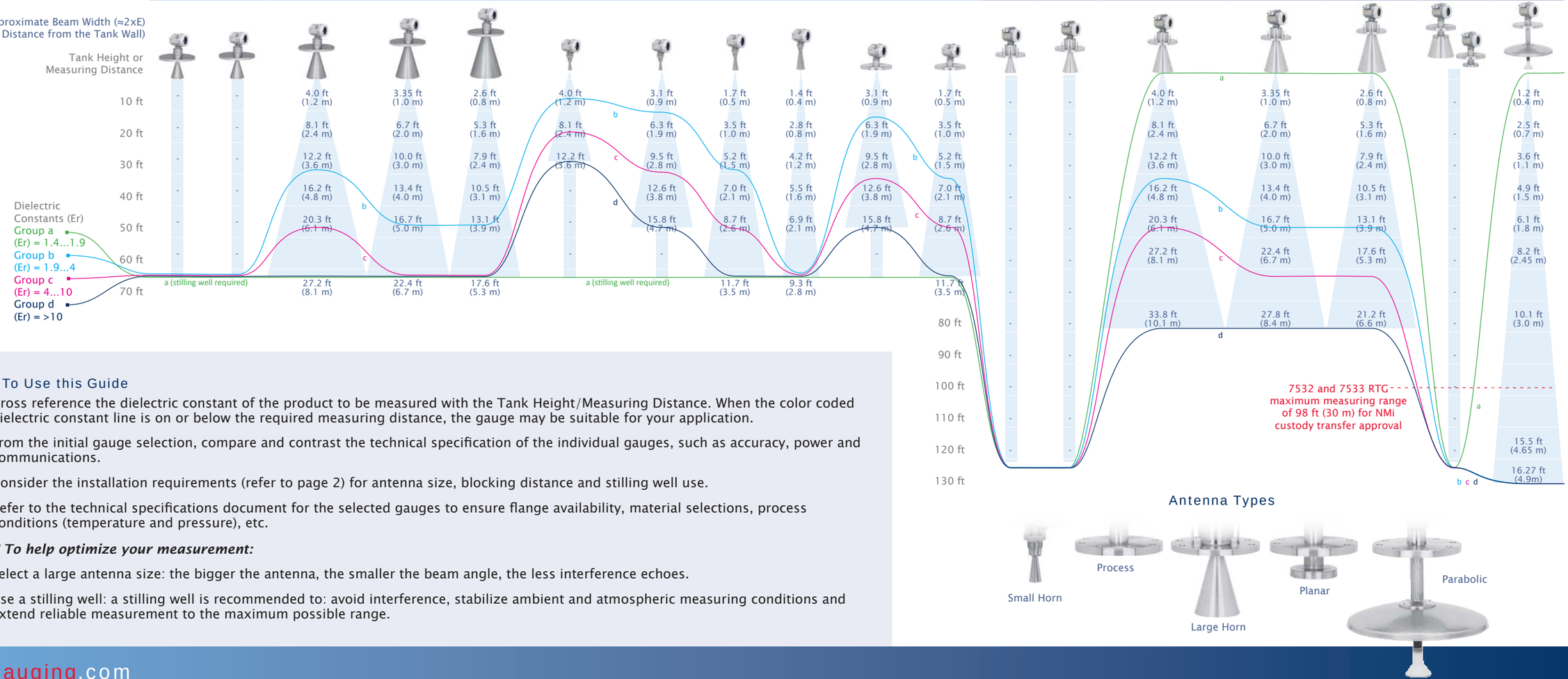
Radar Tank Gauge Selection Guide

This guide is designed to assist in the selection of a suitable radar tank gauge. The usable measuring range and accuracy depends on the size of the antenna, reflectivity (dielectric constant) of the liquid, mounting location and eventual interference reflections.

	7230 RTG					7240 RTG						7245 RTG		7530 RTG						7532 RTG	7533 RTG
Measuring Method	Pulse (6 GHz)					Pulse (26 GHz)						Pulse (26 GHz)		Pulse (6 GHz)							
Accuracy	±10 mm					±3 mm								±1 mm (±0.5 mm at 2 Sigma value)							
Power	2-wire I.S.													4-wire I.S. (24V dc via 4590 Tank Side Monitor)							
Communications	Tank Side HART® Multi-drop (Field communications via 4590 Tank Side Monitor - see notes)													Tank Side HART® Multi-drop (Field communications via 4590 Tank Side Monitor - see notes)							
Approvals	ATEX (EEx ia/EEx d (ia)), FM, CSA, SIL 2 and IP65/NEMA 4x Rated													ATEX, FM, CSA and IP65/NEMA 4x Rated							
Beam Angle	Stilling Well		23°	19°	15°	23°	18°	10°	8°	18°	10°			Stilling Well		23°	19°	15°		Stilling Well	7°
Antenna Size Length (mm) Diameter (mm)	3" 2.9" (74) 2.9" (75)	4" 4.6" (119) 3.7" (95)	6" 8" (204) 5.7" (145)	8" 8" (204) 7.4" (190)	10" 14.9" (379) 9.4" (240)	1.5" 3.3" (86) 1.5" (40)	2" 5.2" (115) 1.9" (48)	3" 8.3" (211) 2.9" (75)	4" 11.1" (282) 3.7" (95)	2" <0.7" (<18) 1.8" (46)	3" <0.7" (<18) 2.7" (70)			3" 2.7" (68) 3" (76)	4" 4.1" (105) 3.8" (96)	6" 7.3" (185) 5.7" (146)	8" 10.5" (267) 7.5" (191)	10" 14.1" (359) 9.5" (241		6" 3.66" (93) 6" (153)	18" 16.4" (414) 18" (454)
Blocking Distance (A)	2" (50 mm)					2" (50 mm)						8" (200 mm)		None (measures to the tip of the antenna)						39" (1000 mm)	
Distance from Tank Bottom (C)	6...12" (150...300 mm)					2...6" (50...150 mm)								6-12" (150...300 mm)							
Recommended Application	Stilling Well		Free Space or Stilling Well											Stilling Well		Free Space or Stilling Well				Stilling Well	Free Space

Approximate Beam Width (≈2xE)
(E = Distance from the Tank Wall)

Tank Height or Measuring Distance



How To Use this Guide

1. Cross reference the dielectric constant of the product to be measured with the Tank Height/Measuring Distance. When the color coded dielectric constant line is on or below the required measuring distance, the gauge may be suitable for your application.
2. From the initial gauge selection, compare and contrast the technical specification of the individual gauges, such as accuracy, power and communications.
3. Consider the installation requirements (refer to page 2) for antenna size, blocking distance and stilling well use.
4. Refer to the technical specifications document for the selected gauges to ensure flange availability, material selections, process conditions (temperature and pressure), etc.

Note! To help optimize your measurement:

1. Select a large antenna size: the bigger the antenna, the smaller the beam angle, the less interference echoes.
2. Use a stilling well: a stilling well is recommended to: avoid interference, stabilize ambient and atmospheric measuring conditions and extend reliable measurement to the maximum possible range.

Antenna Types

Dielectric Constant (Er) of Liquid Products

The achievable measuring range of a radar gauge is highly dependent on the reflectivity (Er value) of the liquid being measured. Varec classifies liquids into one of four groups.

Group a - Dielectric Constant (Er) = 1.4...1.9 e.g. non-conducting liquids and liquefied gases, such as (LPG) chlorine (1.8), air at -140°C (1.5), butane (1.5), propane (1.5), etc.

Group b - Dielectric Constant (Er) = 1.9...4 e.g. non-conducting liquids and petroleum based products, such as benzene, oil, toluene, white products, black products, crudes, bitumen/asphalts, fuel oils, etc.

Group c - Dielectric Constant (Er) = 4...10 e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone, etc.

Group d - Dielectric Constant (Er) = >10 e.g. conducting liquids, e.g. aqueous solutions, dilute acids, alkalis, etc.

Note! Reference Dielectric Constant (Er) values for Air (1) and Water (81)

Measuring Range (H)

The measuring range begins where the beam hits the tank bottom for free space applications or the end of the stilling well for stilling well applications.

Tank Bottom (C)

In case of media with a low dielectric constant (groups a & b), the tank bottom can be visible through the medium at low levels (low height C). Reduced accuracy has to be expected in this range. If this is not acceptable, we recommend positioning the zero point at a distance C above the tank bottom in these applications.

Blocking Distance (A)

In principle it is possible to measure up to the tip of a horn antenna. However, due to considerations regarding corrosion, condensate and build-up, the end of the measuring range (blocking distance A) should not be chosen any closer than A to the tip of the antenna. A reliable measurement cannot be guaranteed inside this distance. If an antenna extension is used, its length should be added to A. In applications with planar or parabolic antennas, especially for media with low dielectric constants, the end of the measuring range (B) should not be closer than 40" (1000 mm) to the flange.

Distance from Tank Wall (E)

The recommended mounting distance from the tank wall (E) to the outer edge of nozzle should be greater than 1/6 of the overall tank diameter (D) and also never closer than 12" (300 mm) for the 7230 RTG and 6" (150 mm) for the 7240 or 7245 RTGs to the tank wall. Reflection of the radar signal from one side of the tank is acceptable. Reflection from both sides of the tank, due to installation position or beam angle, should be ruled out.

Measuring Conditions

In case of boiling surfaces, bubbling or tendency for foaming, select a wide beam angle (e.g. 7230 RTG). Depending on its consistency, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions.

In case of heavy steam or condensate, the maximum measuring range may decrease depending on density, temperature and composition of the steam. For the measurement of absorbing gases, such as ammonia or some fluorocarbons, a stilling well is recommended.

Obstacles (1, 2, 6)

Avoid any installations with obstacles inside the signal beam (1 & 2), i.e. vacuum rings, heating coils, baffles, limit switches, temperature sensors, etc. A narrow beam angle focuses the radar energy and reduces influence from obstacles (refer to the beam angle and beam width at the maximum measuring range). Metallic screens (6) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes. The measurement can also be optimized by selecting an appropriate mounting position, orientation and by means of electronic suppression of interference echoes.

Gauge Orientation (3, 4, 5)

It is recommended to use a weather protection cover (3) in order to protect the transmitter from direct sun or rain and to not install the radar tank gauging in the center (4) of the tank or above a fill stream (5).

Mounting in a Stilling Well

The stilling well should be constructed from metal with a constant diameter that is not larger than the diameter of the antenna. Any rectangular increase of the pipe diameter has to be avoided. The welding seam should be as smooth as possible and on the same axis as the slots. Slots should offset 180° (not 90°). Slot width/diameter should be less than 1/10 of the well's diameter. The length and number of slots do not have any influence on the measurement.

At any transition (e.g. when using a ball valve or mending pipe segments) the gap between segments must not exceed 0.04" (1 mm). Do not weld through the transition. The stilling well must be de-burred and remain smooth on the inside. Otherwise, strong interference echoes will be generated and material build-up will be promoted.

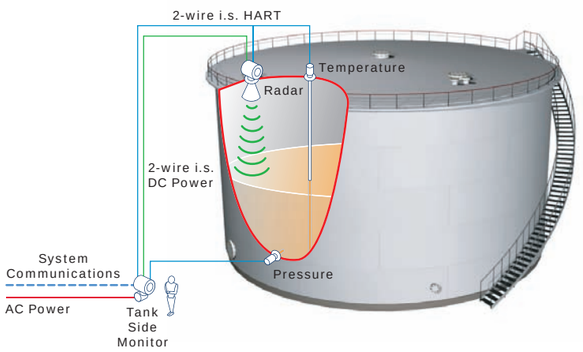
Select an antenna as big as possible. For intermediate sizes, select the next larger antenna and adapt it mechanically.

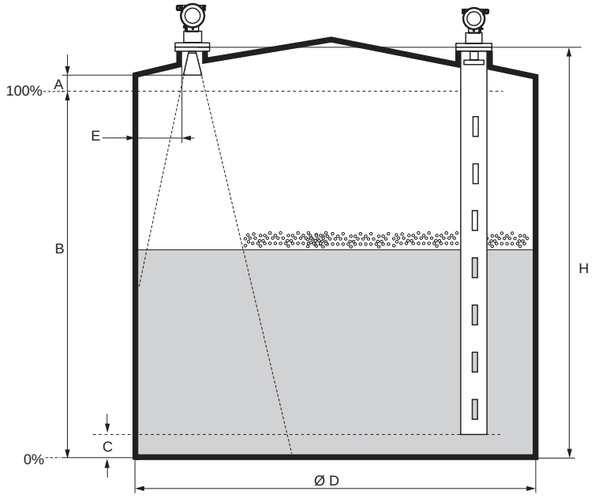
Floating Roof Reflector

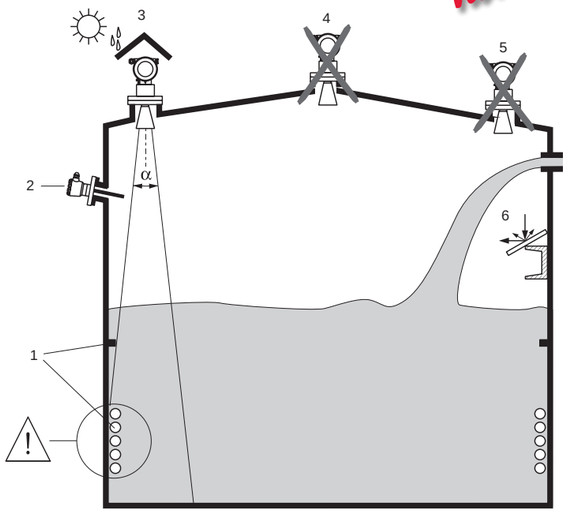
Measurements on floating roofs are not recommended for highly accurate measurements due to the unsteady movements of the roof itself. Varec recommends using a stilling well on floating roof applications. Alternatively, a special reflector can be used for free space applications on floating roofs.

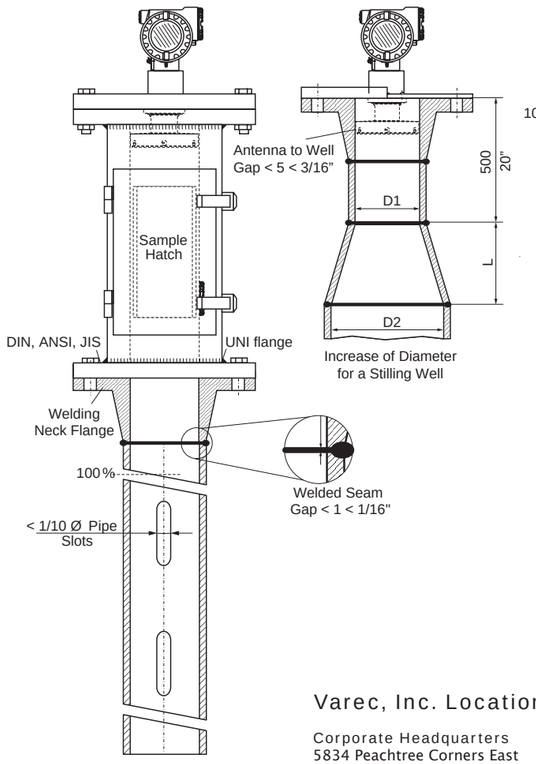
Communications

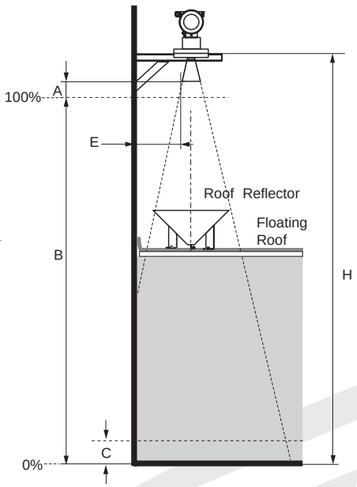
HART, PA, FF are the available in the gaugehead for local tank communications. The 4590 Tank Side Monitor offers local display and configuration for radar tank gauges and also provides the following filed communications to the host system: ENRAF BPM, GPE, Whessoe WM550, Mark/Space, MODBUS, L&J and V1.

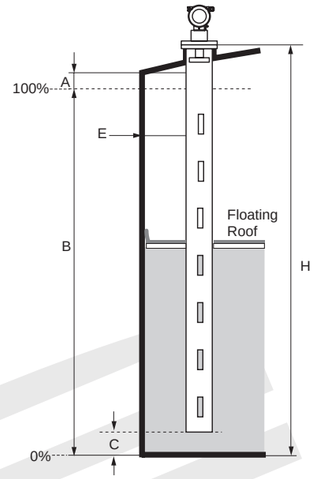












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