



**SIEMENS**

Siemens Industry, Inc / IA / Process Instruments

# Level Measurement Products Installation Considerations-Ultrasonic

# Ultrasonic

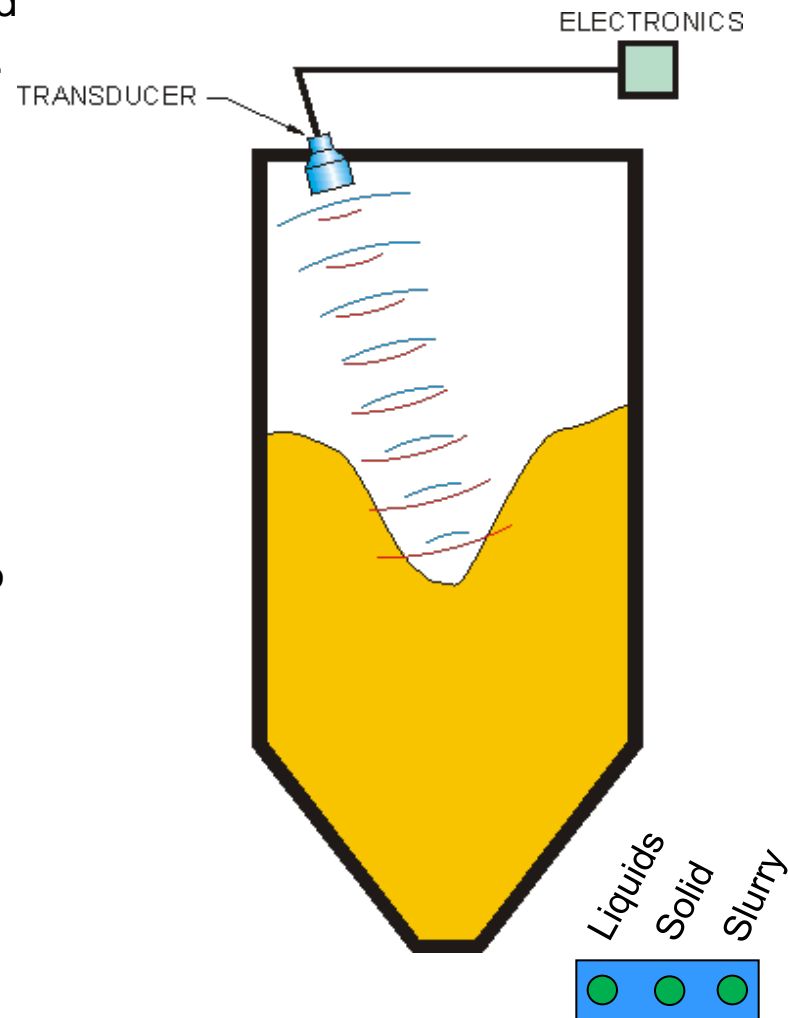
Measures time of flight from transmission to received echo. This determines distance and calculates level.

## Advantage

- Non-contact
- Well proven
- Solids, liquids or slurries
- Self cleaning transducer face
- Able to detect submergence (with installed shield)
- Control capabilities (pumping & alarms)
- Remote display
- Potted / Robust transducer for vibration and shock. (no electronics in vessel)

## Disadvantage

- Sensitive to vapor changes in medium
- Can be sensitive to foam
- Limited pressure and temperature range



# Siemens Ultrasonics Application Challenges

- High Temperature (>100° C)
- Certain Vapors
- Severe Dust
- Light density Foam
- Absolute Vacuum
- **These are Radar applications**



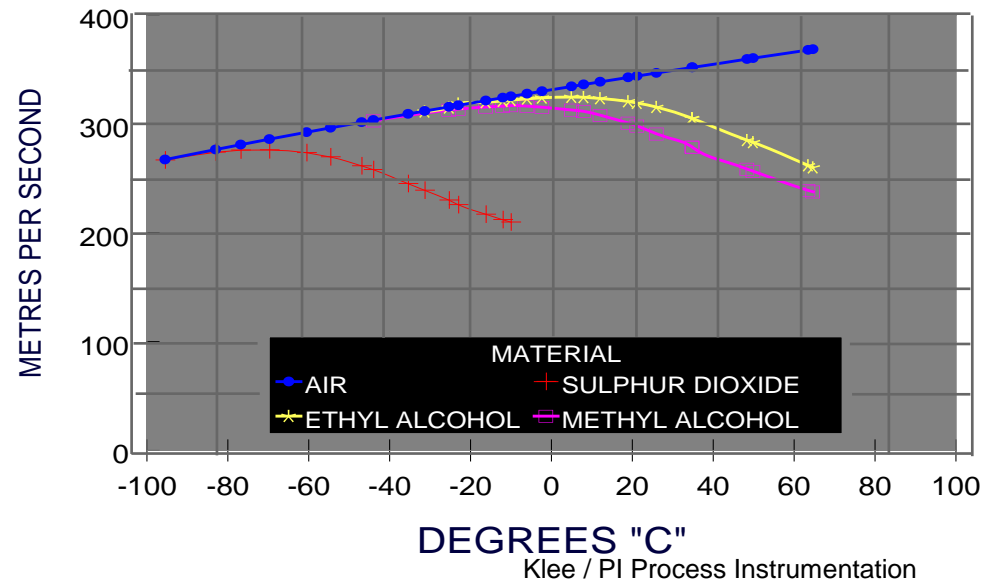
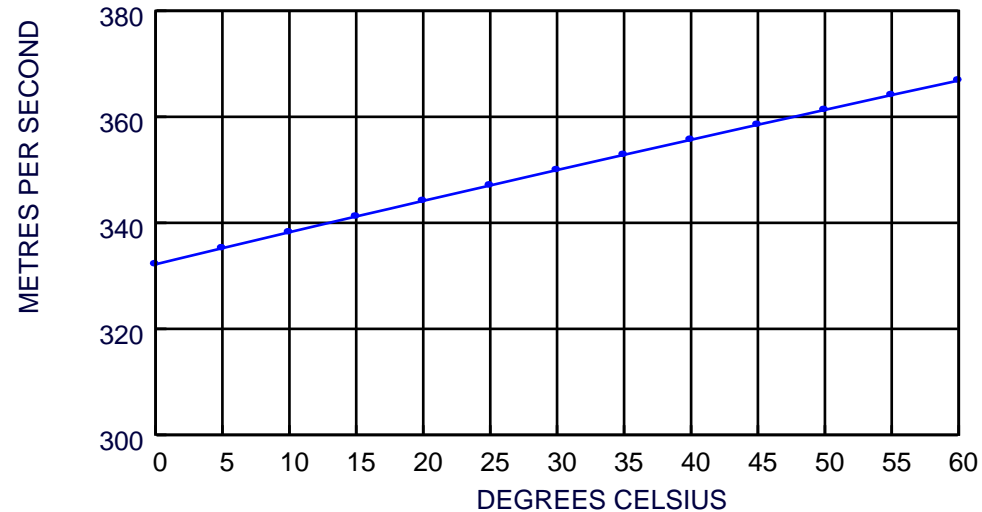
# Siemens Ultrasonics Application Challenges

## Speed of Sound vs. Temperature

- Speed of sound varies with temperature and must be compensated for
  - ~0.17% error per meter per ° C
- Siemens ultrasonics measure temperature and compensate for changes in speed of sound

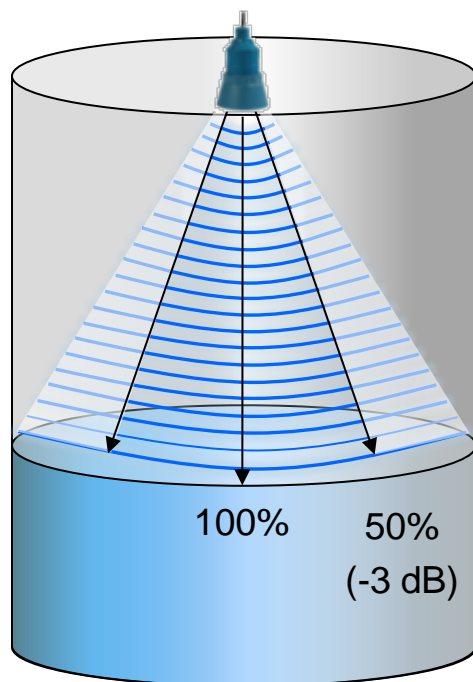
## Attenuation of sound in different atmospheres

- Speed of sound varies with atmospheres other than air
- Sound does not propagate in some atmospheres (e.g. carbon dioxide, vacuum) and therefore alternative technologies are required.
- Siemens ultrasonics can be calibrated in many atmospheres other than air



# Siemens Ultrasonics Transducer Beam Angle

- Beam angle of 6 to 12 degrees inclusive with Siemens Echomax transducers
  - Measured to the -3dB boundary (or half power boundary)



12° inclusive with:

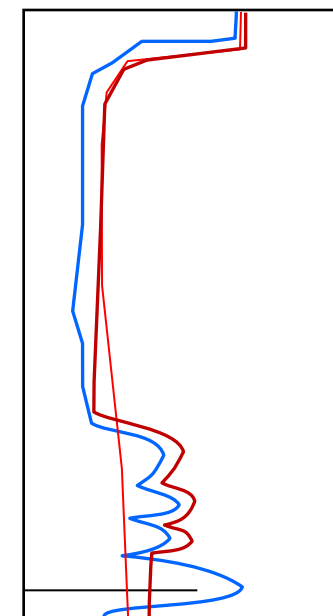
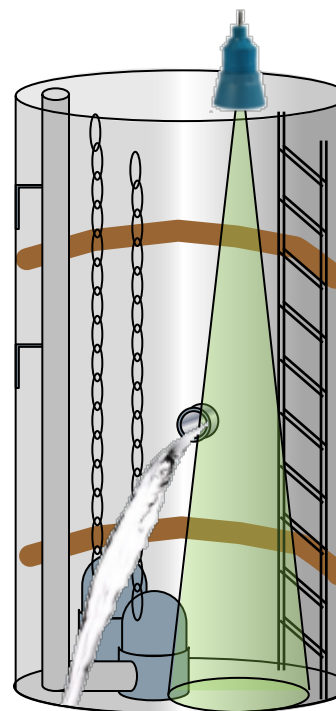
- ST-H
- XPS-10

10° inclusive with:

- XRS-5

6° inclusive with:

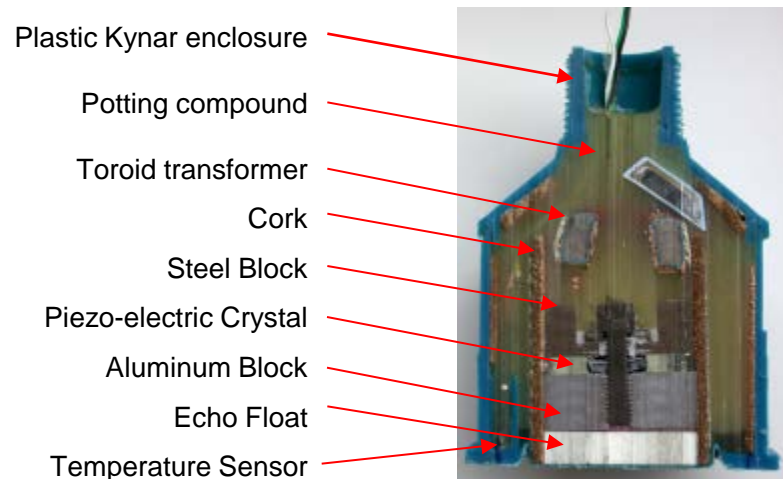
- XPS-15
- XPS-30



# Siemens Ultrasonics

## Transducer Blanking (the blind zone)

- While the crystal is in the flexed state, no measurement can be made; this state is known as the Ringdown.
  - This lasts for 800  $\mu$ S, depending on the transducer.



- When equated to distance, this is known as the Blanking distance or blind zone.

$$\text{If } D = V \times T$$

$$D = 1129 \text{ ft/s} \times 0.000,886 \text{ s}$$

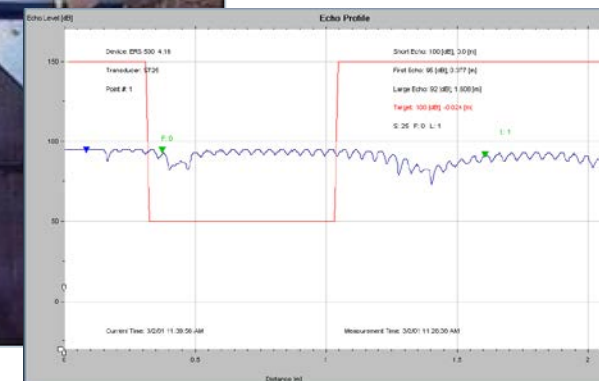
$$D = 1 \text{ ft}$$

- This is the typical blanking distance for our 44 KHz transducers.



# Siemens Ultrasonics Self-cleaning and Submergence

- Siemens Ultrasonic transducers have a Self-Cleaning Face!
  - NO fouling (condensation)
  - NO build-up
  - NO deposit
  
- Submergence detection
  
- If ever the transducer is submerged
  - Submergence kit
  - keeps the transducer face clean
  - allows pump monitoring during submergence



## 24/7 Technical Support Hotline

(800) 333-7421

To create a Tech Support request on-line:

<http://www.siemens.com/automation/support-request>

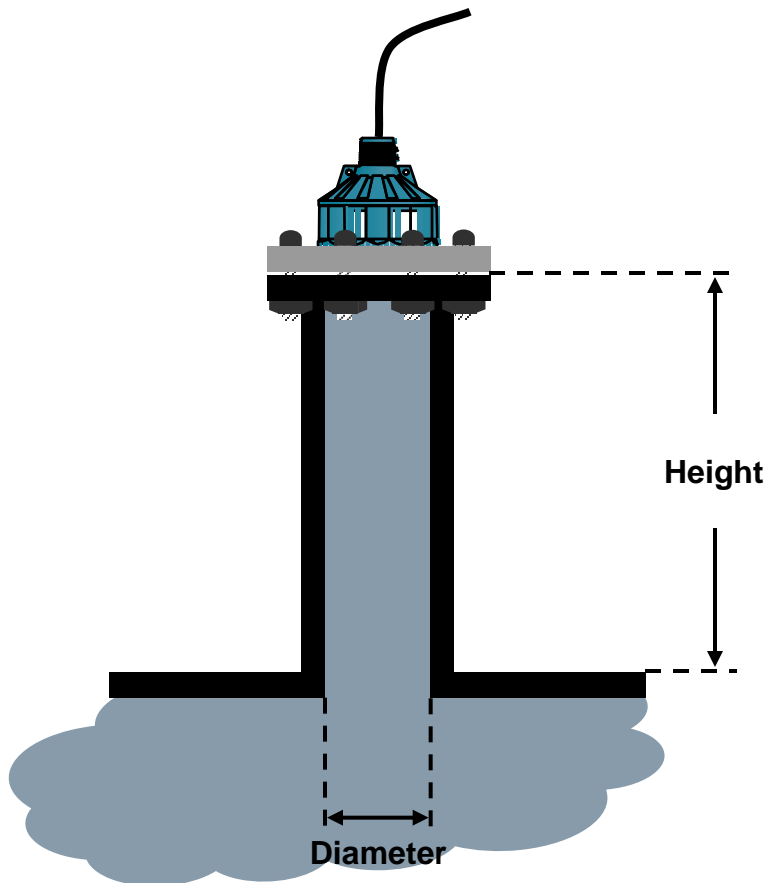


# Troubleshooting

## Recommended information to provide

- Model
- Serial number
- Description of the problem
- Quick Start Parameter values
- Troubleshooting parameter values
  - P804 Confidence Threshold
  - P805 Confidence Value
  - P806 Echo Strength
  - P807 Noise Level
    - P805 through P807 when working correctly and during erroneous operation if possible
  - P820 Algorithm

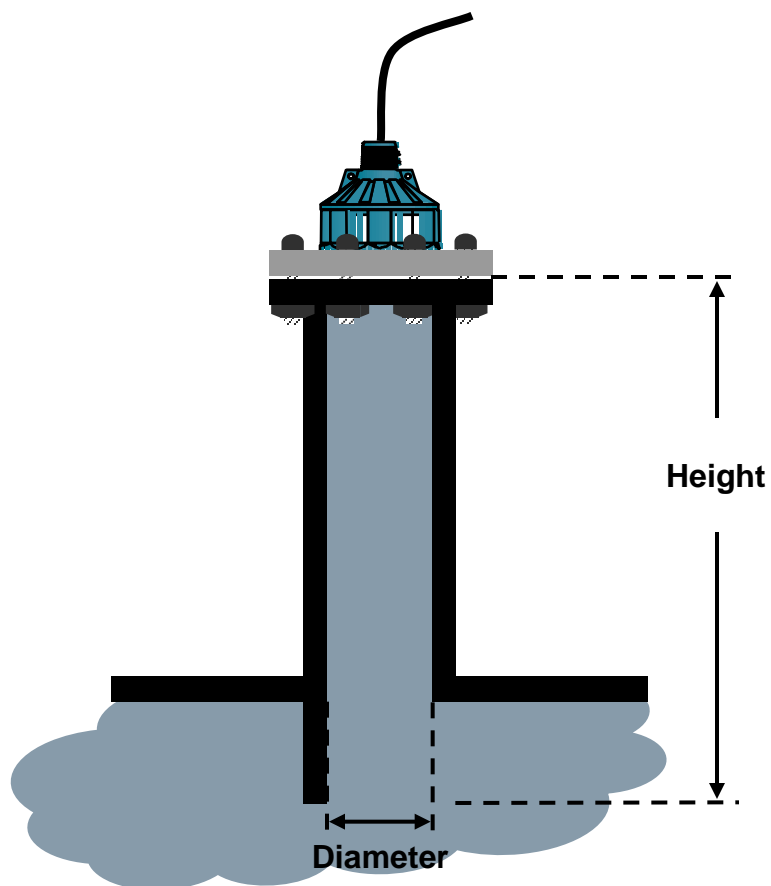
# Ultrasonic Transducers



## Mounting considerations

- Standpipe / nozzle
  - Minimum standpipe diameter of 3"
  - Standpipe height should be less than 3 times the diameter
  - If overall standpipe height is 6" or less, factory blanking can be used
  - If height is greater than 6" increase blanking to 4" beyond the standpipe bottom

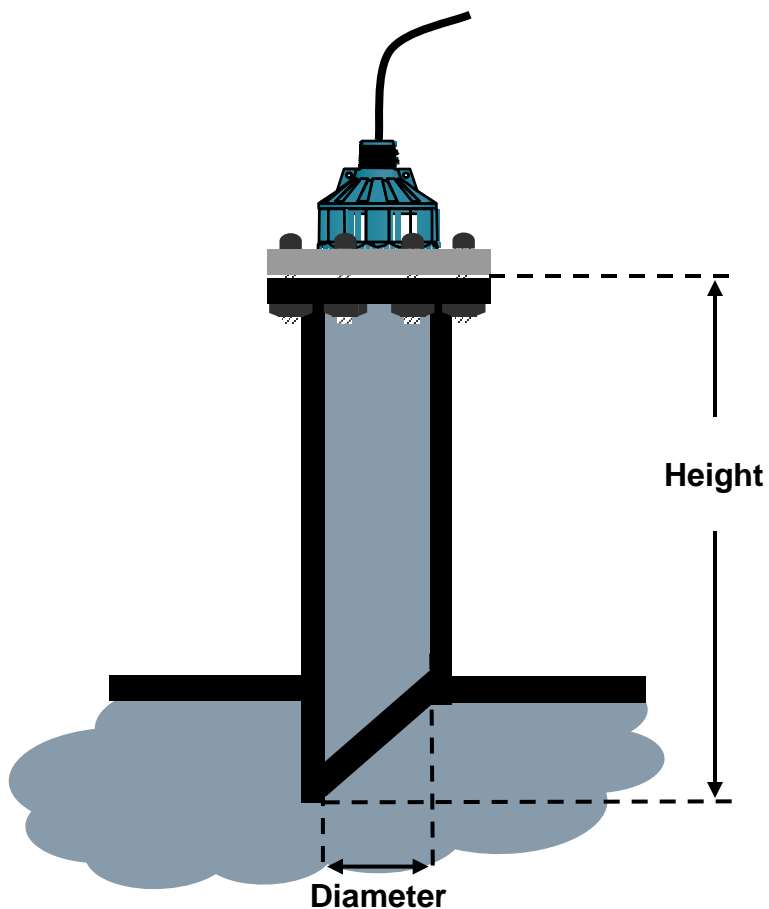
# Ultrasonic Transducers



## Mounting considerations

- Standpipe / nozzle
  - When considering height to width ratio ensure standpipe inside the vessel is included

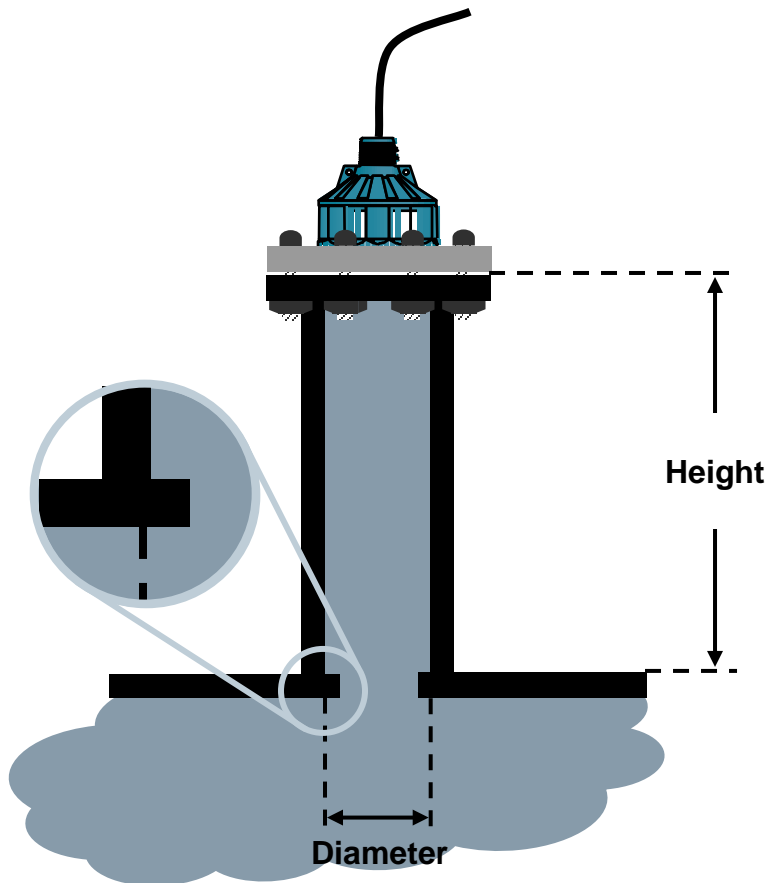
# Ultrasonic Transducers



## Mounting considerations

- Standpipe / nozzle
  - When considering height to width ratio ensure standpipe inside the vessel is included
  - Ideally, standpipe nozzles should be cut at a  $45^\circ$  angle

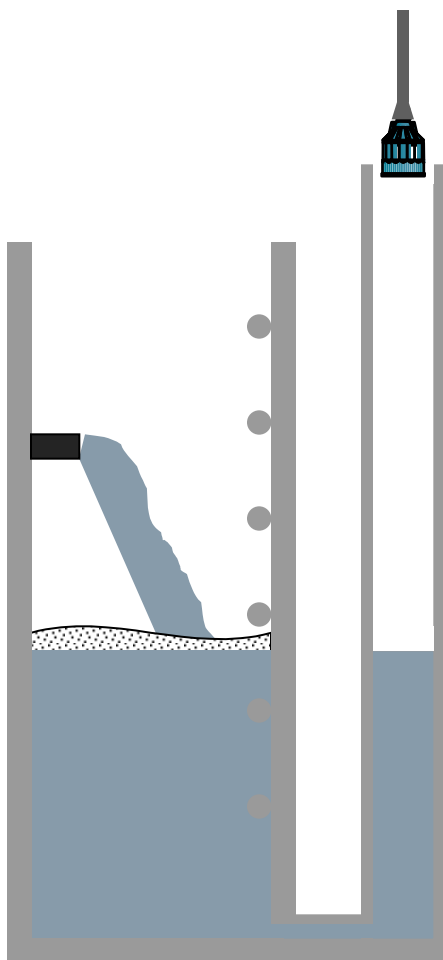
# Ultrasonic Transducers



## Mounting considerations

- Standpipe / nozzle
  - When considering height to width ratio ensure standpipe inside the vessel is included
  - Ideally, standpipe nozzles should be cut at a  $45^\circ$  angle
  - Standpipe side wall should be seamless and free of welds or burrs

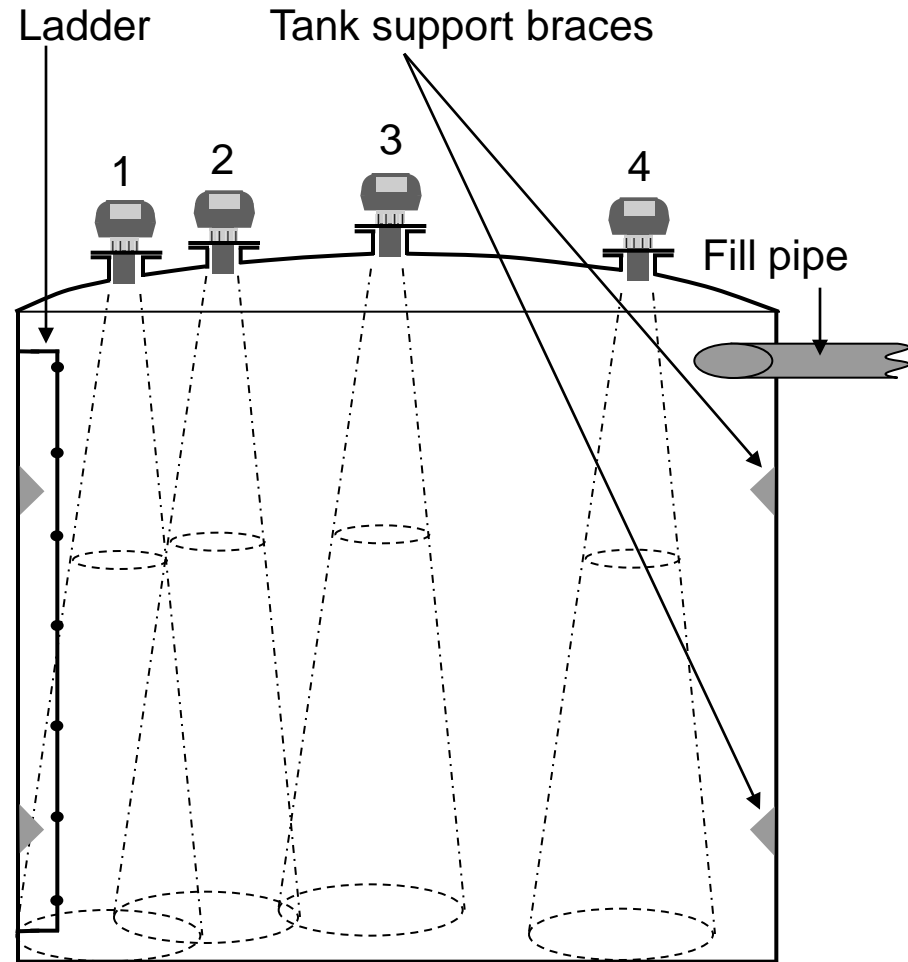
# Ultrasonic Transducers



## Mounting considerations

- Stilling Well
  - Vessels with obstructions
  - Foam
  - Highly agitated surfaces
  - Installed inside or outside the vessel
  - Must be vented at top with inlet at the bottom
  - Clean liquids only

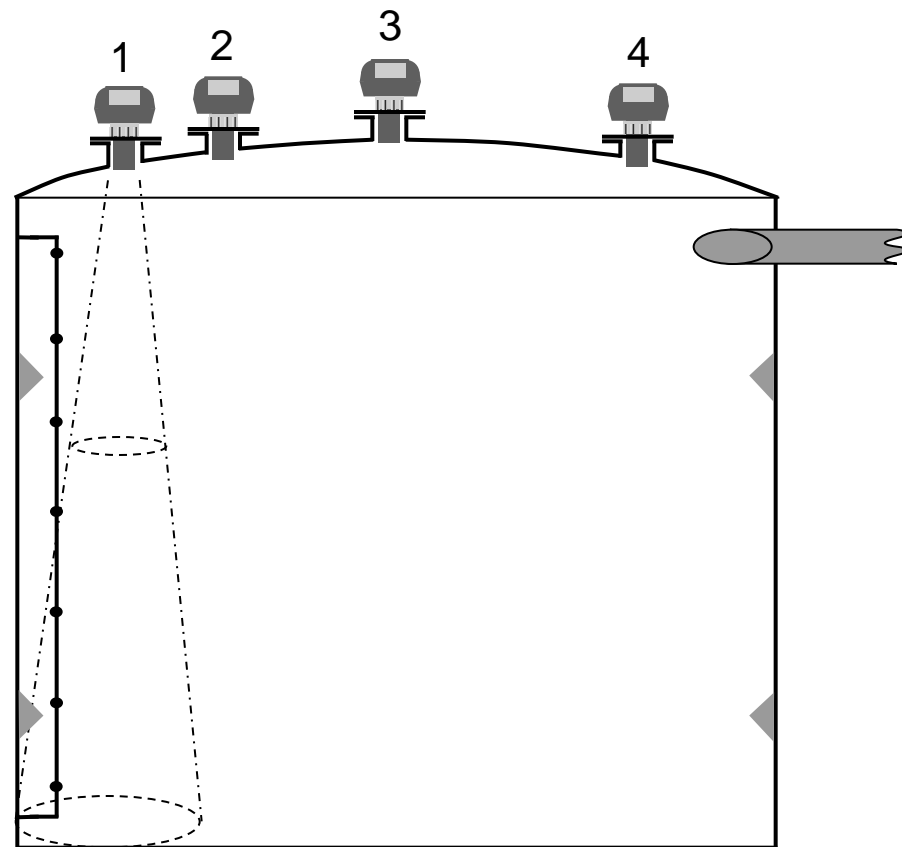
# Siemens Ultrasonics Mounting Considerations





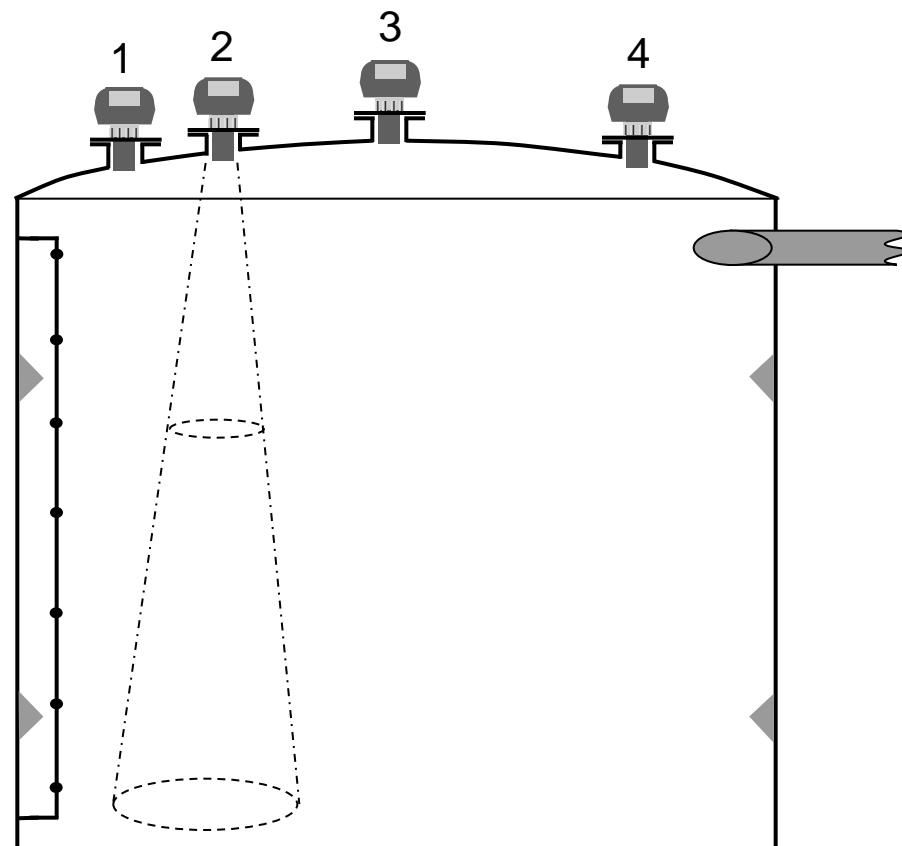
# Siemens Ultrasonics Mounting Considerations

1. Too close to side wall – interference from ladder rungs and support braces



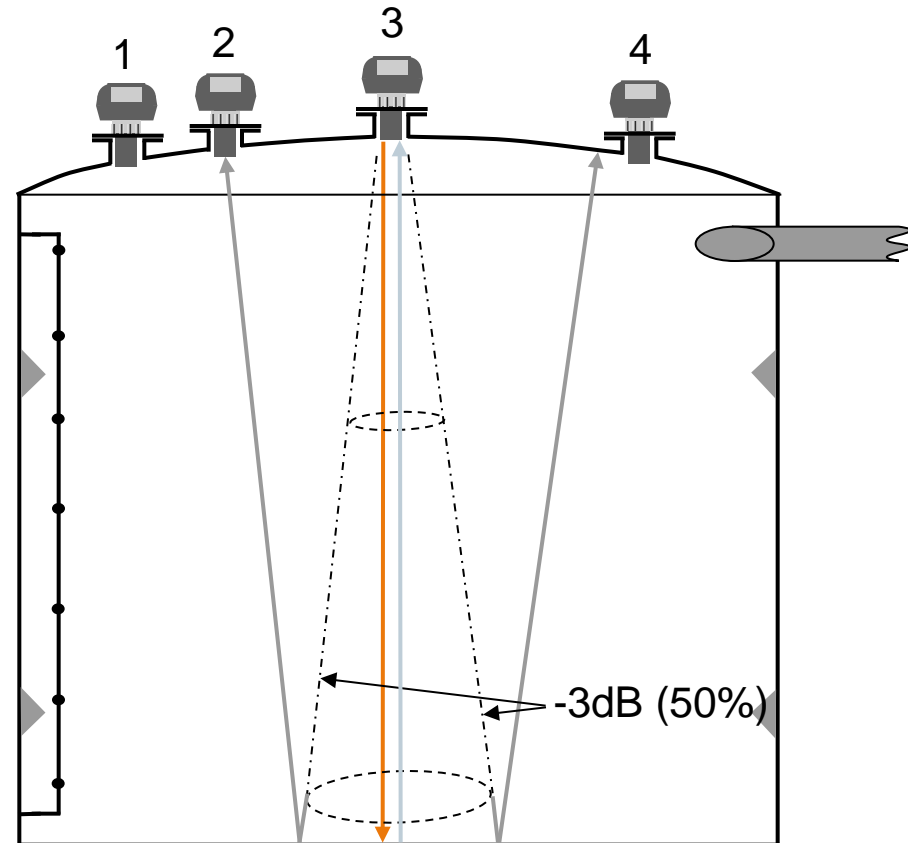
# Siemens Ultrasonics Mounting Considerations

1. Too close to side wall – interference from ladder rungs and support braces
2. Correct installation –  $\frac{1}{3}$  the distance from the side wall, no obstructions



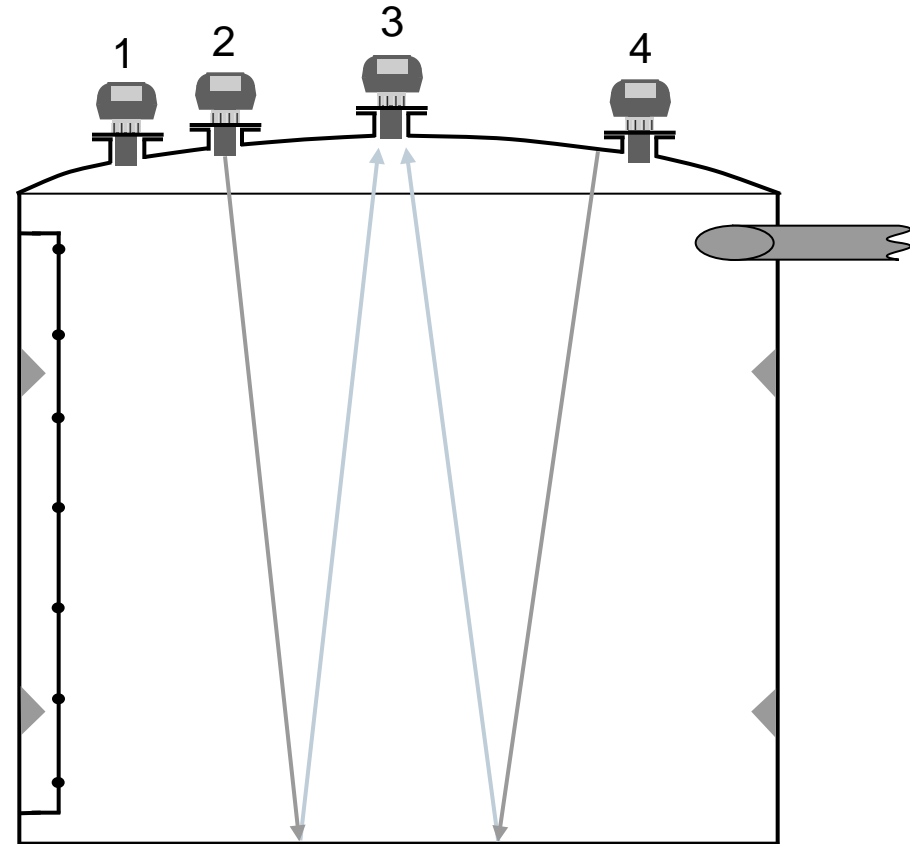
# Siemens Ultrasonics Mounting Considerations

1. Too close to side wall – interference from ladder rungs and support braces
2. Correct installation – 1/3 the distance from the side wall, no obstructions
3. Center of a parabolic tank – problems with secondary echoes



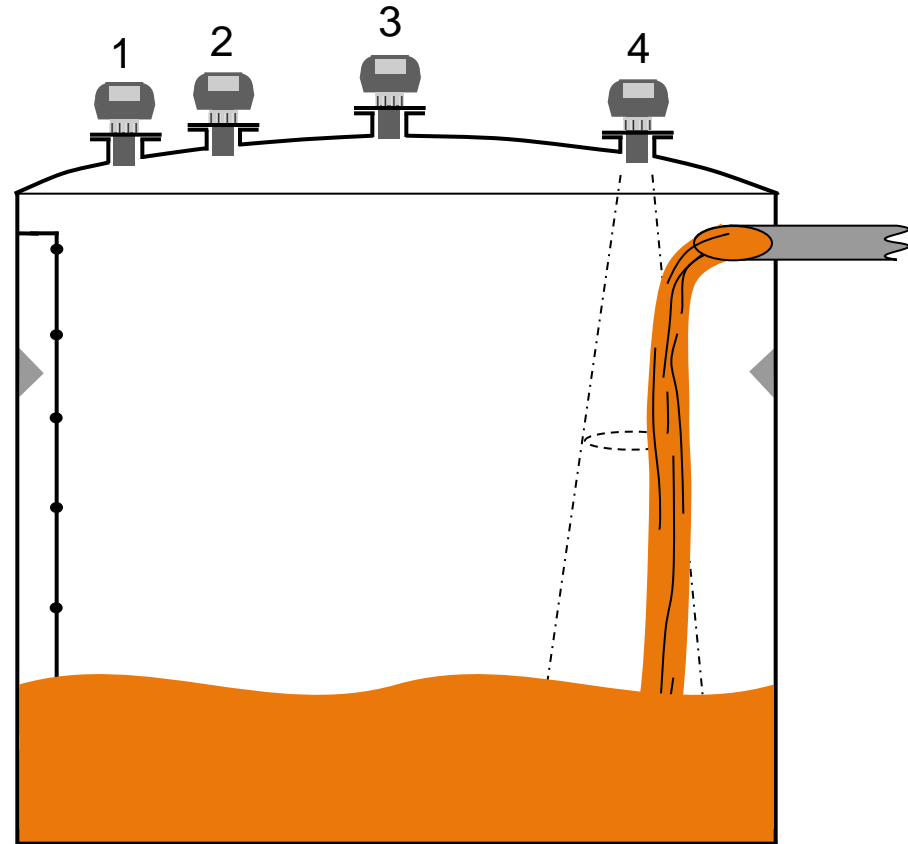
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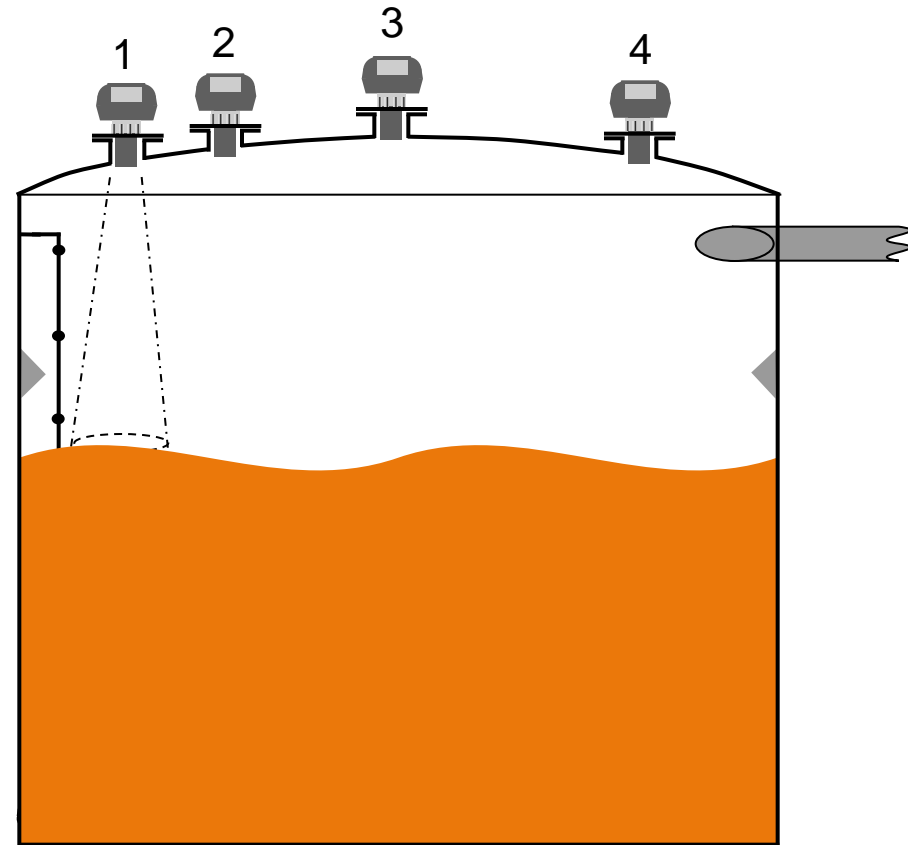
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1. Too close to side wall – interference from ladder rungs and support braces
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3. Center of a parabolic tank – problems with secondary echoes
4. Obstruction from fill stream



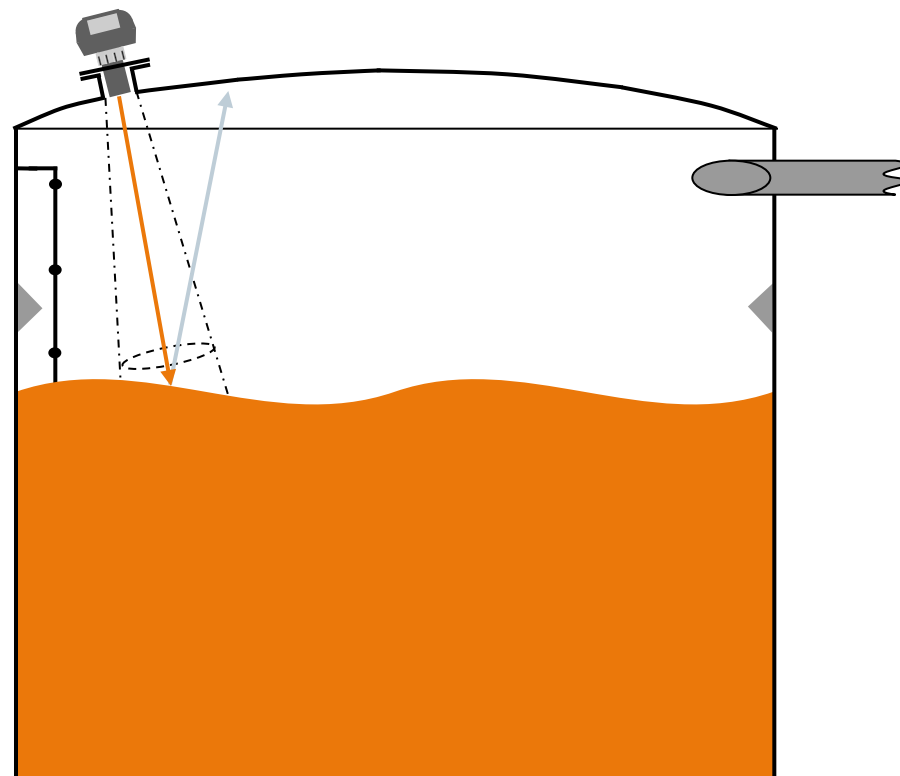
# Siemens Ultrasonics Mounting Considerations

- All material levels should be considered when selecting mounting location
- Obstructions must be exposed before Auto False Echo Suppression can be performed



# Siemens Ultrasonics Mounting Considerations

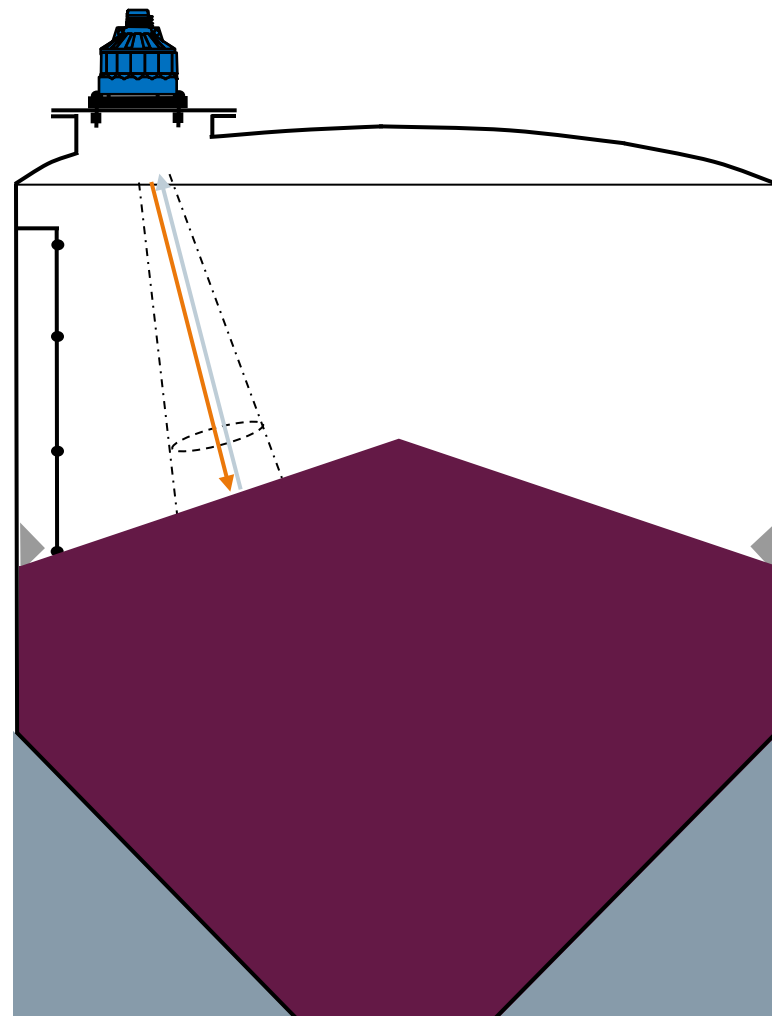
- The sound path should be perpendicular to the monitored surface
  - Flat for liquids and slurries





# Siemens Ultrasonics Mounting Considerations

- The sound path should be perpendicular to the monitored surface
  - Flat for liquids and slurries
  - Matching the angle of repose for solids



# Siemens Ultrasonics Mounting Considerations

- The sound path should be perpendicular to the monitored surface
  - Flat for liquids and slurries
  - Matching the angle of repose for solids
- For Ultrasonics, avoid proximity to high voltage or current wiring, high voltage or current contacts, and to variable frequency motor speed controllers

