

## UHF-PD Sensors



Condition Monitoring  
(for Generation)

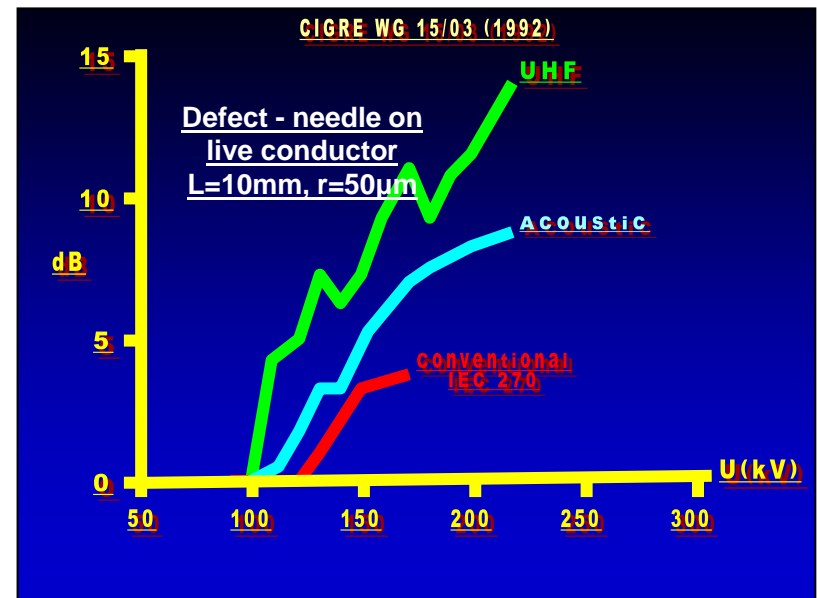


Condition Monitoring  
(for T&D)

- **UHF Sensors: Introduction**
- **UHF Sensor for Transformer**
  - **Internal Sensors**
  - **Window Sensors**
  - **Drain Valve Sensors**



- UHF measurement of partial discharge in GIS is only possible if the UHF signal can reach a suitably placed sensors
- Passive antenna manufactured to capture the very high frequency signals (200-3000 MHz) emitted by any spark inside the insulation material of any high voltage equipment
- **Features:**
  - Robust, passive, fixed sensors
  - Less sensitive to Noise (air corona and radio frequency) than HF, CT or TEV: No need of signal conditioning
  - Easy to install
  - Suitable for Continuous online monitoring
  - Highly accurate fault identification and localisation
  - Suitable for all kind of insulating material



## • UHF Sensor Type

- Internal Sensor
- Window Sensor
- Drain Valve Sensor

## • Sensor Location on transformer

- Depending on the user requirement

Feature	Single Phase Transformer and size up to 4m x 2m x 3m			
	1 Sensor	2 Sensors	3 Sensors	4 Sensors
PD Detection	Full Coverage	Full Coverage	Full Coverage	Full Coverage
PD fault classification	Yes	Yes	Yes	Yes
PD Localization	No	Poor	Accurate	V. Accurate

Feature	Three Phase Transformer or size > 4m x 2m x 3m					
	1 Sensor	2 Sensors	3 Sensors	4 Sensors	5 Sensors	6 Sensors
PD Detection	Partial Coverage	Partial Coverage	Full Coverage	Full Coverage	Full Coverage	Full Coverage
PD fault classification	Yes	Yes	Yes	Yes	Yes	Yes
PD Localization	No	No	Poor	Medium	Accurate	V. Accurate

## • Sensor Locations for accurate fault localisation

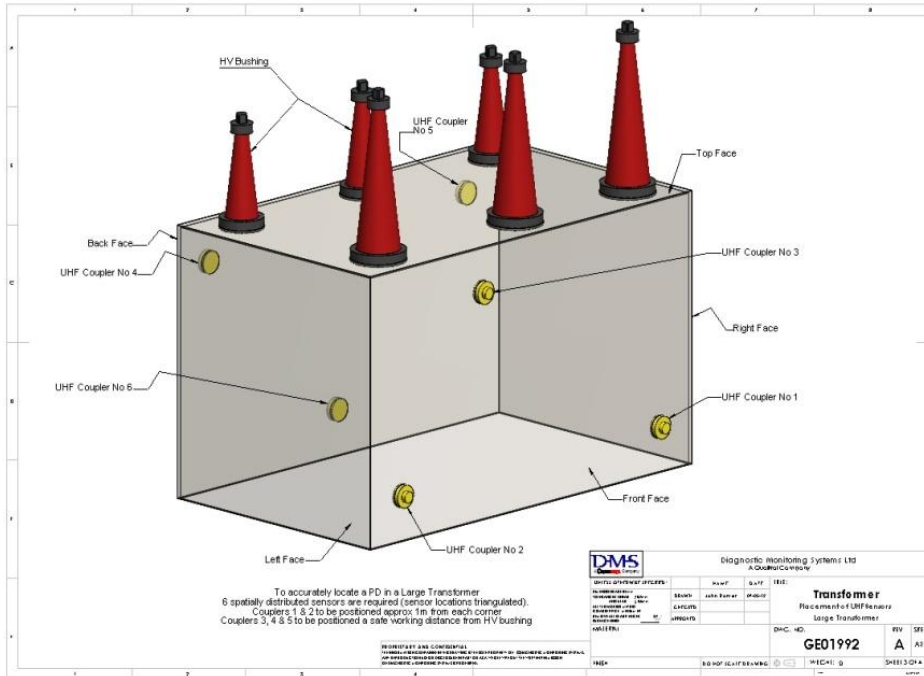
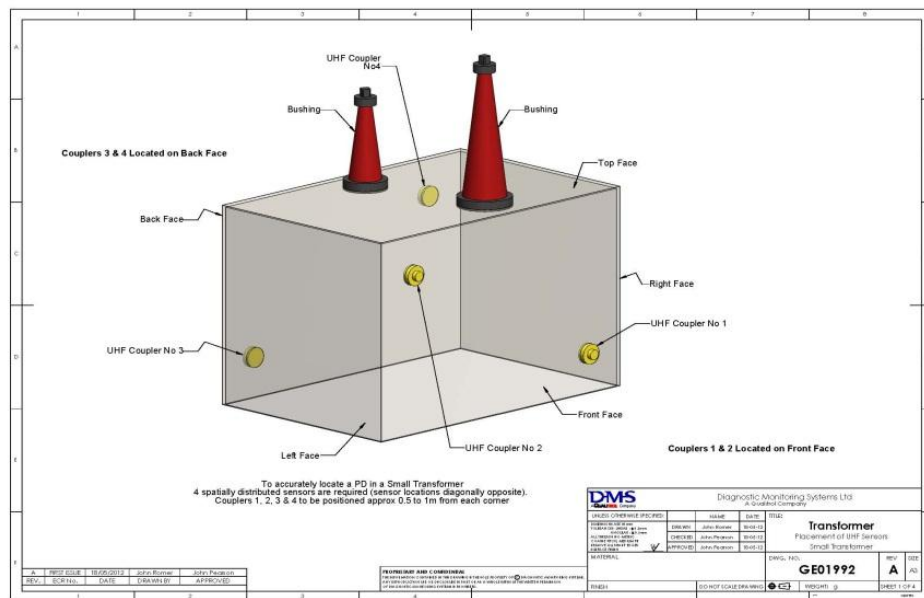
• Sensors are fitted with maximum possible spacing between them to allow better triangulation of signal

• **4 sensors:** Single phase transformers. e.g.

4m x 2m x 3m

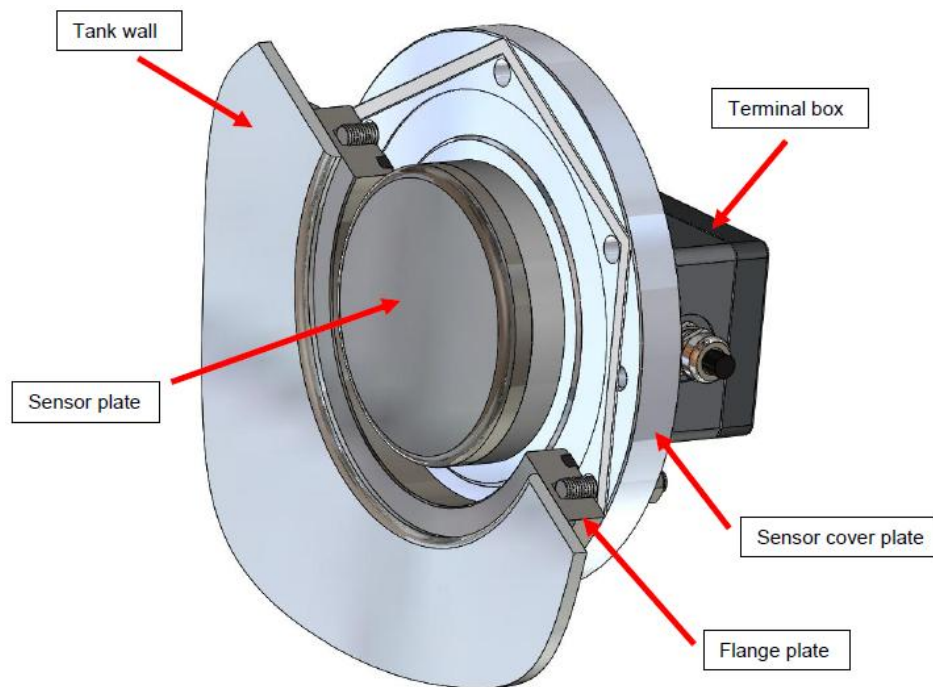
• **6 sensors:** 3-phase transformers and larger transformers e.g. larger than 4m x 2m x 3m

• Number may change in special cases depending on complexity of internal parts, separate tap changers etc



## • Features

- Mounted inside the tank
- New Transformer: Direct mount on the tank wall
- Retrofit – Mounted on hatch covers
- Flange plate provides the interface for mounting the sensors
- Suitable for the areas with high electric field
- Output: from an N-type, UHF co-axial connector
- Protective mounting of connectors by terminal box
- Built-In over voltage protection



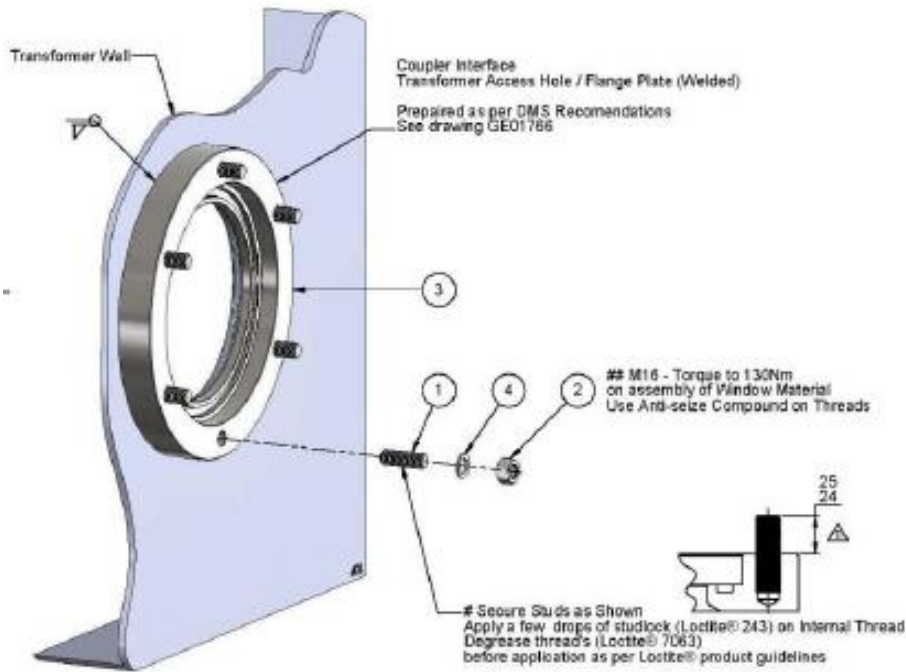
## • Technical Specifications

SI No	Paramter	Value
1	Frequency response	400 - 1500 KHz
2	Minimum effective sensitivity height (He) (NGC Standard)	6 mm (between 500 - 1500 MHz)
3	Percentage effective sensitivity height (P) (NGC Standard)	80% (between 500 - 1500 MHz)
4	UHF connection	N-type
5	Impedance of UHF connection	50 $\Omega$
6	Maximum operating pressure	15 bar
7	Maximum vacuum	0 bar
8	Minimum working temperature	-5 °C (Customizable for higher temperaures)
9	Maximum working temperature	120 °C (Customizable for higher temperaures)
10	Seals	VITON O'ring
11	Main body material	6082T6 - Aluminium
12	Type Testing	
12.1	- Vibration	BS EN 60068-2-6
12.2	- Shock	BS EN 60068-2-27
12.3	- Bump	BS EN 60068-2-29
13	Outside dimensions (diameter x depth)	290 x 60 mm
14	Weight (nominal)	6.9 Kg
15	Storage temperature	0 to +40 °C
16	Shelf life	12 months

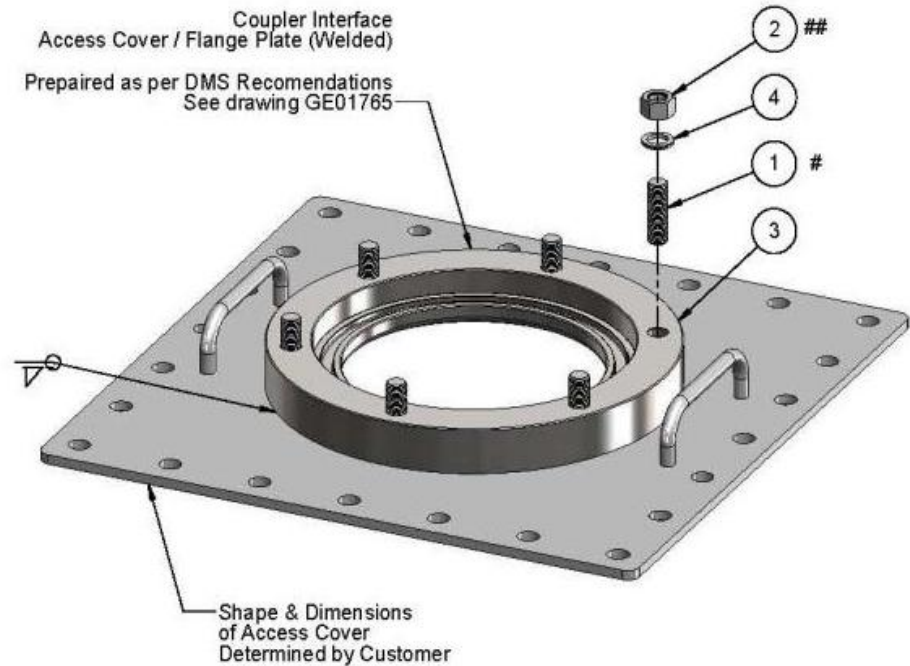
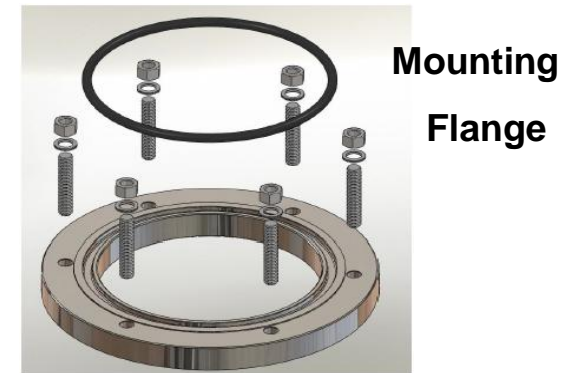


## • Installation Procedure

- Standard sensors must not intrude into high field areas – special sensors are available for such areas



**Directly mounted on the wall of the tank**

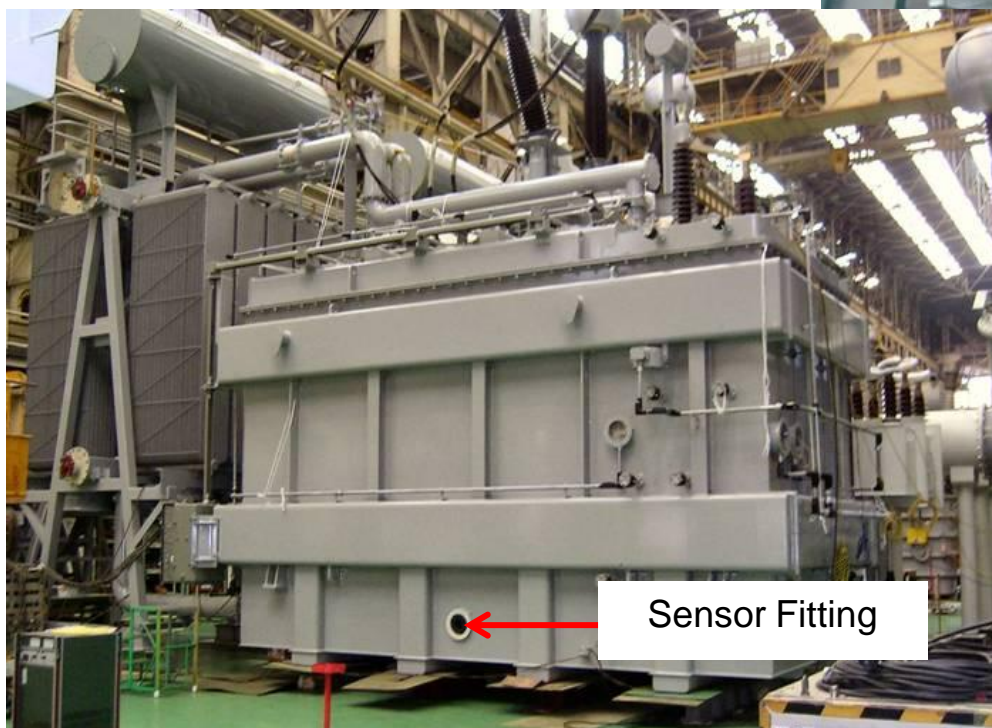


**Mounted on the hatch covers**



## Case Studies:

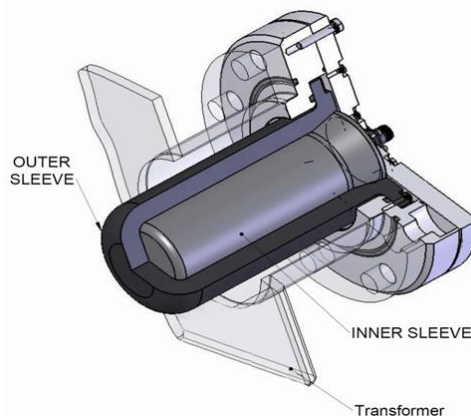
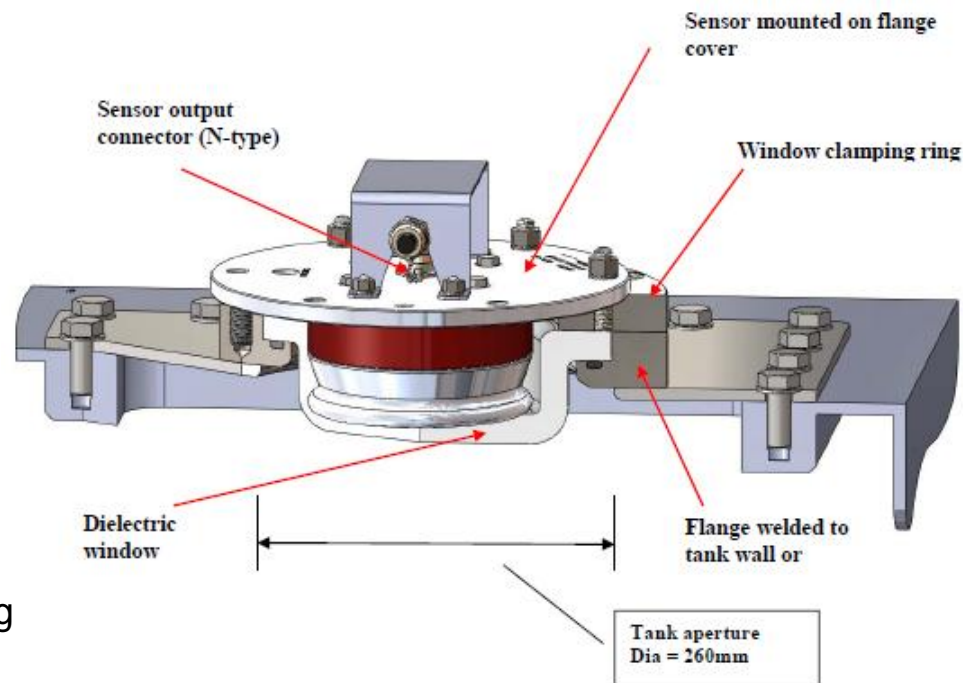
### Internal Sensor installations



PD Sensors fitted to a new build 400kV Phase Shift Transformer

## • Features

- Dielectric window mounted on the tank wall
- Sensor mounted to the flange of the window
- Sensor does not come in contact with the oil
- Ideal for new and retrofit transformers
- Suitable for the areas with high electric field
- Flange plate provides the interface for mounting the sensor
- Output is from an N-type, UHF co-axial connector
- Protective mounting of connectors by terminal box
- Over voltage protection

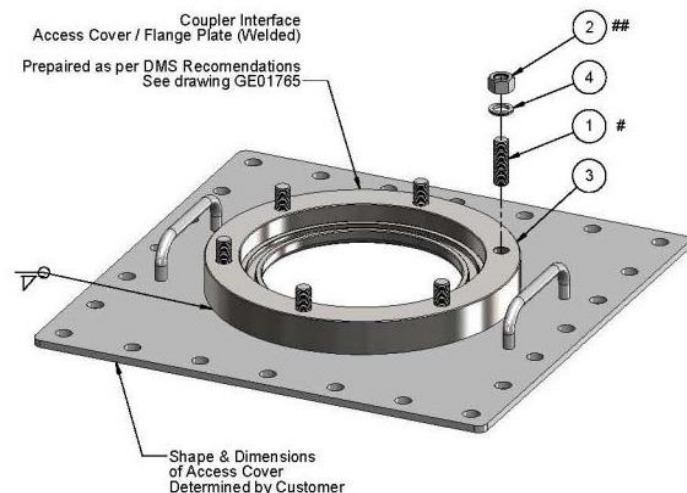
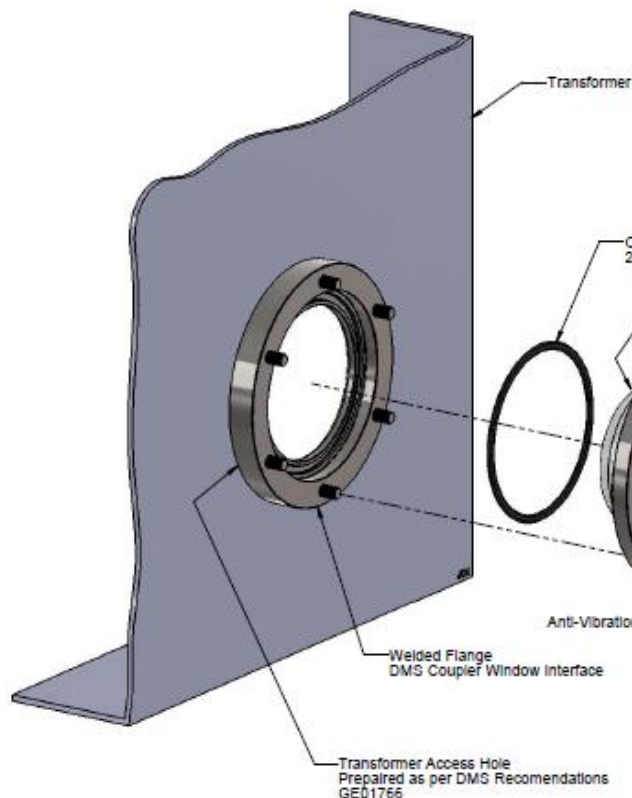
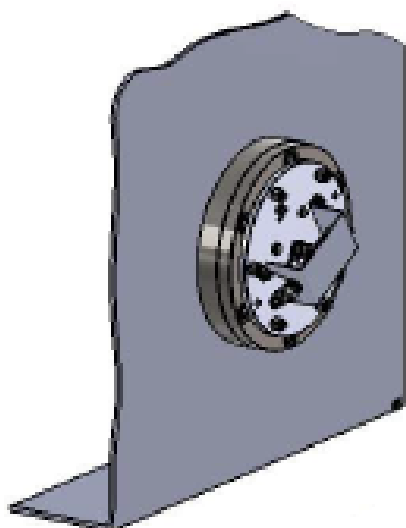


## • Technical Specifications

SI No	Paramter	Value
1	Frequency response	400 - 1500 KHz
2	Minimum effective sensitivity height (He) (NGC Standard)	6 mm (between 500 - 1500 MHz)
3	Percentage effective sensitivity height (P) (NGC Standard)	80% (between 500 - 1500 MHz)
4	UHF connection	N-type
5	Impedance of UHF connection	50 Ω
6	Maximum operating pressure	15 bar
7	Maximum vacuum	0 bar
8	Minimum working temperature	-5 °C (Customizable for lower temperaures)
9	Maximum working temperature	120 °C (Customizable for higher temperaures)
10	Seals	VITON O'ring
11	Window size	Customised
12	Main body material	6082T6 - Aluminium
13	Type Testing	
13.1	- Vibration	BS EN 60068-2-6
13.2	- Shock	BS EN 60068-2-27
13.3	- Bump	BS EN 60068-2-29
14	Weight (Window)	3.0 Kg
15	Weight (Sensor)	6.9 Kg
16	Storage temperature	0 to +40 °C
17	Shelf life	12 months

## • Installation Procedure

- Dielectric window mounted on the tank wall
- Sensor mounted to the flange of the window



**Hatch covers for mounting window**

**Window directly mounted on the wall of the tank**



## Case Studies:

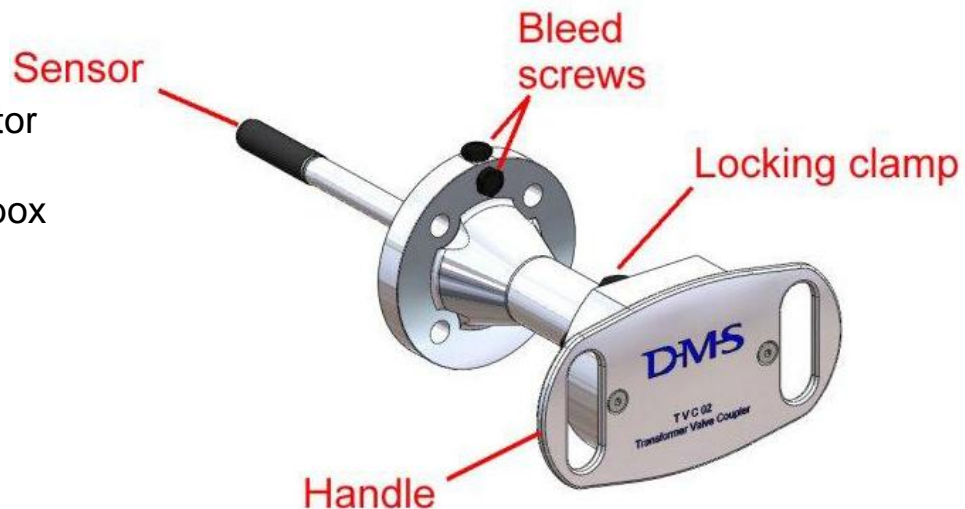
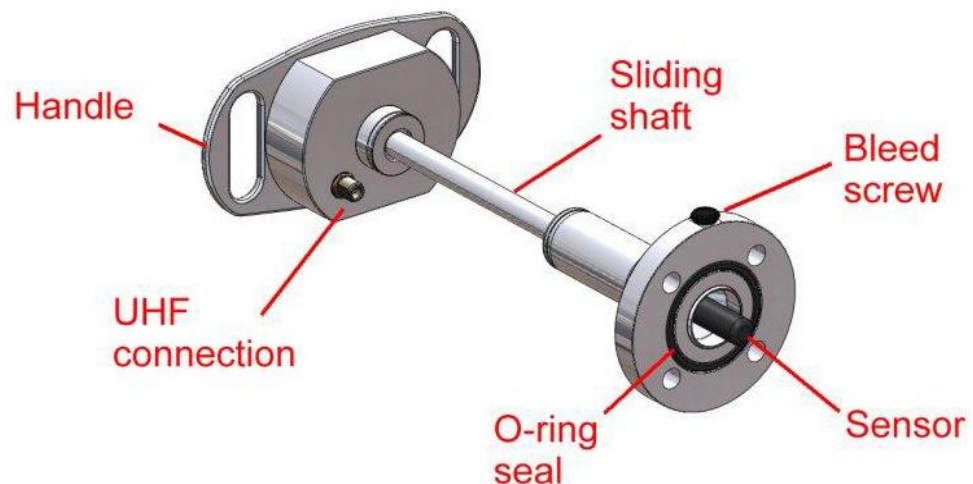
### Window Sensor installations



**Window PD sensor fitted to a new build 400kV Series Reactor**

## • Features

- Dielectric window mounted on the tank wall
- Sensor mounted to the flange of the window
- Sensor does not come in contact with the oil
- Ideal for new and retrofit transformers
- Suitable for the areas with high electric field
- Flange plate provides the interface for mounting the sensor
- Output is from an N-type, UHF co-axial connector
- Protective mounting of connectors by terminal box
- Over voltage protection

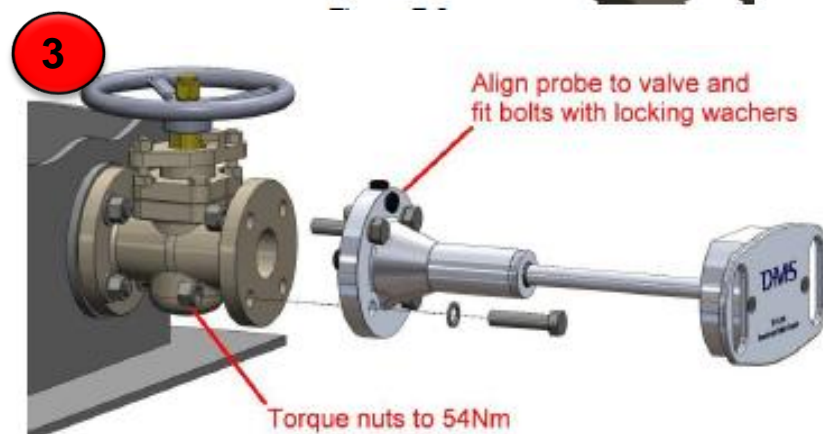
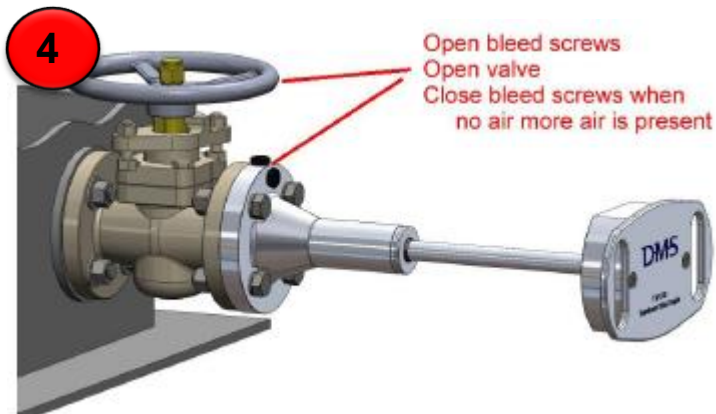
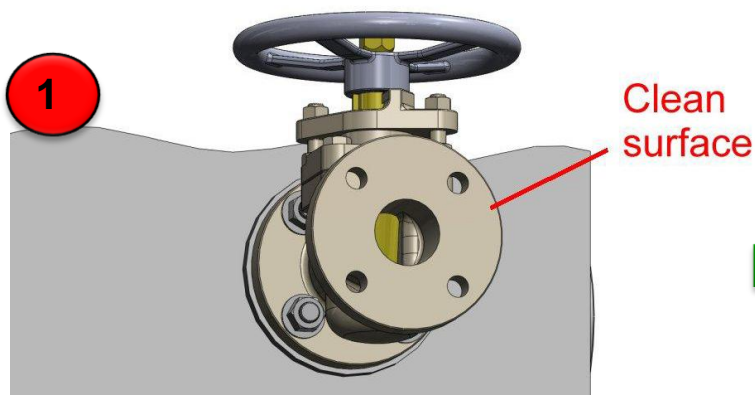


## • Technical Specifications

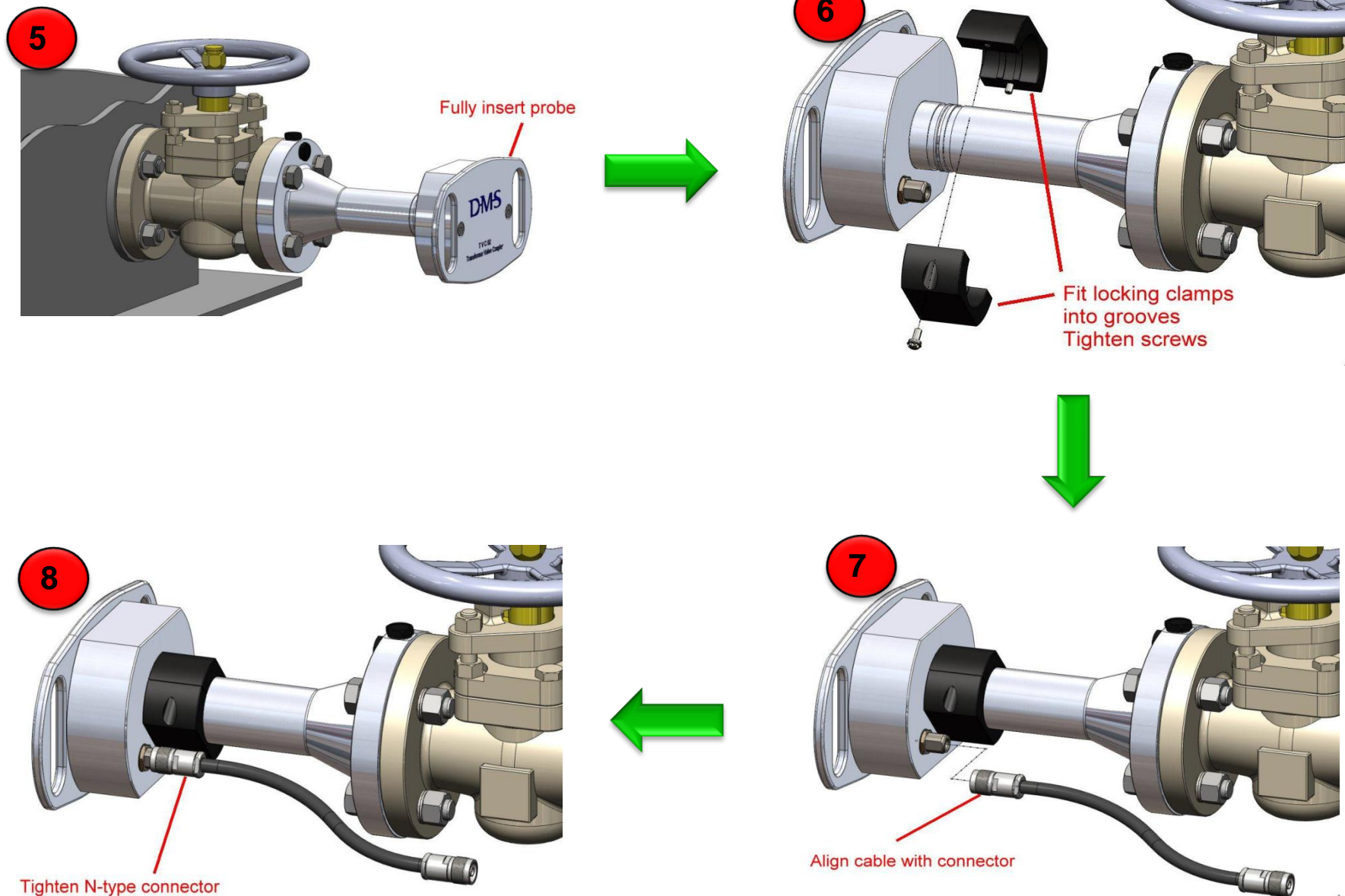
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4	UHF connection	N-type
5	Impedance of UHF connection	50 $\Omega$
6	Maximum operating pressure	15 bar
7	Maximum vacuum	0 bar
8	Minimum working temperature	-5 °C (Customizable for higher temperaures)
9	Maximum working temperature	120 °C (Customizable for higher temperaures)
10	Seals	VITON O'ring
11	Main body material	6082T6 - Aluminium
12	Type Testing	
12.1	- Vibration	BS EN 60068-2-6
12.2	- Shock	BS EN 60068-2-27
12.3	- Bump	BS EN 60068-2-29
13	Full Length	785 mm
14	Maximum protruding distance beyond inner tank wall	80 mm
15	Weight (nominal)	3.5 Kg
16	Storage temperature	0 to +40 °C
17	Shelf life	12 months



- **Installation Guide**

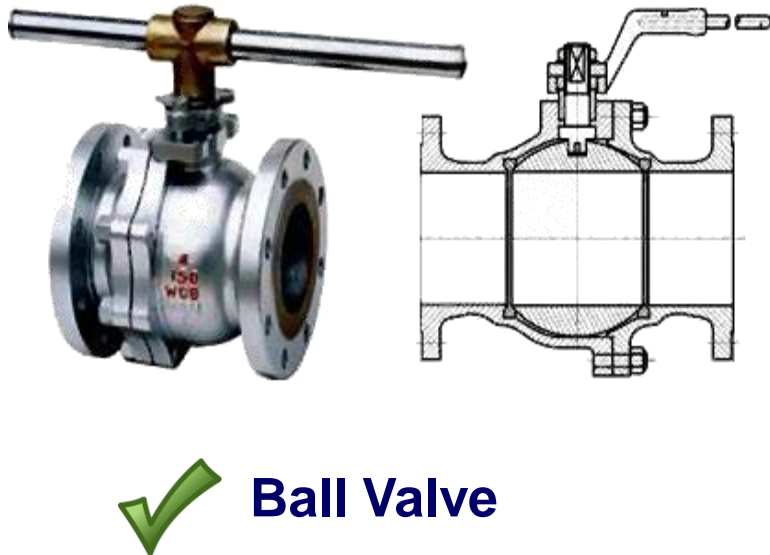


## • Installation Procedure



- **Acceptable Drain Valves**

- PD in a transformer can be monitored using UHF sensors inserted into the oil drain/filter valves provided that they are the correct type





## Case Studies: Drain Valve Sensor installations



