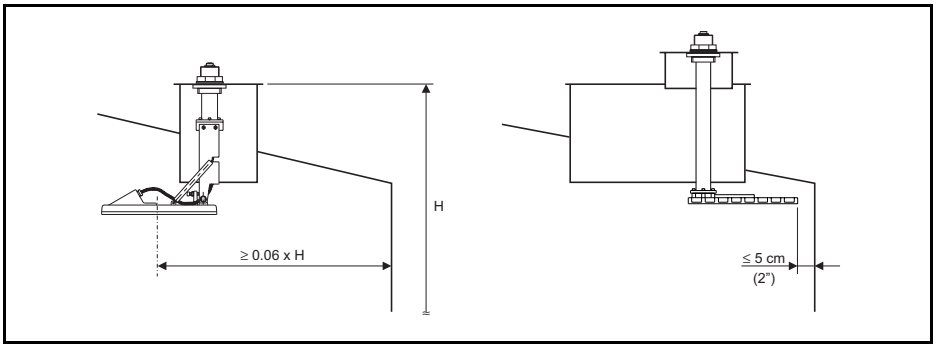


Figure 6.2 Distance to tank shell

Note:

Obstacles at the inner side of the tank shell, such as piping or welding seams, influences the radar measurement when the (hinged) WALP antenna is positioned towards the tank shell.

6.1 Field orientation of the 6" (hinged) WALP Antenna

For best performance, it is advised to install the planar antenna with the electric field (E-field) directed towards the tank shell as indicated in figure 6.3.

The antenna unit + antenna assembly is locked against rotation by means of locking pins.

All locking pins are in the centre line of the E-field.

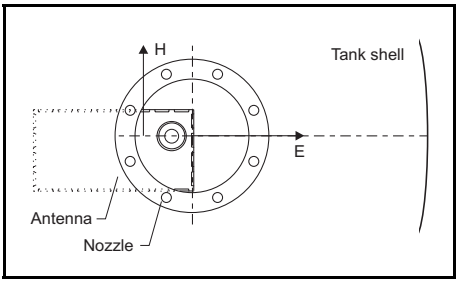


Figure 6.3 Field orientation of 6" WALP antenna

6.2 Manhole cover preparation

For easy instrument installation of the T06 antenna (hinged WALP), it is advised to make a short 6" nozzle on the manhole cover.
For the W06 antenna the nozzle size is at least 10". The maximum length of the nozzle equals 200 mm (8"). However, it should be as low as possible to minimize the antenna stem length.

This nozzle can be constructed from a welding neck flange. Refer to figure 6.4.

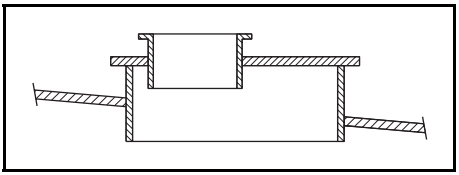


Figure 6.4 Manhole nozzle for SmartRadar

6.3 Installing the tank separator

Refer to figure 6.5.

1) Check if the O-ring (1) on the tank separator is in place.

2) Insert the tank separator (2) from underneath the adapter plate. Mind the locking pin.

3) Place M55 inside star washer (3) over the tank separator.

4) Tighten the tank separator nut (4).

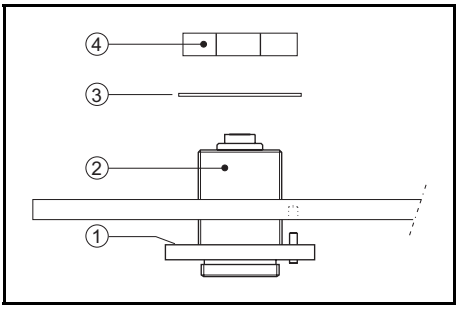


Figure 6.5 Installing the tank separator

6.4 Installing the (hinged) WALP antenna

Refer to figure 6.6.

1) Place and hold antenna lock washer (1).

2) Place the antenna stem (2) into the tank separator (3); align the pin, and tighten the antenna stem nut (4) manually.

3) Bend the antenna lock washer (1) at one side of the antenna stem nut to lock the antenna stem nut.

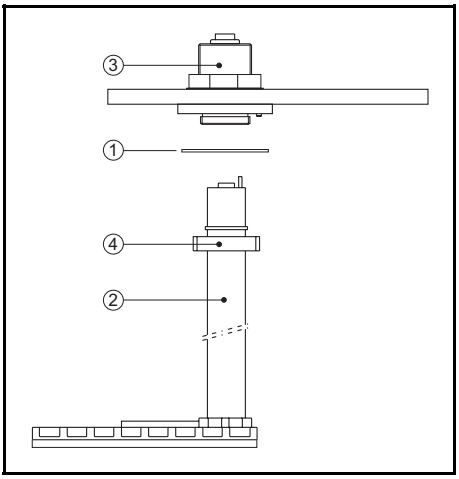


Figure 6.6 Installing the 6" WALP antenna

6.5 Installing antenna with adapter plate on the nozzle

6.5.1 Installing the WALP antenna (W06)

Refer to figure 6.7.

Place the assembly WALP antenna / adapter plate on the roof nozzle.

Place the adapter plate in such a direction, that:

1) the tank separator (1) is located as far as possible from the tank shell;

2) the position of the locking hole (2) on top of the tank separator is directed towards the tank shell.

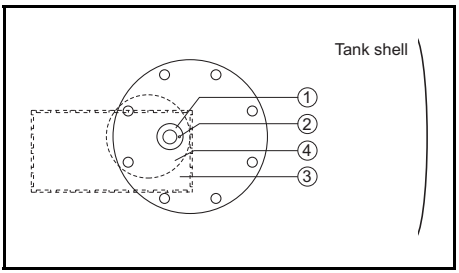


Figure 6.7 Position of antenna assembly on the roof (manhole) nozzle

Note:

In case the WALP antenna is installed as close as possible to the tank shell, the tank separator shall be located close to the tank shell and the locking hole on top of the tank separator is then directed towards the tank centre.

3) Fix the adapter plate.
The position of the antenna is indicated by line (3) in figure 6.7, when installed towards the tank centre.

Warning

To ensure a good grounding between the adapter plate and the flange, a copper strip must be placed under one of the flange bolts. A shark ring should be placed between flange and strip (see figure 6.8).

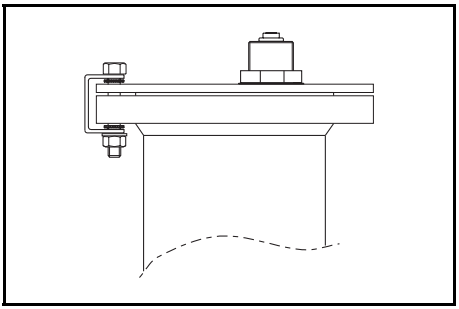


Figure 6.8 Example of flange ground connection

6.5.2 Installing the hinged WALP antenna (T06)

This antenna has the option of rotating the antenna surface 90°, before installing the antenna / adaptor plate assembly into the roof nozzle (refer to figure 6.9).

When lowering the antenna into the roof nozzle and reaching the end of the nozzle, a small firm rotation of the adaptor plate will cause the antenna to rotate back into it's original position.

Before fixing the adaptor plate, check the position of the antenna surface.

Follow the instructions as given in section 6.5.1.

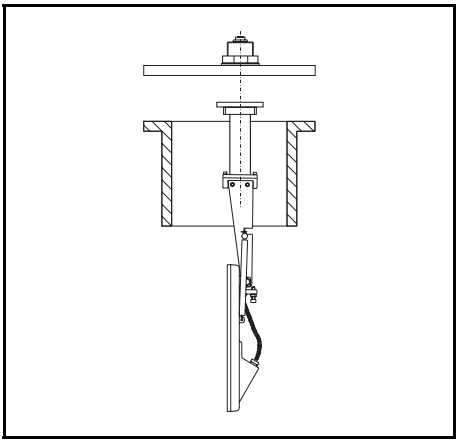


Figure 6.9 Inserting hinged WALP antenna

7 Installation free space RoD antenna

This section explains the mechanical installation of the 873 SmartRadar RoD antenna.
The RoD antenna can be installed on a 4" (100 mm) or larger roof nozzle or on a manhole.

There are two versions of the RoD antenna:

- RoD antenna (D04) with standard tank separator
  This type can be installed on an adapter plate or flange (refer to chapter 4).
- RoD antenna (D02) with 1½" NPT screw connection
  This type can only be installed on a flange.

Position of the antenna

The antenna can be positioned at any place on the tank roof. In general it is advised that, for best performance, the antenna is located at a minimum distance of 0.15 x tank height from the tank shell and to choose a position such that the radar beam is free from large reflecting obstacles.

7.1 Installing the RoD antenna with tank separator (D04)

7.1.1 Manhole cover preparation

For easy instrument installation it is advised to make a 6" nozzle on the manhole cover.

It should be as low as possible.
This nozzle could be constructed from an 6", 150 lbs welding neck flange.

Refer to figure 7.1.

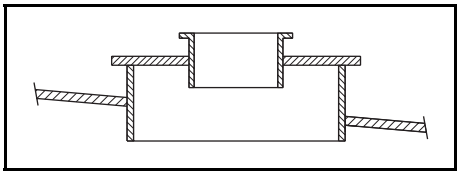


Figure 7.1 Manhole nozzle for SmartRadar

7.1.2 Installing the tank separator

Refer to figure 7.2.

1) Check if the O-ring (1) on the tank separator is in place.

2) Insert the tank separator (2) from underneath the adapter plate. Mind the locking pin. Make sure that the tank separator and the adapter plate are in full contact over the entire surface. Otherwise, lower the locking pin of the tank separator.

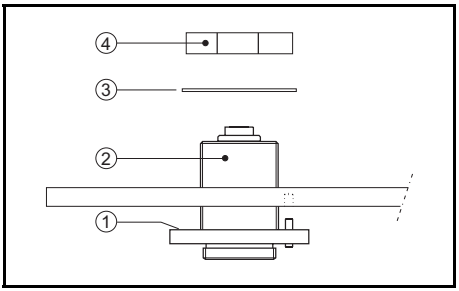


Figure 7.2 Installing the tank separator

3) Place M55 inside star washer (3) over the tank separator.

4) Tighten the tank separator nut (4).

7.1.3 Installing the RoD antenna

Refer to figure 7.3.

1) If the tank separator is equipped with **two** O-rings, remove the first O-ring (1)

2) Slide the carbon PTFE ring (4) over the glass-filled PTFE RoD antenna (3).

3) Insert the RoD antenna (with ring) into the body (5). Mind the position of the body!

4) Place the antenna lock washer (2) over tank separator.
Mind the hole for the locking pin!

5) Insert the total assembly into the tank separator.

6) Secure the RoD antenna assembly onto the tank separator by turning the body lock nut (6).

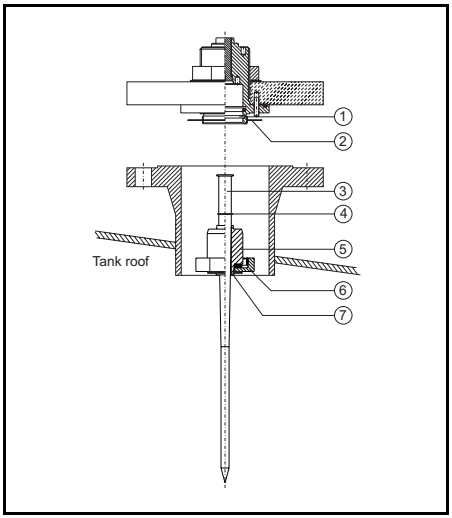


Figure 7.3 Installing the RoD antenna

7) Check if there is any free play in the RoD antenna. If so, press the antenna body (7) completely in the tank separator.

8) Bend the antenna lock washer (1) at one side over the body lock nut to lock the body lock nut.

7.1.4 Install flange with RoD antenna on manhole cover

Place the assembly RoD antenna / flange on the manhole cover.

Place the flange in such a direction, that the hole for the Antenna Unit locking pin (1) is located closest to the tank shell.

Secure the adapter plate.

The position of the Antenna Unit is indicated by line (2) in figure 7.4.

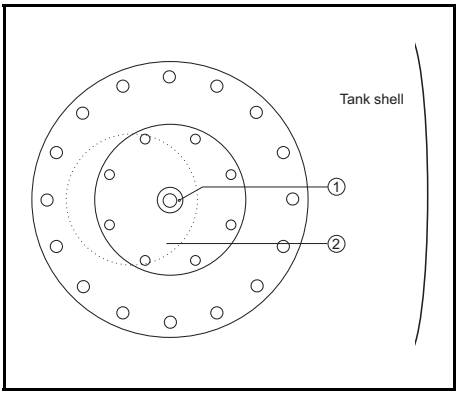


Figure 7.4 Position of antenna assembly on roof (manhole) nozzle

7.1.5 Grounding

Warning
To ensure a good grounding between the adapter plate and the flange, a copper strip must be placed under one of the flange bolts. A shark ring (1) should be placed between flange and strip (see figure 7.5).

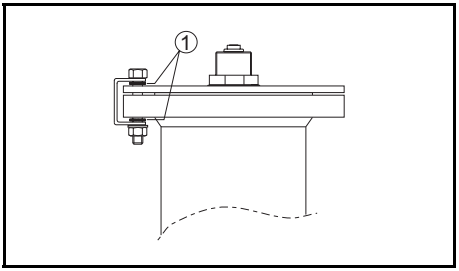


Figure 7.5 Example of flange ground connection

7.2 Installing the RoD attenna with screw connection on manhole cover (D02)

7.2.1 Manhole cover preparation

For easy instrument installation it is advised to weld a socket with 1½" NPT screw thread onto the manhole cover.

In the centre of the manhole cover, a hole should be made, largre enough to fit the socket.
Refer to figure 7.6.

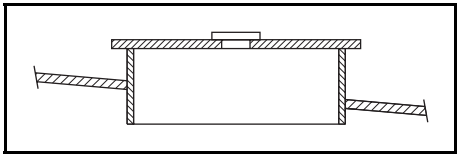


Figure 7.6 Manhole nozzle for SmartRadar

Refer to appendix B for an example of the socket which can be ordered from Enraf.

7.2.2 Screw RoD antenna in socket

1) Put some PTFE-tape or pipe-sealant around the screw-thread of the RoD antenna.

2) Insert and screw the antenna into the socket (1).

3) Lock the antenna with the locking nut (2). Refer to figure 7.7.

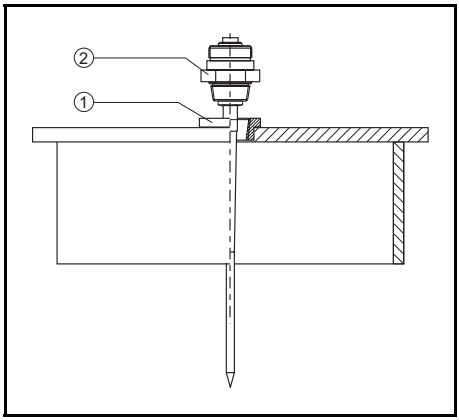


Figure 7.7 Installing the RoD antenna

7.2.3 Install the manhole cover

1) Position the manhole cover such that the locking pin hole of the RoD antenna is directed towards the tank shell.

2) Secure the manhole cover.

3) The position of the Antenna Unit is indicated by line 2 in figure 7.8.

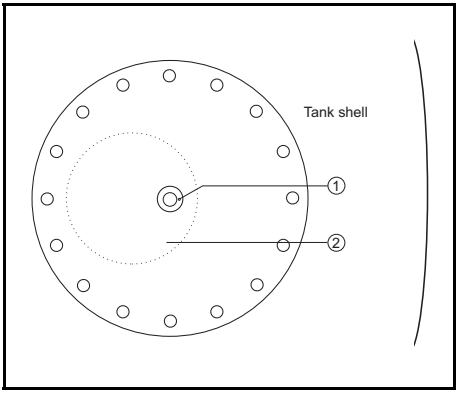


Figure 7.8 Position of antenna on manhole cover

7.2.4 Grounding

Warning

To ensure a good grounding between the manhole cover and the tank, a copper strip must be placed under one of the flange bolts. A shark ring (1) should be placed between flange and strip (see figure 7.9).

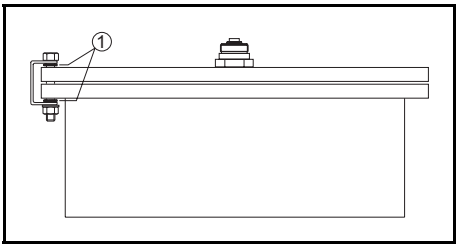


Figure 7.9 Example of manhole ground connection

7.3 Install the RoD antenna with screw connection on nozzle flange (D02)

7.3.1 Flange preparation

The flange requires a hole with screw thread of 1½" NPT. The hole should be positioned in the centre of the flange. Refer to Appendix B.

Make sure the obliquity of the flange is within 2 degrees. Refer to figures 7.10 and Appendix B
The thickness of the flange should be such, that the safety requirements of this antenna are met.

7.3.2 Screw the RoD antenna in the flange

Refer to figure 7.10

1) Put some PTFE-tape or pipe-sealant around the screw-thread of the RoD antenna.

2) Insert and screw the antenna into the flange from the top part (1).

3) Lock the antenna with the locking nut (2).

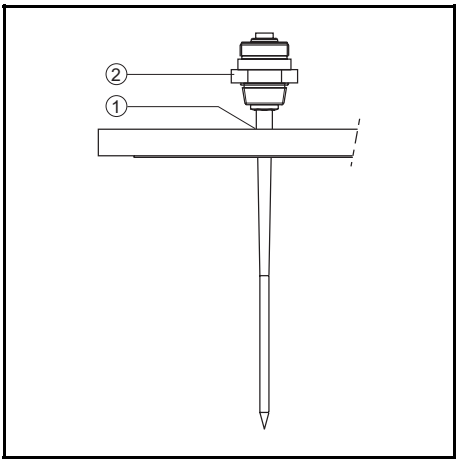


Figure 7.10 Installing the RoD antenna

7.3.3 Install flange with RoD antenna on nozzle

Place the assembly RoD antenna / flange on the roof nozzle.

Place the flange in such a direction, that the hole for the Antenna Unit locking pin (1) is located closest to the tank shell.

Secure the adapter plate.

The position of the Antenna Unit is indicated by line (2) in figure 7.11.

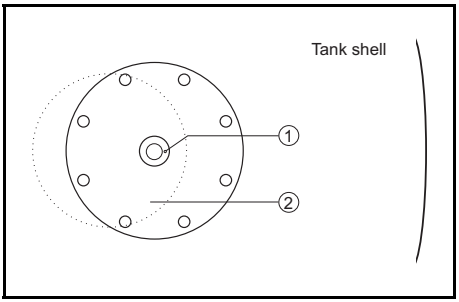


Figure 7.11 Position of antenna assembly on the roof (manhole) nozzle

7.3.4 Grounding

Warning
To ensure a good grounding between the flange and the tank, a copper strip must be placed under one of the flange bolts.
A shark ring (1) should be placed between flange and strip (see figure 7.7).

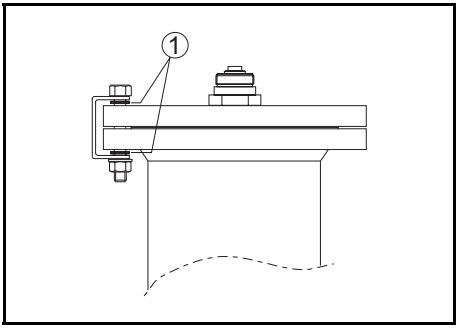


Figure 7.12 Example of flange ground connection

8 Installation 6" to 12" stilling well planar antennas

This section explains the mechanical installation of the planar antenna on a stilling well.
Refer to chapter 4 for information about the adapter plate.

The stilling well should have *at least* one row of equalisation holes with a pitch of 500 mm (20").

The diameter of the holes: 15 mm (½") for a 6" stilling well
20 mm (¾") for 8" and 10" stilling well
25 mm (1") for a 12" stilling well

The inner side of the stilling well should be free from burrs at the position of the equalisation holes. For high accuracy applications, the stilling well should be straight and consistent in diameter without welding seams at the inside, and the obliquity of the pipe should be within 0.5 degrees.

Standard the stilling well antenna will be installed directly under the adapter plate. An antenna with a 50 mm (2") stem is used. This method is suitable for ambient and atmospheric applications and hinged constructions. The latter allows easy access for manual dipping. For more information about the hinged construction, please consult factory.
For fixed roof tanks containing heated products, the planar antenna can be lowered into the heated tank area to prevent condensation. In this case the planar antenna is provided with a longer stem.

Figure 8.1 gives both the installation possibilities.

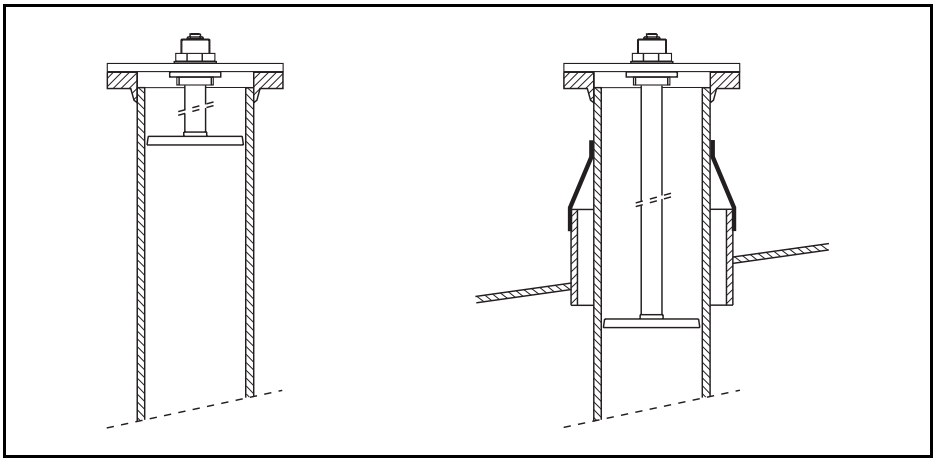


Figure 8.1 Installation example of a stilling well antenna on floating roof and fixed roof tank with heated product

8.1 Installing the tank separator

Refer to figure 8.2.

1) Check if the O-ring (1) on the tank separator is in place.

2) Insert the tank separator (2) from underneath the adapter plate. Mind the locking pin.

3) Place M55 inside star washer (3) over the tank separator.

4) Tighten the tank separator nut (4).

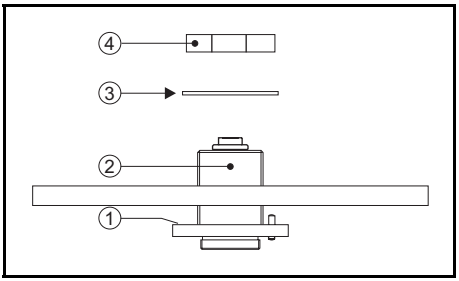


Figure 8.2 Installing the tank separator

8.2 Installing the antenna

Refer to figure 8.3.

1) Place and hold antenna lock washer (1).

2) Place the antenna stem (2) into the tank separator (3); mind the pin (4), and tighten the antenna stem nut (5) manually.

3) Bend the antenna lock washer (1) at one side of the antenna stem nut to lock the antenna stem nut.

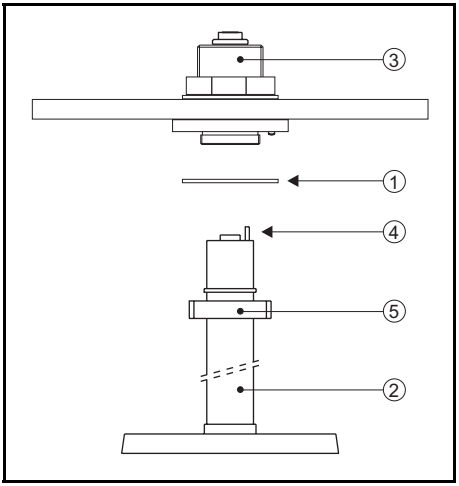


Figure 8.3 Installing the antenna

8.3 Installing antenna with adapter plate on the stilling well

Refer to figure 8.4.

Place the assembly antenna / adapter plate on the stilling well's counter flange.

The position of the hole for the locking pin on the tank separator (1) determines the position of the Antenna Unit (2).

Fix the adapter plate.

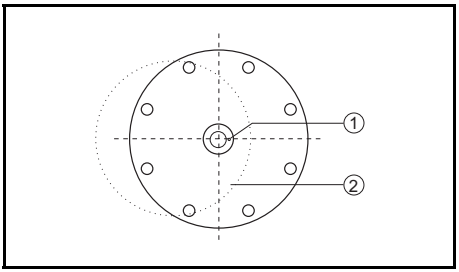


Figure 8.4 Position of 8" antenna assembly on Stilling well

Warning

To ensure a good grounding between the adapter plate and the flange, a copper strip must be placed under one of the flange bolts. A shark ring (1) should be placed between flange and strip (see figure 8.5).

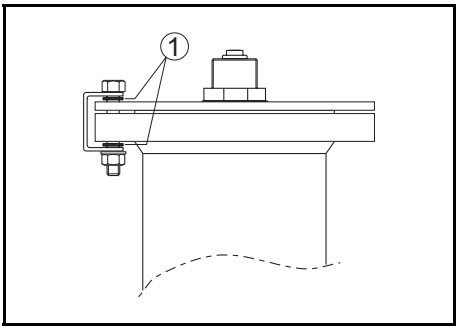


Figure 8.5 Example of flange ground

9 Installation 4" high pressure horn antenna

This section explains the mechanical installation of the 4" High Pressure Horn Antenna on a stilling well.

The stilling well(s) should have *at least* one row of equalisation holes with a diameter of 5 - 10 mm ($^3/_{16}$ - $^3/_8$") at a pitch of 500 mm (20"). Local regulations may require a different pitch and/or size of the equalisation holes. In this case consult Enraf or the local representative.
The inner side of the stilling well should be smooth and free from burrs.
As can be seen in figure 9.1, the position of the equalisation holes in the pipe should be clearly marked on the stilling well flange. When using verification pins, they should also be in line with the mark on the flange.

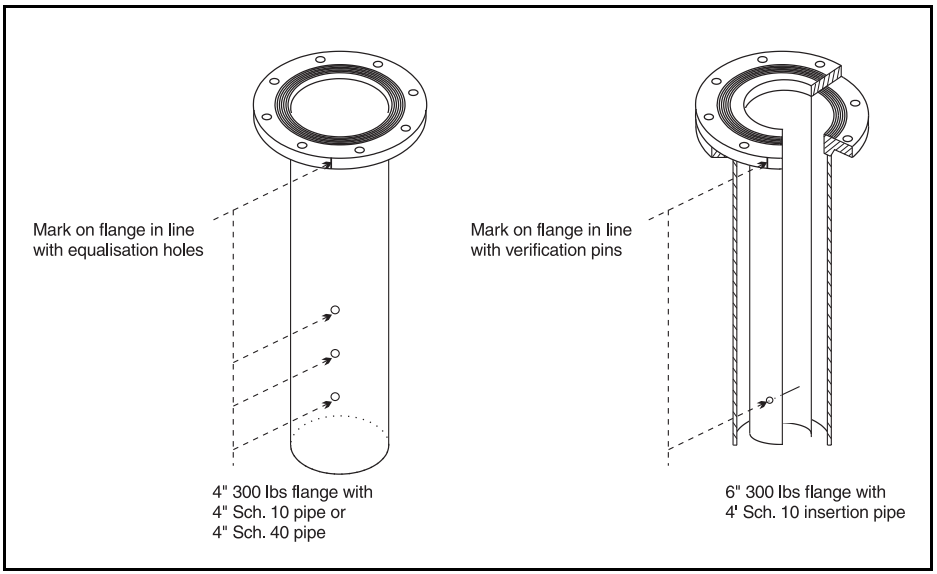


Figure 9.1 Holes and verification pins in line with the mark on the flange

There are three possible installation configurations:

- on a 4" ball valve, type H04/B4 (refer to section 9.1)
- in a 4" SCH40 stilling well, type H04/N4 (refer to section 9.2)
- in a 4" SCH10s insert pipe, type H04/N1 (refer to section 9.3)

9.1 Installation on 4" ball valve (type H04/B4)

Figure 9.2 gives the dimensions for a SmartRadar installation above a 4" ball valve.

Item	Description
1	4" SCH40 stilling well with welding neck flange (300 lbs)
2	4" full bore ball valve (300 lbs)
3	spool piece
4	tank separator
5	Antenna Unit

Note:

The 4" full bore ball valve should be well aligned on the welding neck flange. Bad alignment of the internal diameters will cause false reflections and hence result in level inaccuracies. Also the spool piece should be well aligned, as the cone will lower into the ball valve housing.

Note:

The spool piece should be provided with a plug for a vent facility (by means of a small valve) and/or pressure gauge.

Start installation with the ball valve and spool piece; mind alignment as described in the note above.

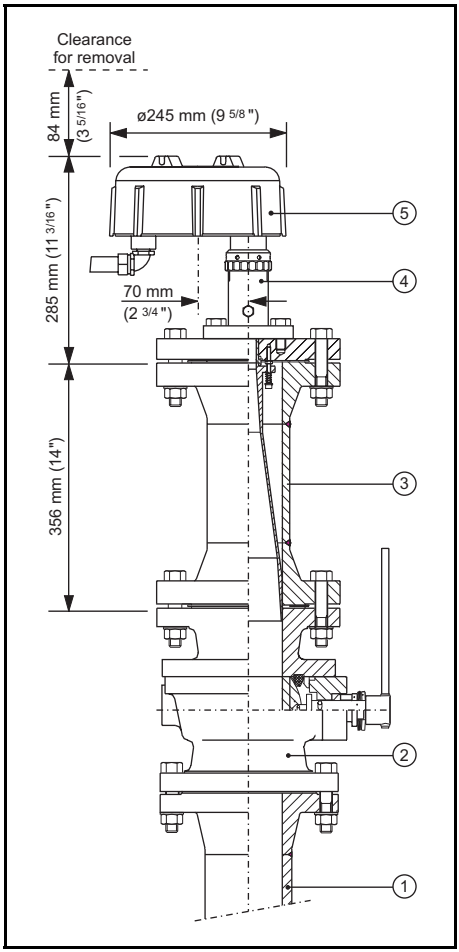


Figure 9.2 Dimensions of SmartRadar installed on top of 4" ball valve

9.1.1 Mount antenna to adapter flange

Refer to figure 9.3.

1) Place in horn antenna (1) the four Allen head screws M6 x 60 (2) with springs (3) and nuts (4).

2) Insert bushing (5) from underneath the 4" adapter flange (6).

3) Place antenna (1) against bushing and turn the Allen head screws (2) into the 4"
adapter flange. Secure the Allen head screws with the nuts (4) against the adapter flange. Leave sufficient space for the springs (3) that they can be pressed for at least 8 mm ($^{5}/_{16}$").

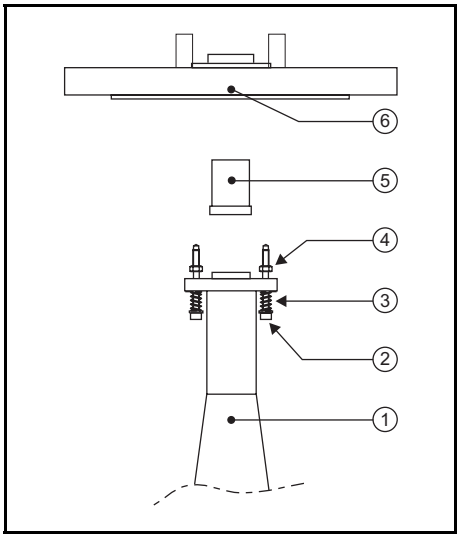


Figure 9.3 Installing antenna to adapter flange

9.1.2 Place antenna with 4" adapter flange in spool piece

1) Place 4" gasket on spool piece flange.

2) Carefully lower the antenna/adapter flange assembly inside the spool piece. Do not yet fix the adapter flange to the spool piece.

9.1.3 Place tank separator and position adapter flange

Refer to figure 9.4.

1) Place the 1" gasket (1) between the four stud bolts on the 4" adapter flange.

2) Place the tank separator (2) over the four stud bolts and tighten it with four nuts.

Note:

Tighten the nuts carefully on opposite sides. Check that the bushing is pressed downwards.

3) Turn the 4" adapter flange in position. The correct position is as indicated in figure 9.4. Hole for locking pin (3), which is 90° away from vent plug (4), is in line with the marker on the stilling well flange (5).

4) Secure the 4" adapter flange to the spool piece flange with standard bolts and nuts.

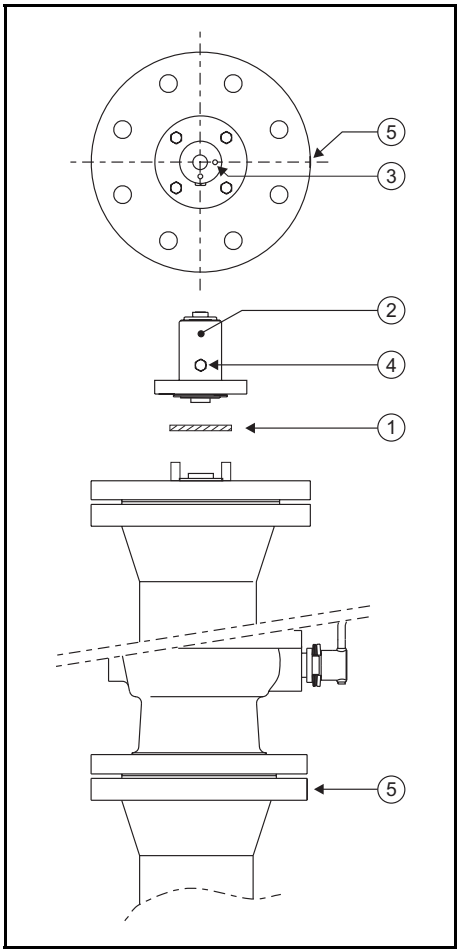


Figure 9.4 Position of adapter flange with respect to equalisation holes or verification pins

Warning

To ensure a good grounding between all flanges, a copper strip must be placed under one of the flange bolts. A shark ring should be placed between flange and strip (see figure 9.5).

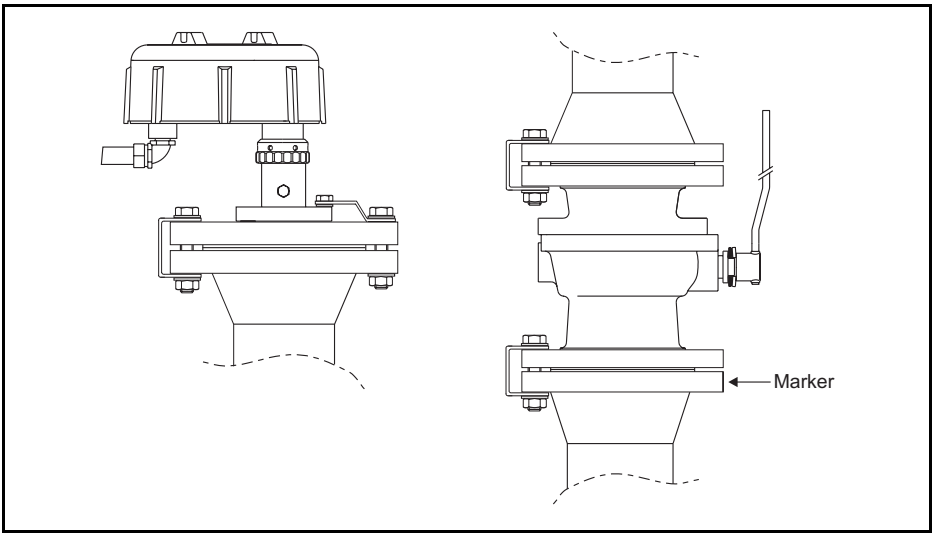


Figure 9.5 Example of flange ground connection

9.2 Installation in 4" SCH40 stilling well (type H04/N4)

Figure 9.6 gives the dimensions for a SmartRadar installed in a 4" SCH40 stilling well.

Item	Description
1	4" SCH40 stilling well with 300 lbs flange
2	4" 300 lbs adapter flange
3	1" full bore ball valve
4	tank separator
5	Antenna Unit

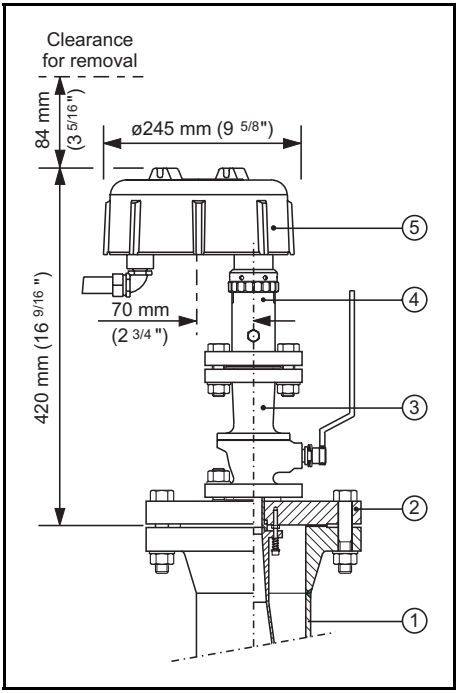


Figure 9.6 Dimensions of SmartRadar installed in 4" SCH40 stilling well

9.2.1 Mount antenna to adapter flange

Refer to figure 9.7.

1) Place in horn antenna (1) the four Allen head screws M6 x 60 (2) with springs (3) and nuts (4).

2) Insert bushing (5) from underneath the 4" adapter flange (6).

3) Place antenna (1) against bushing and turn the Allen head screws (2) into the 4" adapter flange. Secure the Allen head screws with the nuts (4) against the adapter flange. Leave sufficient space for the springs (3) that they can be pressed for at least 8 mm ($^5/_{16}$").

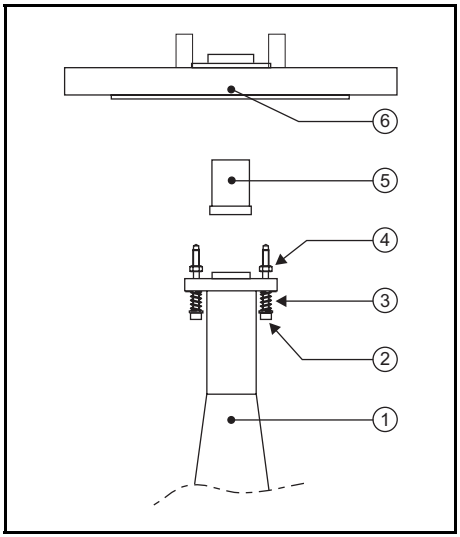


Figure 9.7 Installing antenna to adapter flange

9.2.2 Place antenna with 4" adapter flange in stilling well

1) Place 4" gasket on stilling well flange.

2) Carefully lower the antenna/adapter flange assembly inside the stilling well. Do not yet fix the adapter flange to the stilling well flange.

9.2.3 Place ball valve and position adapter flange

Refer to figure 9.8.

1) Place the 1" gasket (1) between the four stud bolts on the 4" adapter flange.

2) Place the 1" ball valve (2) over the four stud bolts and tighten it with four nuts.

Note:

Tighten the nuts carefully on opposite sides. Check that the bushing is pressed downwards.

3) Turn the 4" adapter flange in position. The correct position is found when the handle of the ball valve (3) is in line with the marker on the stilling well flange (4).

4) Secure the 4" adapter flange to the stilling well flange with standard bolts and nuts.

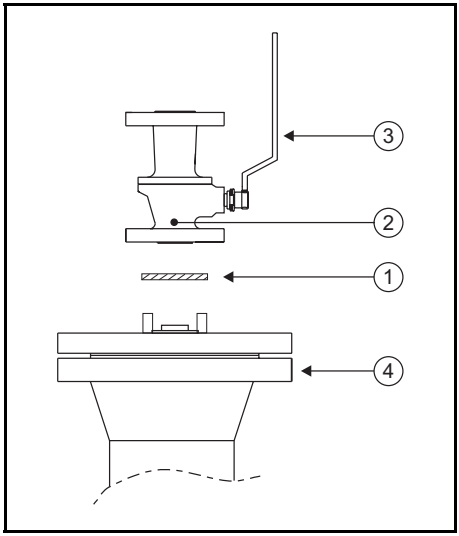


Figure 9.8 Position of adapter flange with respect to equalisation holes orverification pins

9.2.4 Install tank separator

Refer to figure 9.9.

1) Place 1" gasket (1) on 1" ball valve flange (2).

2) Place the tank separator (3).
Mind the position!
The correct position is as indicated in figure 9.9.
Hole for locking pin (4), which is 90° away from vent plug (5), is in line with the marker on the stilling well flange (6).

3) Secure the tank separator with 4 standard bolts and nuts.

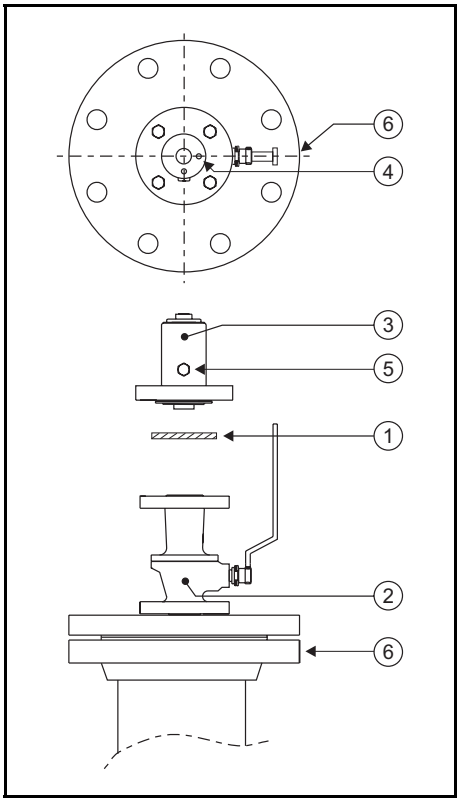


Figure 9.9 Position of tank separator

Warning

To ensure a good grounding between all flanges, a copper strip must be placed under one of the flange bolts. A shark ring should be placed between flange and strip (see figure 9.10).

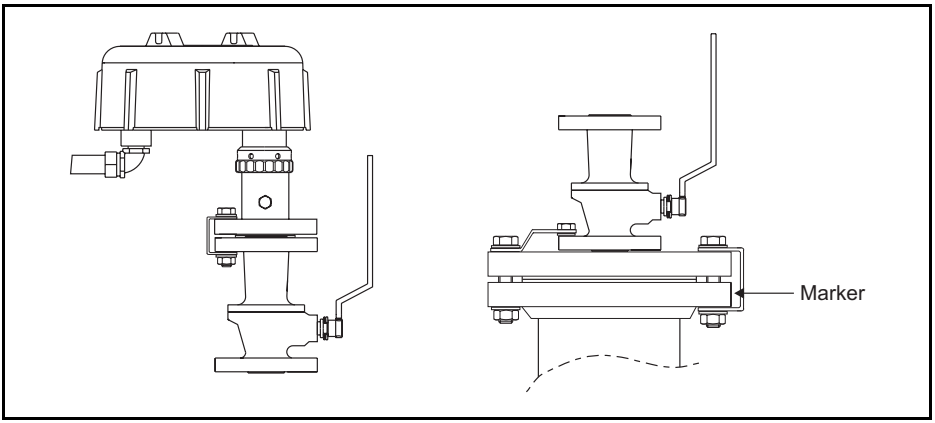


Figure 9.10 Example of flange ground connection

9.3 Installation in 4" SCH10s insert pipe (type H04/N1)

Figure 9.11 gives an installation overview and dimensions for a SmartRadar installed in a 4" SCH10s insert pipe.

Item	Description
1	6" SCH40 stilling well (or nozzle)
2	4" SCH10s insert pipe
3	6" 300 lbs intermediate flange
4	6" 300 lbs adapter flange
5	1" full bore ball valve
6	tank separator
7	Antenna Unit

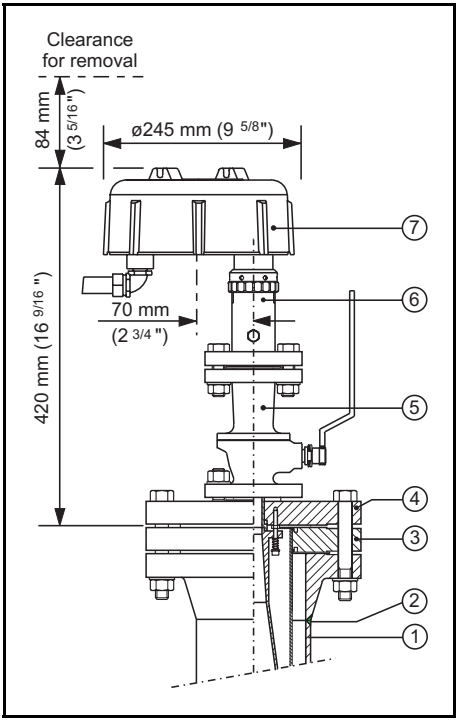


Figure 9.11 Dimensions of SmartRadar installed in 4" SCH10s insert pipe

9.3.1 Mount antenna to adapter flange

Refer to figure 9.12.

1) Place in horn antenna (1) the four Allen head screws M6 x 60 (2) with springs (3) and nuts (4).

2) Insert bushing (5) from underneath the 6" adapter flange (6).

3) Place antenna (1) against bushing and turn the Allen head screws (2) into the 6" adapter flange. Secure the Allen head screws with the nuts (4) against the adapter flange. Leave sufficient space for the springs (3) that they can be pressed for at least 3 mm ($^1/_8$").

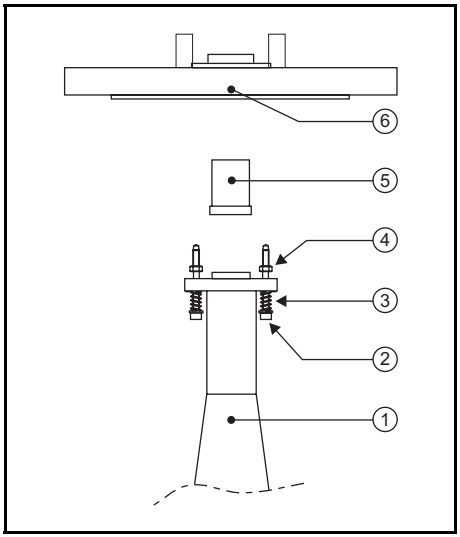


Figure 9.12 Installing antenna to adapter flange

9.3.2 Place antenna with 6" adapter flange in insert pipe

1) Place 6" gasket on intermediate flange.

2) Carefully lower the antenna/adapter flange assembly inside the insert pipe. Do not yet fix the adapter flange.

9.3.3 Place ball valve and position adapter flange

Refer to figure 9.13.

1) Place the 1" gasket (1) between the four stud bolts on the 6" adapter flange.

2) Place the 1" ball valve (2) over the four stud bolts and tighten it with four nuts.

Note:
Tighten the nuts carefully on opposite sides.

3) Turn the 6" adapter flange in position. The correct position is found when the handle of the ball valve (3) is in line with the marker on the intermediate flange (4).

4) Secure the 6" adapter flange to the stilling well flange with standard bolts and nuts.

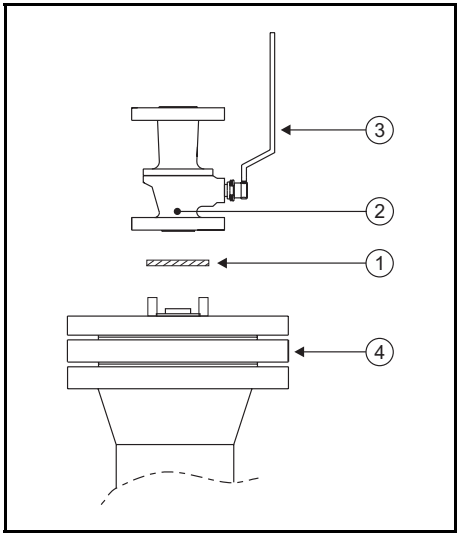


Figure 9.13 Position of adapter flange with respect to equalisation holes or verification pins

9.3.4 Install tank separator

Refer to figure 9.14.

1) Place 1" gasket (1) on 1" ball valve flange (2).

2) Place the tank separator (3).
Mind the position!
The correct position is as indicated in figure 9.14. Hole for locking pin (4), which is 90° away from vent plug (5), is in line with the marker on the intermediate flange (6).

3) Secure the tank separator with 4 standard bolts and nuts.

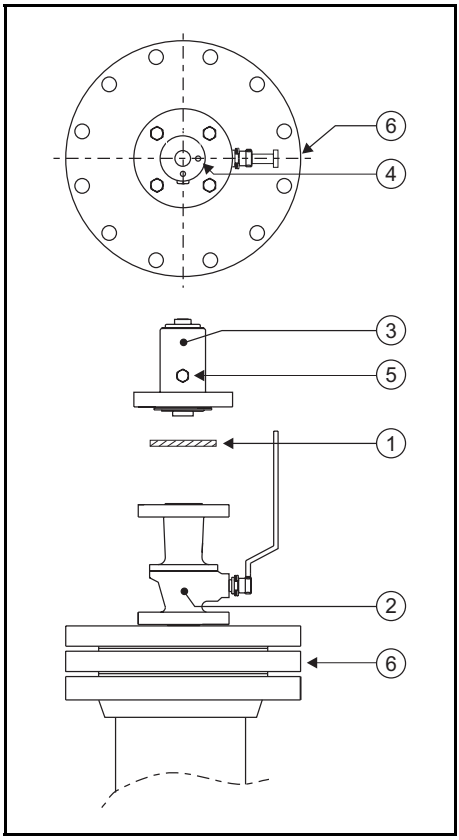


Figure 9.14 Position of tank separator

Warning

To ensure a good grounding between all flanges, a copper strip must be placed under one of the flange bolts. A shark ring should be placed between flange and strip (see figure 9.15).

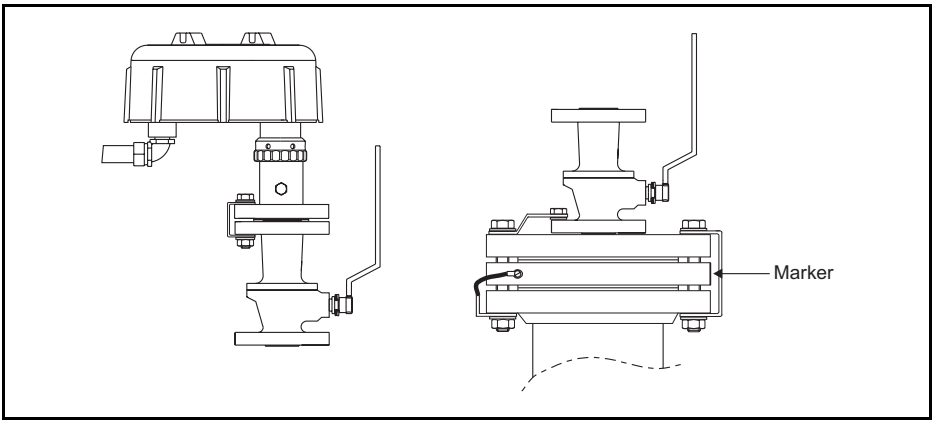


Figure 9.15 Example of flange ground connection

10 Installation 2" high pressure planar antenna

This section explains the mechanical installation of the 2" High Pressure Planar Antenna on a stilling well.

The stilling well(s) should have *at least* one row of equalisation holes with a diameter of 3 - 5 mm ($^1/_8$ - $^3/_{16}$") at a pitch of 500 mm (20"). Local regulations may require a different pitch and/or size of the equalisation holes. In this case consult Enraf or the local representative.
The position of the equalisation holes should be clearly marked on the flange.

The inner side of the stilling well should be free from burrs.

The installation of the planar antenna on a 2" full bore ball valve with inner diameter of 52.6 mm (2"), a 2" SCH40 stilling well and on a 1.5" SCH5 insert pipe, is described in sections 10.1 to 10.4.

10.1 Installation on 2" ball valve and 2" SCH40 pipe (type H02V4)

Figure 10.1 gives the assembly for a SmartRadar installation above a 2" ball valve.

Item	Description
1	2" SCH40 stilling well with welding neck flange (300 lbs)
2	2" full bore ball valve (300 lbs)
3	adapter ring to match the inner diameter of the ball valve with the antenna aperture
4	2", 300 lbs counter flange
5	tank separator with integrated 2" planar antenna
6	Antenna Unit

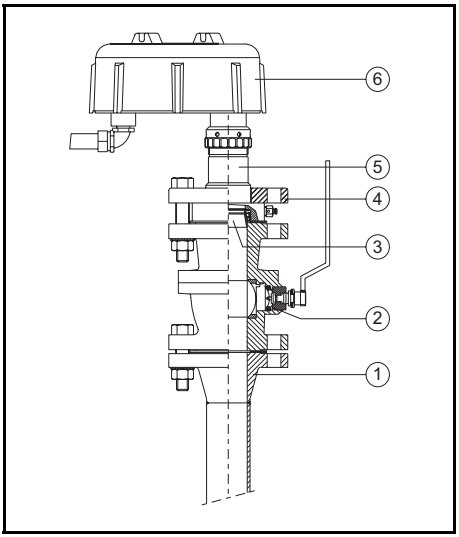


Figure 10.1 Antenna type H02V4

Note:

The 2" full bore ball valve should be well aligned on the welding neck flange.
Bad alignment of the internal diameters will cause false reflections and hence result in level inaccuracies. Also the antenna should be well aligned, as the adapter ring will lower into the ball valve housing.

Installation procedure:

Refer to figure 10.1.

- Check if the adapter ring (3) is correctly screwed into the H02 antenna housing (5).
- Place a 2" gasket on the top of the ball valve
- Place the adapter ring with tank separator (5) carefully in the ball valve housing and mind the alignment as described in the notes. Mind the correct position of the gasket. Watch the position of the bleed valve in respect to the flange bolts, and to be in an angle of 90° with the marker on the flange (refer to figure 10.2).
- Lower the 2", 300 lbs counter flange over the tank separator, and let it rest on the antenna housing.
- Fix the 2", 300 lbs counter flange on the 2" ball valve flange.

Refer to chapter 10.5; grounding example.

Item	Description
1	marker, which indicates position of holes in pipe
2	use this locking pin hole for the Antenna Unit
3	bleed valve
4	tank separator
5	2", 300 lbs counter flange
6	position of Antenna Unit

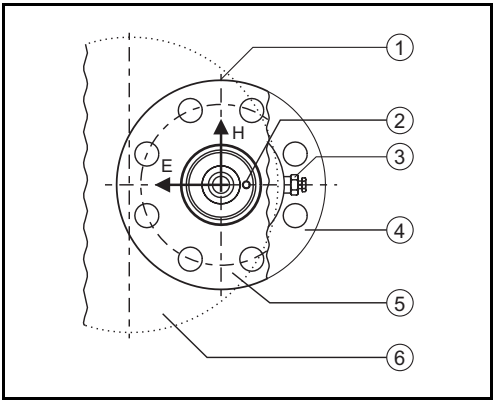


Figure 10.2 Position tank separator / 2" antenna

The magnetical field (H-field) is directed towards equalisation holes in the stilling well.

10.2 Installation on 2" ball valve and 1.5" SCH5 pipe (type H02V5)

Figure 10.3 gives the assembly for a SmartRadar installation above a 2" ball valve and 1.5" insert pipe.

Item	Description
1	1.5" SCH5 stilling well
2	intermediate plate
3	2", 300 lbs roof nozzle flange
4	adapter ring between 1.5" pipe and 2" full bore ball valve
5	2" full bore ball valve (300 lbs)
6	adapter ring to match the inner diameter of the ball valve with the antenna aperture
7	2", 300 lbs counter flange
8	tank separator with integrated 2" planar antenna
9	Antenna Unit

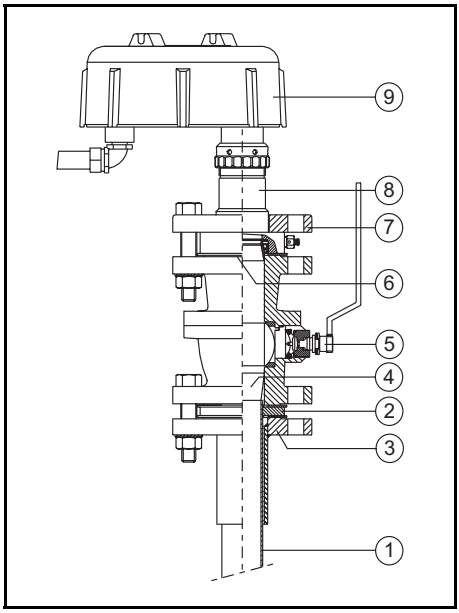


Figure 10.3 Antenna type H02V5

Note:

The 2" full bore ball valve should be well aligned on the 1.5" insert pipe.
Bad alignment of the internal diameters will cause false reflections and hence result in level inaccuracies. Also the antenna should be well aligned, as the adapter ring will lower into the ball valve housing.

Installation procedure:

Refer to figure 10.3.

- Place the adapter ring (3) over the end of the 1.5" insert pipe (1)
- Place a gasket on top of the intermediate plate connected to the 1.5" flange (1).
- Place the 2" full bore ball valve (4)
- Check if the adapter ring (5) is correctly screwed into the H02 antenna housing (7).
- Place a 2" gasket on the top of the ball valve
- Place the adapter ring with tank separator (5) carefully in the ball valve housing and mind the alignment as described in the notes. Mind the correct position of the gasket. Watch the position of the bleed valve of the H02 antenna in respect to the flange bolts, and to be in an angle of 90° with the marker on the flange (refer to figure 10.2).
- Lower the 2", 300 lbs counter flange over the tank separator, and let it rest on the antenna housing.
- Fix the 2", 300 lbs counter flange on the 2" ball valve flange.

Refer to chapter 10.5; grounding example.

10.3 Installation in a 2" SCH40 stilling well (type H02P4)

Figure 10.4 gives the dimensions for a SmartRadar installed in a 2" SCH40 stilling well.

Item	Description
1	2" SCH40 stilling well with welding neck flange (300 lbs)
2	adapter ring to match the inner diameter of the stilling well with the antenna aperture
3	2", 300 lbs counter flange
4	tank separator with integrated 2" planar antenna
5	Antenna Unit

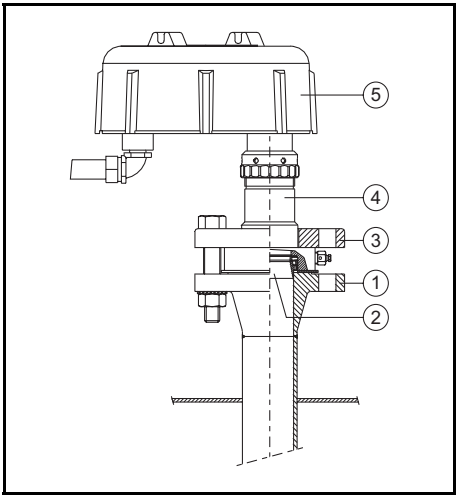


Figure 10.4 Antenna type H02P4

Installation procedure:

Refer to figure 10.4.

- Check if the adapter ring (2) is screwed correctly into the H02 antenna housing (4).
- Place a 2" gasket on the top of the 2" stilling well flange.
- Place the adapter ring with tank separator (4) carefully in the stilling well. Use the adapter ring for alignment and mind the correct position of the gasket. Watch the position of the bleed valve of the antenna in respect to the flange bolts, and to be in an angle of 90° with the marker on the flange (refer to figure 10.2).
- Lower the 2", 300 lbs counter flange over the tank separator, and let it rest on the antenna housing.
- Fix the 2", 300 lbs counter flange on the 2" stilling well flange.

Refer to chapter 10.5; grounding example.

10.4 Installation in a 1.5" SCH5 insert pipe (type H02P5)

Figure 10.5 gives an installation overview and assembly for a SmartRadar installed in a 1.5" SCH5 insert pipe.

Item	Description
1	2" stilling well (or nozzle)
2	1.5" SCH5 insert pipe
3	intermediate plate
4	adapter ring to match the inner diameter of the insert pipe with the antenna aperture
5	tank separator with integrated 2" planar antenna
6	2", 300 lbs counter flange
7	Antenna Unit

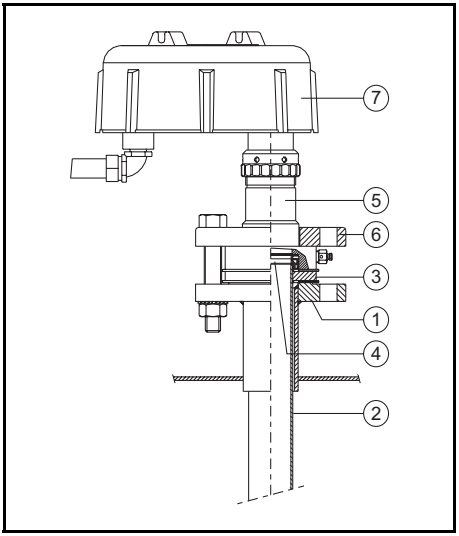


Figure 10.5 Antenna type H02P5

Note:

When using a 2" full bore ball valve in combination with a 1.5" SCH5 insert pipe, a second adapter ring is required between these two items. This unit should be placed over the end of the 1.5" stilling well first, before the ball valve is installed on top of the intermediate installation plate.

Installation procedure:

Refer to figure 10.5.

- Check if the adapter ring (2) is screwed correctly into the H02 antenna housing (4).
- Place a 2" gasket on the top of the 2" stilling well flange.
- Place the adapter ring with tank separator (4) carefully in the stilling well. Use the adapter ring for alignment and mind the correct position of the gasket. Watch the position of the bleed valve of the antenna in respect to the flange bolts, and to be in an angle of 90° with the marker on the flange (refer to figure 10.2).
- Lower the 2", 300 lbs counter flange over the tank separator, and let it rest on the antenna housing.
- Fix the 2", 300 lbs counter flange on the 2" stilling well flange.

10.5 Grounding example

Warning
To ensure a good grounding between all flanges, a copper strip must be placed under one of the flange bolts. A shark ring should be placed between flange and strip (see figure 10.6).

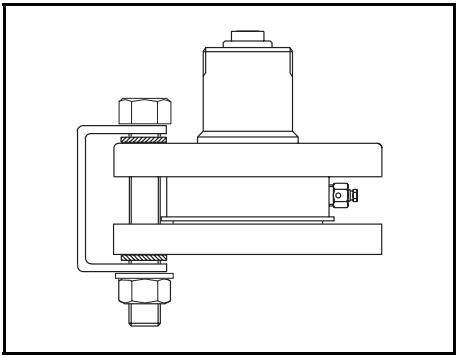
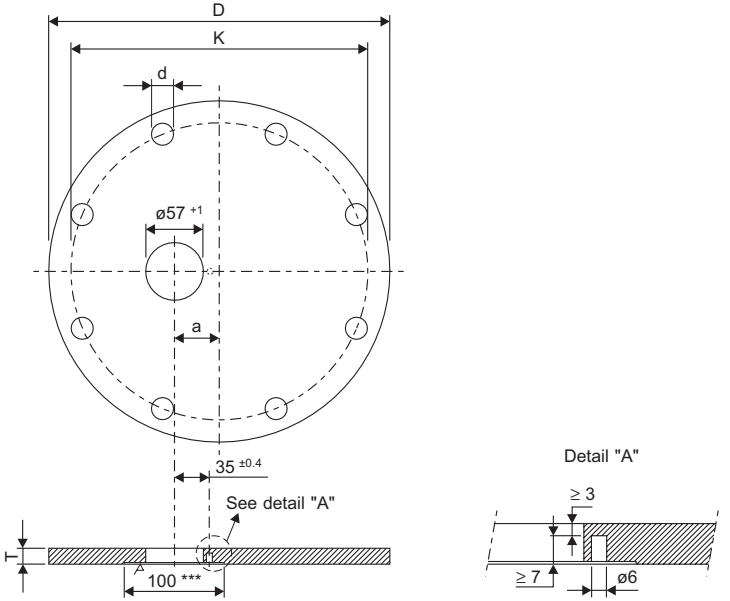


Figure 10.6 Example of flange ground connection

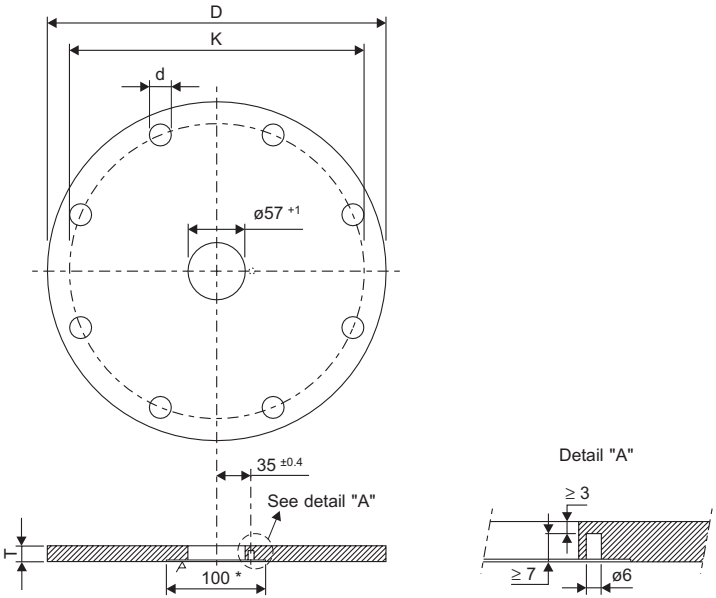
Appendix A Adapter plates



Thickness: $10 \leq T \leq 30$

Flange	D	K	d	n (number of holes)	a	Antenna type	Part no. (cs version)	Part no. (ss version)
6", 150 lbs	279.4	241.3	22.2	8	20	T06		
8", 150 lbs	342.9	298.4	22.2	8	45	F08, T06	0186.422	0186.424
10", 150 lbs	406.4	361.9	25.4	12	70	F08, T06, W06 *		
12", 150 lbs	482.6	431.8	25.4	12	95	F08, T06, W06 **		
NW150 ND6	265	225	18	8	20	T06		
NW200 ND6	320	280	18	8	45	F08, T06		
NW200 ND10	340	295	23	8	45	F08, T06		
NW250 ND6	375	335	18	12	70	F08, T06, W06 *		
NW250 ND10	395	350	23	12	70	F08, T06, W06 *		
NW300 ND6	440	395	23	12	95	F08, T06, W06 **		
NW300 ND10	445	400	23	12	95	F08, T06, W06 **		

Notes: *) Maximum nozzle length 200 mm
**) Maximum nozzle length 350 mm
***) General finish 20 µm, gas finish 1.6 µm

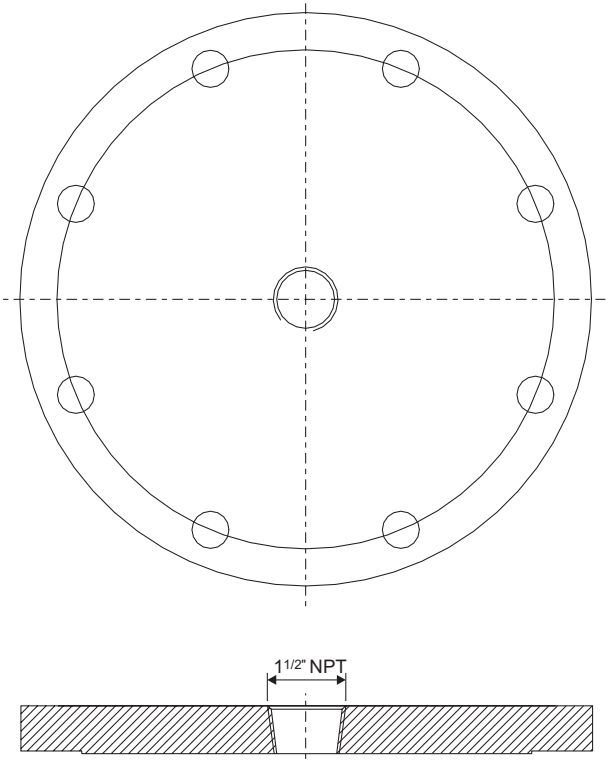


Thickness: 10 ≤ T ≤ 30

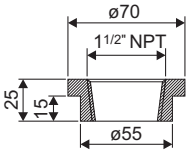
Flange	D	K	d	n (number of holes)	Antenna type	Part no. (cs version)	Part no. (ss version)
4", 150 lbs	228.6	190.5	19	8	D04		
6", 150 lbs	279.4	241.3	22.2	8	D04, S06	0186.430	0186.431
8", 150 lbs	342.9	298.4	22.2	8	D04, S08	0186.423	0186.425
10", 150 lbs	406.4	361.9	25.4	12	D04, S10	0186.426	0186.427
12", 150 lbs	482.6	431.8	25.4	12	D04, S12	0186.428	0186.429
NW100 ND6	210	170	18	4	D04		
NW150 ND6	265	225	18	8	D04, S06		
NW200 ND6	320	280	18	8	D04, S08		
NW200 ND10	340	295	23	8	D04, S08		
NW250 ND6	375	335	18	12	D04, S10		
NW250 ND10	395	350	23	12	D04, S10		
NW300 ND6	440	395	23	12	D04, S12		
NW300 ND10	445	400	23	12	D04, S12		

Notes: *) General finish 20 μm
Gas finish 1.6 μm

Appendix B Flange and socket for SmartRadar RoD antenna



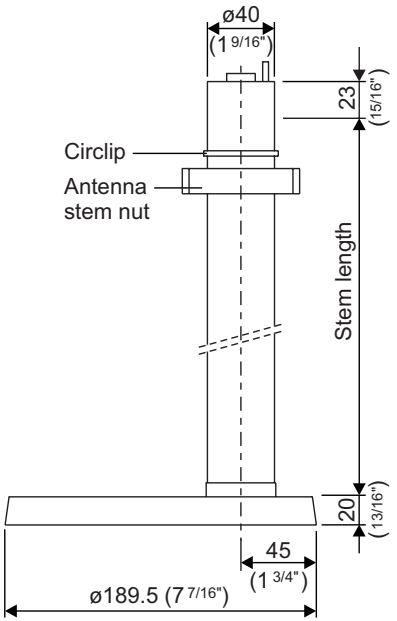
Flange for SmartRadar RoD antenna with screw connection



Socket for SmartRadar RoD antenna
with screw connection

Appendix C Dimensional drawings antennas

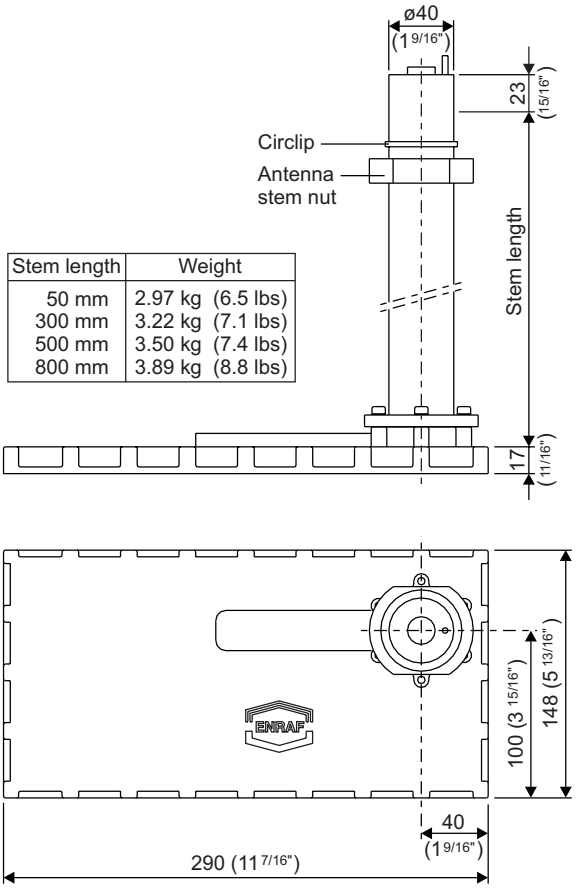
F08 Antenna



Stem length	Weight
50 mm	1.23 kg (2.7 lbs)
300 mm	1.58 kg (3.5 lbs)
500 mm	1.86 kg (4.1 lbs)
800 mm	2.25 kg (4.9 lbs)

Material: AISI 316L, mat. no.: 1.4404

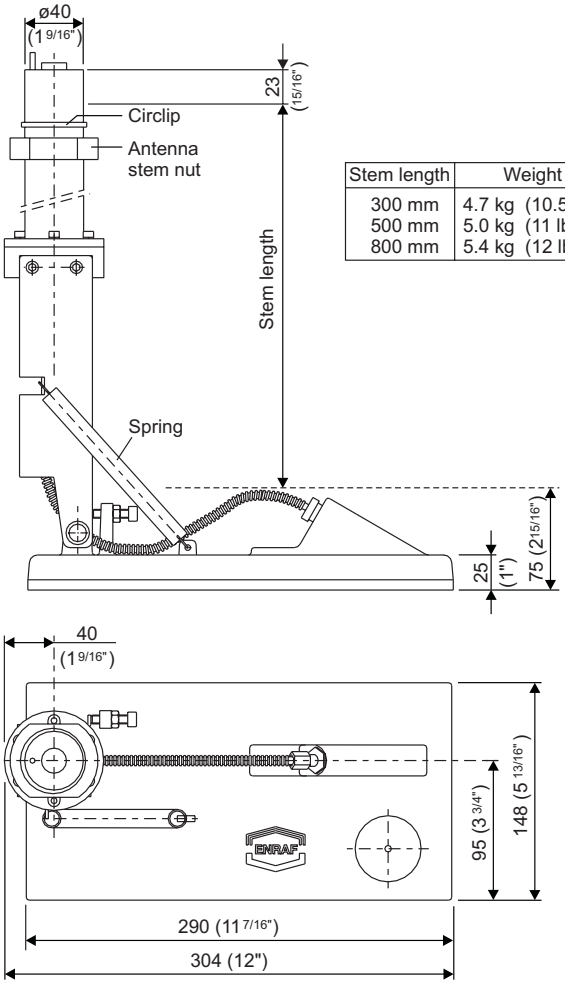
W06 Antenna



Stem length	Weight
50 mm	2.97 kg (6.5 lbs)
300 mm	3.22 kg (7.1 lbs)
500 mm	3.50 kg (7.4 lbs)
800 mm	3.89 kg (8.8 lbs)

Material: antenna stem : AISI 316L, mat. no.: 1.4404
antenna cover : ASTM A351 CF8M, mat no.: 14408

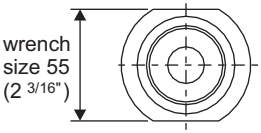
T06 Antenna



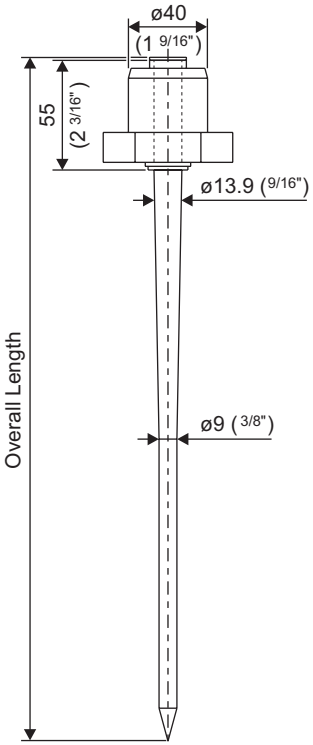
Stem length	Weight
300 mm	4.7 kg (10.5 lbs)
500 mm	5.0 kg (11 lbs)
800 mm	5.4 kg (12 lbs)

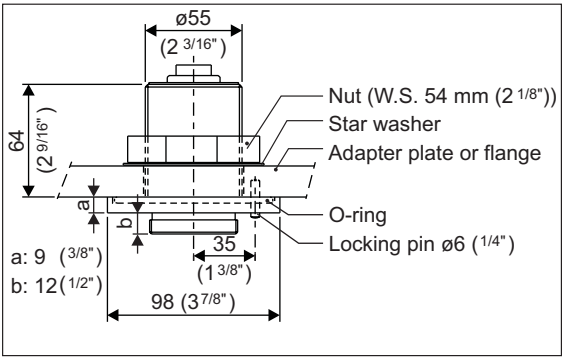
Material: antenna stem : AISI 316L, mat. no.: 1.4404
antenna cover : ASTM A351 CF8M, mat no.: 14408

D04 Antenna with tank seperator



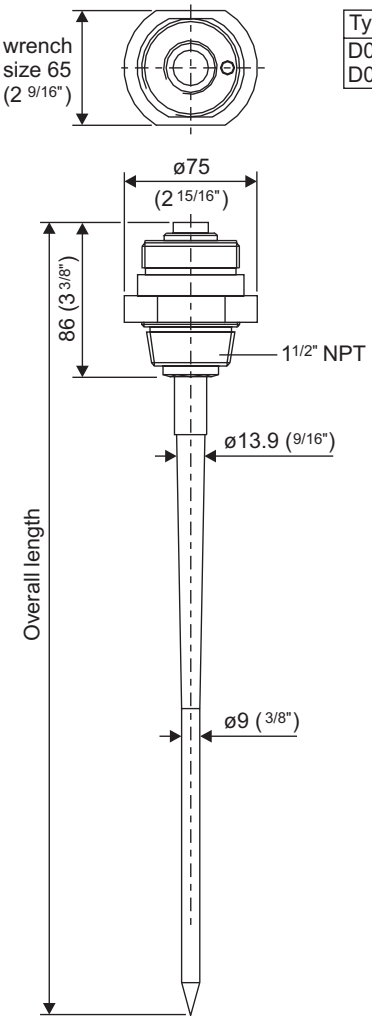
Type	Overall Length
D0400	343 (13 1/2")
D0415	493 (19 7/16")





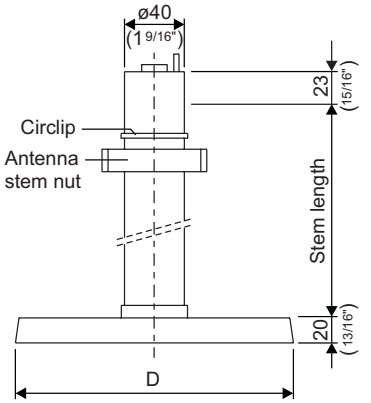
Tank seperator

D02 Antenna with screw connection



Type	Overall Length
D0200	391 (15 3/8")
D0215	541 (21 5/16")

S06 - S12 Antennas



S06 D = ø137 (5 3/8")	
Stem length	Weight
50 mm	0.62 kg (1.4 lbs)
300 mm	0.97 kg (2.1 lbs)
500 mm	1.60 kg (3.5 lbs)
800 mm	2.65 kg (5.8 lbs)

S08 D = ø187 (7 1/4")	
Stem length	Weight
50 mm	1.23 kg (2.7 lbs)
300 mm	1.58 kg (3.5 lbs)
500 mm	1.86 kg (4.1 lbs)
800 mm	2.25 kg (4.9 lbs)

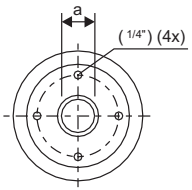
S10 D = ø237 (9 3/8")	
Stem length	Weight
50 mm	1.66 kg (3.7 lbs)
300 mm	2.01 kg (4.4 lbs)
500 mm	2.29 kg (5 lbs)
800 mm	2.71 kg (6 lbs)

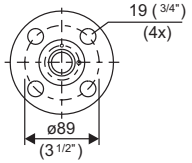
S12 D = ø287 (11 1/4")	
Stem length	Weight
50 mm	2.18 kg (4.8 lbs)
300 mm	2.53 kg (5.6 lbs)
500 mm	2.81 kg (6.2 lbs)
800 mm	3.23 kg (7.1 lbs)

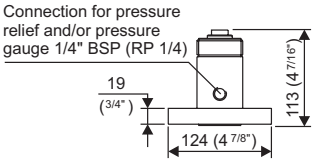
Material: AISI 316L, mat. no.: 1.4404

H04 Antenna

	mm	inches
a	ø 25	1"
b	ø 85	3 3/8"
c	65	2 9/16"
d	ø 32	1 1/4"
e	5	3/16"
f	10	3/8"

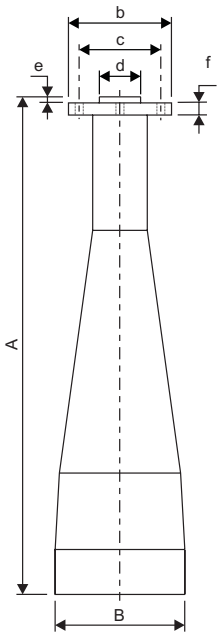






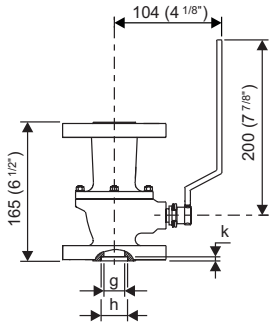
Material : AISI 316 mat. no.: 1.4401
Weight : 3.1 kg (6.8 lbs)

Flange : 1", 300 lbs, rf acc. to ANSI B16.5



	H04N1	H04*4
A	410 (16 1/8")	360 (14 3/16")
B	ø 107 (4 3/16")	ø 101 (4")

Material : ASTM A351 CF8M, 316 mat. no.: 1.4408
Weight : 2.9 kg (6.4 lbs)

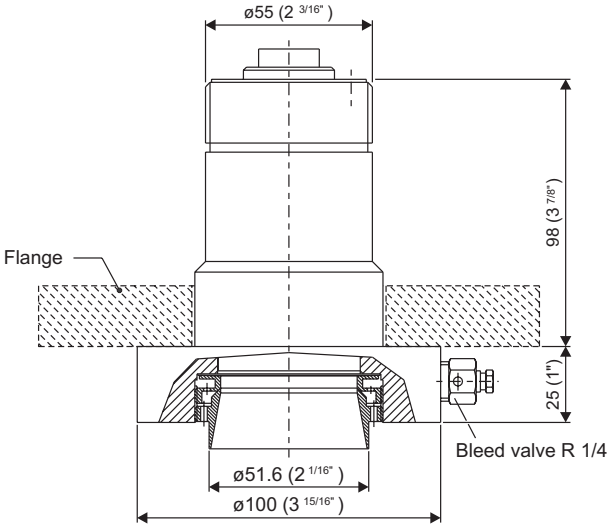


	mm	inches
g	ø 25	1"
h	ø 32	1 1/4"
k	5	3/16"

Material : AISI 316 mat. no.: 1.4401
Weight : 5.7 kg (12.5 lbs)

Flange : 1", 300 lbs, rf acc. to ANSI B16.5
Flange finish : turning, Ra: 3.2-6.3 µm

H02 Antenna



Material : AISI 316, mat. number 1.4401
Weight : 5.5 kg (12.1 lbs)

Flange dim. acc. to ANSI B16.5
Flange: 2", 300 lbs, ff. standard included

Appendix D Related publications

Title	Part no.
Installation guide 873 SmartRadar Control Unit & Antenna Unit	4416.569 4416.731
Installation guide 873 SmartRadar Sample hatch	4416.590
Installation guide 873 SmartRadar Beam Aligner	4416.598
Installation guide 873 SmartRadar Verification pins	4416.591
Installation guide 873 SmartRadar Roof reflector	4416.580
Instruction manual 873 SmartRadar	4416.571
Instruction manual 873 SmartRadar APU Hard alarm output contacts	4416.579
Instruction manual 873 SmartRadar verification pin compensation	4416.586
Instruction manual Ensite service tool	4416.587
Identification code 873 SmartRadar	4416.952

Index

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