GE Oil & Gas
Drilling & Surface

Sondex* Wireline

Ultrawire™ Noise Tool

In-Line, $1^{11}/_{16}$", Ultrawire™, 20KPSI, SX Ends

Operation & Maintenance Manual

CE

Tool Code: NTO009
Document: MN-NTO009
Revision: C
Date: 30 April 2014

GE imagination at work

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Contents

0 ABOUT THIS MANUAL

0.1 Manual History

Date	Issue	Description	Auth	Chk	App
14/11/13	A	Draft issue of manual for Field Trials only.	BES	MN/ TG/PS	PR
24/04/14	B	Initial Issue.	BES	MN/ TG/PS	PR
28/04/14	C	Part Number change for: • Item 23 on AD-416005. • Item 9 in KITB-NTO009. • Item 8 in KITO-NTO009.	BES	SL	PR

0.2 References

Below are the manuals/links required for use in conjunction with this manual:

- Refer to: ***www.weeerohsinfo.com/***.
- Tool Safety Clamp manual (***MN-TSC001***).
- Warrior manual (***MN-WARRIOR***).
- Bullnose manual (***MN-BUL***).

0.3 Technical Help

For further technical help contact GE Oil & Gas Technical Services as follows:

Address: GE Oil & Gas
Building X107
Range Road
Cody Technology Park
Farnborough
Hampshire
GU14 0FG
United Kingdom

Telephone: +44 (0)1252 862200
Fax: +44 (0)1252 862349
Web: ***www.geoilandgas.com/downholetechnology***

0.4 Feedback

To help us improve future issues of this manual, please visit our website ***www.geoilandgas.com/downholetechnology***, reference the document number and add your comments or corrections.

Thank you.

Photographs and sketches are for illustration purposes only. Dependant on the tool model that you have, certain features or dimensions can differ from those shown.

Documents from external sources (for example MSDS/SDS) supplied with or referenced to in this manual, are considered the latest version at the time the manual was issued. However, the document can be altered by the external source without prior notice to Sondex Wireline Ltd.

1 OVERVIEW

The Ultrawire™ Noise Tool (NTO009) is designed to measure downhole noise in the frequency range 100Hz to 12.7kHz. The tool Sensor Assembly is an extremely sensitive hydrophone that is highly effective in the detection of flow both inside and outside the cased well. The Electronics Assembly digitises the downhole noise and sends a frequency spectrum to the surface to be recorded. The frequency spectrum and the standard six high-pass frequency cuts are displayed on the log for interpretation.

Figure 1-1 NTO009

1.1 Applications

The Noise Tool can be used to:

- Evaluate flow profiles.
- Locate channels behind a well case.
- Locate gas-liquid interfaces.
- Locate leaks in a well case.

In addition, the tool can be combined with a Casing Collar Locator (CCL), Temperature and Gamma Ray or other Ultrawire™ tool.

1.2 Interface & Tool Combinations

- Ultrawire™ Controller for toolstring communication.
- Simultaneous operation with other Ultrawire™ Logging tools.
- Bottom end tool or Bullnose (BUL) for Ultrawire™ termination.

1.3 Specifications

Table 1-1 NTO009 specifications

Parameter	Specification	Remarks
Maximum Temperature	177°C (350°F)	---
Maximum Pressure	20,000psi (137.9MPa)	---
Diameter	$1^{11}/_{16}$" (43mm)	---
Make-up Length	594mm 23.39")	---
Transportation Length	691mm (27.21")	Thread protectors fitted
Measure Point	200mm (7.87")	From the bottom of the tool
Weight	4.75kg (9.92lbs)	---
Operational Voltages:		
Nominal	18VDC	---
Range	12VDC to 20VDC	---
Max	22VDC	---
Current Consumption	15mA to 20mA @18VDC	Typical
Ultrawire™ Tool Address	25	Factory default address
End Threads:		
Upper	$1^{3}/_{16}$˝ 12 UN 2B Sondex female	---
Lower	$1^{3}/_{16}$˝ 12 UN 2A Sondex male	---
End Connectors:		
Upper	4mm single conductor male pin	---
Lower	4mm single conductor female socket	---

2 SAFETY

In normal use, there are some specific safety instructions to safely handle GE Oil & Gas equipment. The information in this section must be followed in addition to your specific Company and Local Rules & Regulations (Directives).

Personnel must be qualified to operate or service this equipment. When the equipment is not installed, commissioned, used and maintained in accordance with the specifications of GE Oil & Gas, protection will likely be impaired.

When GE Oil & Gas equipment is incorporated with other equipment into a system, the safety of that system is then the responsibility of the person who assembles the system.

When the warning symbols  or  are displayed on the equipment, the manual **MUST** be consulted to understand fully any potential hazards and required safety precautions before the equipment is used or serviced.

2.1 Hazardous Areas and 'Hot Work'

WARNING!

HAZARDOUS AREAS AND 'HOT WORK'!

Under certain circumstances or failure modes this equipment can become a potential source of ignition.

It can be used only in Safe Areas and cannot be used in classified Hazardous Areas ('Zoned' areas) unless a approved system of work is in place (for example, Hot Work Permit) and applicable precautionary measures have been followed (for example, monitor for gas leaks, site inspection, equipment to fight fires, work procedures).

This must be done in accordance with local and national legislation with regard to the use of electrical equipment in potentially explosive atmospheres.

2.1.1 WELL FLUID

WARNING!

WELL FLUID!

When the tool has been recovered from the well it could be contaminated with Well Fluid residues. These Well Fluids can contain irritants and/or poisonous gases.

Well Fluids could contain:

- **Hydrogen Sulphide (H_2S).**
- **Carbon Dioxide (CO_2).**

Wear protective glasses/goggles.

Wear protective gloves.

DO NOT operate, service or store contaminated tools in an enclosed area.

Consult the Well Operator for the relevant safety information and data sheets on the listed or any other contaminants.

Refer to *Section 2.1.2, Disposal of Hazardous Substances*.

WARNING!

TOXIC!

Inhalation of Well Fluid gases can be toxic and can cause breathing difficulties and effects on the nervous and cardiovascular systems.

Contact with eyes or skin can cause irritation.

WARNING!

FLAMMABLE!

DO NOT use near open flames, sparks or high-heat sources.

DO NOT smoke!

WARNING!

ENVIRONMENTAL HAZARD!

Well Fluid is very dangerous to the environment.

DO NOT release Well Fluid into drains or other aquatic discharges/water courses.

2.1.2 *Disposal of Hazardous Substances*

All hazardous substances **MUST** be disposed of in accordance with the relevant MSDS/SDS, Local Rules & Regulations (Directives) and International Rules & Regulations (Directives).

2.2 *Electrical Hazard*

WARNING!

ELECTRICAL HAZARD!

To protect operators during the maintenance and the service of the downhole tools when powered via a dummy logging cable, make sure the Tool Safety Clamp (*P/N: KITB-UW-Earth Clip* for Ultrawire™ tools) is attached to the toolstring and grounded correctly. Refer to the Tool Safety Clamp manual (*MN-TSC001*).

2.3 *Stored Energy*

WARNING!

STORED ENERGY!

Some GE Oil & Gas logging tools have components/areas that can store energy. This energy can be released without warning and can present a potential hazard to personnel.

Read *Section 5.1, Relief of Trapped Pressure - Tool Disassembly* and take the precautions recommended. When in doubt contact *GE Oil & Gas Technical Services* for further advice.

2.3.1 TRAPPED PRESSURE SAFETY PRECAUTIONS

WARNING!

TRAPPED PRESSURE!

Spaces in GE Oil & Gas logging tools can retain trapped pressure after a downhole leakage. As this pressure can be released without warning, always:

- **Follow the instructions in the manual, inform *GE Oil & Gas Technical Services* IMMEDIATELY of the situation and to obtain additional advice when required.**
- **Make sure all trapped pressure has been removed from the tool before it is transported. Well fluid can be hazardous. Refer to *Section 2.1.1, Well Fluid*.**

Wear a protective face shield.

Wear a protective apron.

Logging tools are subjected to harsh conditions downhole. High hydrostatic-pressure, high-temperature, shock, vibration and contact with corrosive substances can all contribute to possible leaks into sealed housings. Leak paths include but are not limited to:

- Permeation through the seals.
- Seal failures.
- Hairline cracks in welds.

During the deployment of a tool down hole, one or more of the above failure conditions can lead to a fluid/gas leak into the cavities of the tool. The leakage paths are rarely completely reversible and so a proportion of the fluid/gas is likely to be retained (trapped) inside the tool as it is recovered from the well. In some cases the quantity, composition and pressure of the trapped fluid/gas will present a significant safety hazard in terms of stored potential energy.

Trapped pressure in a tool represents a significant hazard as the tool is handled immediately after it is removed from a well. The hazard continues to exist during the subsequent transportation, storage, repair and service operations. In extreme conditions, the tool could explode! Therefore all precautions must be taken to mitigate injury to the operator and nearby personnel.

Listed below are some signs that indicate the tool could contain trapped pressure:

- Telemetry failures downhole.
- Signs of mechanical damage.
- Unusual seepage of fluid, bubbles or gas out of the tool.
- Tools that have been fished.
- Tools that have been downhole for extended periods.
- Hard to undo Housings or Split Nuts.

When there are signs of trapped pressure, read first ***Section 4.4, Post-Logging: Toolstring Disassembly*** and then ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly*** in the order shown to mitigate hazards.

2.3.1.1 REMEMBER

1 **DO NOT** point parts of the tool (that can become projectiles) at either yourself or others.

2 **DO NOT** release the pressure by the removal of filler plugs or other small plug items, unless the tool manual shows different instructions (refer to ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly***) that this is the correct method to release the trapped pressure.

3 **DO NOT** ignore the risk of trapped pressure and return the tool to its transport case. The tool can explode at any time due to sudden mechanical shock or changes in atmospheric pressure. This could be dangerous with some methods of transport. For example, when the tool is transported in an aircraft.

4 **DO NOT** open the tool in a confined or enclosed space. There is a possibility of toxic chemical release. Refer to ***Section 2.1.1, Well Fluid***.

5 **DO NOT** install the Thread Protectors to the ends of the tool.

2.3.1.2 Recommended Precautions to Follow

1 **Always** wear Personal Protective Equipment (PPE) - hard toe boots, safety glasses and fluid resistant gloves are a minimum.

2 **Always** put (in a prominent position) a noticeable warning indicator on the tool (marker pen, sticky label, etc.) to tell others that the tool could contain trapped pressure.

3 **Always** let the tool stand in a cordoned-off safe area (outdoors is recommended - refer to ***Section 2.1.1, Well Fluid***) with hazard signs to indicate the potential hazard that can be read from a safe distance, for a minimum of 24hrs (where possible, let the tool stand for a longer period). Pressure can leak out slowly and (with a sufficient period) the tool pressure will decrease to a less dangerous and a more manageable level.

4 **Always** make all colleagues and other operators in the area know that the tool could contain trapped pressure.

5 **Always** give a sufficient period for the tool to cool down to the ambient temperature. Fluids (especially gases) have more stored potential energy at a high temperature than at ambient temperature. When the tool is allowed to cool down, it will decrease this potential energy.

6 **Always** know that the well fluid in the tool could be hazardous or toxic. For example, it could contain Hydrogen Sulphide (H_2S). Take all necessary precautions to prevent harm to operators. Thus do disassemble the tool outdoors and monitor for toxic chemicals.

7 **Always** know that the well fluid in the tool could be a flammable gas or mist. Disassemble the tool away from sources of ignition.

8 **Always** make sure the suspect tool is disassembled until all inner volumes have been made safe and free of pressure.

9 Refer to ***Section 4.4, Post-Logging: Toolstring Disassembly***.

2.4 Irritants

The necessary precautions to use, store or discard an irritant are:

- **ALWAYS** refer to the applicable Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for the irritant.
- **DO NOT** allow the irritant to come into contact with the skin or eyes.
- **DO NOT** ingest or allow the irritant to come into contact with the mouth.

When the disposal of an irritant is necessary, it **MUST** be in accordance with all Local Rules & Regulations (Directives) for the country where the disposal is to occur. When not available, then International Rules & Regulations (Directives) **MUST** be followed.

2.4.1 *LIQUID-O-RING® TYPE 101 LUBRICANT*

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Wear protective gloves.

Wear protective goggles/glasses.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Liquid-O-Ring® type 101.

2.4.2 *LOCTITE® 290 THREADLOCKER*

IRRITANT!

LOCTITE® 290 THREADLOCKER

Wear protective gloves.

Wear protective goggles/glasses.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Loctite® 290.

2.4.3 *DOW CORNING® 3140 RTV COATING*

IRRITANT!

DOW CORNING® 3140 RTV COATING

Wear protective gloves.

Wash hands after use.

For further safety information, refer to the Safety Data Sheet (SDS) for Dow Corning® 3140 RTV Coating.

2.4.4 *DOW CORNING® 3145 RTV ADHESIVE/SEALANT*

IRRITANT!

DOW CORNING® 3145 RTV ADHESIVE/SEALANT

Wear protective gloves.

Wash hands after use.

For further safety information, refer to the Safety Data Sheet (SDS) for Dow Corning® 3145 RTV Adhesive/Sealant.

2.4.5 DOW CORNING® 200® FLUID, 100CST OIL

IRRITANT!

DOW CORNING® 200® FLUID, 100CST OIL

Wear protective gloves.

Wear protective goggles/glasses.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Dow Corning® 200® Fluid, 100CST Oil.

2.4.6 ISOPROPYL ALCOHOL (IPA)

IRRITANT!

ISOPROPYL ALCOHOL (IPA)

Wear protective gloves.

Wear protective goggles/glasses.

Wash hands after use.

For further safety information, refer to the Safety Data Sheet (SDS) for Isopropyl Alcohol (IPA).

WARNING!

FLAMMABLE!

DO NOT use near open flames, sparks or high-heat sources.

DO NOT smoke!

2.5 Tool Integrity

2.5.1 GREASES AND SEALANTS

CAUTION!

GREASES AND SEALANTS!

Electrical failure can occur when some greases and sealants are used. Those that contain a volatile content can produce gasses in the tool when heated.

The correct greases and lubricants **MUST** be used in the maintenance of all GE Oil & Gas downhole equipment. Some threads are internal and do not stop the ingress of grease into the tool. **DO NOT** use too much grease. **DO NOT** use copper loaded greases unless specified in the related tool manual.

2.5.2 Seal Maintenance

CAUTION!

Seal Integrity!

Tool function relies on seal integrity.

Remove, discard and replace when damaged and at recommended service intervals. Refer to ***Section 7.1.4, Seal Replacement Recommendations***.

2.5.3 Fluid/Gas Ingress

CAUTION!

Fluid/Gas Ingress!

The Split Nuts/Tool Joints **MUST** be tightened correctly and fully to prevent fluid ingress.

The tool is designed to be used in a hostile environment. This is only possible when:

- All seals are installed correctly.
- All Split Nuts/Tool Joints have been tightened correctly and fully.

Failure to complete the above can result in the ingress of fluids or corrosive gases that could damage the tool. Where there is fluid/gas ingress the tool could contain trapped pressure. This trapped pressure can be dangerous when not released in a procedure approved for the tool. Refer to the applicable Section in the related equipment manual for the correct procedure to release trapped pressure and to ***Section 2.3.1, Trapped Pressure Safety Precautions***.

2.6 Connection to the Toolstring

2.6.1 Bend Stresses During Rig Up/Rig Down

CAUTION!

Bend Stresses!

When the tool is not supported correctly, it can be subjected to bend stresses that exceed its design limit.

To prevent damage to the tool/toolstring:

- GE Oil & Gas recommends the tool/toolstring is assembled/disassembled with the use of a riser or a lubricator. When not possible, Rig Up/Rig Down the toolstring vertically.
- **DO NOT** move an assembled long or heavy tool/toolstring between the horizontal and the vertical positions.
- **DO NOT** lift long or heavy tools/toolstring by the cable head to manoeuvre it or for transportation purposes.
- Make sure the tool is supported sufficiently when serviced.

2.6.2 Torque Application

CAUTION!

Torque Application!

DO NOT apply a torque along the length of the Crystal Housing.

A torque along the length of the Crystal Housing can damage:

- The Crystal Housing.
- The lower end of the Mandrel.

2.7 Electrostatic Discharge (ESD)

CAUTION!

ELECTROSTATIC DISCHARGE!

The tool contains electronic circuits and devices that can suffer permanent damage when exposed to electrostatic discharge (ESD).

ALL ESD precautions must be taken to prevent electrostatic discharge damage to the electronics during tool maintenance.

2.7.1 CHARGE BUILD-UP

WARNING!

SHOCK HAZARD!

Some stresses can induce charge build-up in the crystal.

GE Oil & Gas recommend the crystal is grounded sufficiently.

2.8 WEEE Disposal Information

CAUTION!

ELECTRICAL EQUIPMENT DISPOSAL!

Disposal of electrical equipment must be in accordance with Local/International Rules and Regulations. They will recommend the collection framework available to return, recycle and treatment of electrical wire and components.

For more information refer to: ***http://www.weeerohsinfo.com/***.

2.9 EMC Classification

CAUTION!

EMC CLASSIFICATION

This is a Class A product. In a domestic environment this product can cause radio interference in which case the user can be required to take adequate measures.

2.10 Transport and Storage

WARNING!

WELL FLUID!

Refer to *Section 2.1.1, Well Fluid*.

Where the equipment is supplied in a carry tube and/or flight case, GE Oil & Gas recommends the equipment is stored and transported in that carry tube and/or flight case for protection.

The tool must be stored and transported with the threads and O-Rings lightly greased with Liquid-O-Ring® (***P/N: LOR101***) and the Thread Protectors fitted.

DO NOT subject the equipment to excessive shock and/or vibration.

Fit other protective devices (Closing Ring, etc.) to the NTO009.

3 THEORY OF OPERATION

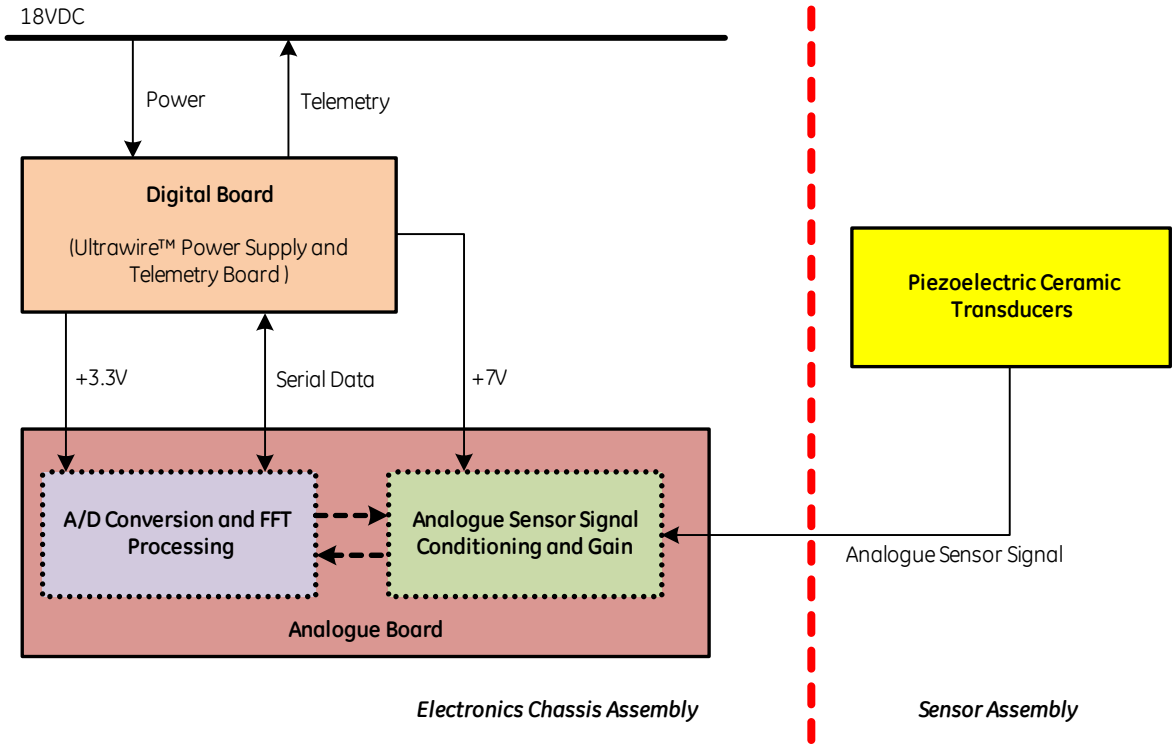


Figure 3-1 System configuration of the NTO009

3.1 Principle of Operation

The In-Line Electronics Chassis Assembly (***item 2, 416026***) consists of two PCBs:

- The Digital Board.
- The Analogue Board.

Figure 3-1 shows the interaction between these boards in the assembly.

Acoustic signals in the well fluid cause vibrations that deform physically (on a microscopic level) the Piezoelectric Ceramic Transducers (contained in an oil-filled hydrophone sensor-cavity). This deformation causes voltages to develop on the surfaces of the Piezoelectric Ceramic Transducers. Subsequently the In-Line Electronics detect these voltages.

These signals are conditioned for frequencies that range from 100Hz to 12.7KHz and are processed digitally downhole to produce a Fast Fourier Transform (FFT) spectrum. This processed signal is sent to the surface where it can be displayed in both FFT and multiple high-pass filter-band formats (refer to ***Figure 4-2*** and ***Figure 4-3***). The magnitudes of the acoustic signals detected in the various frequency bands are displayed as a voltage (in millivolts) and represent the signal from the Sensor Section Assembly.

The Ultrawire™ telemetry from the tool to the surface consists of data packets that contain:

- The magnitudes of the various frequency-components in the FFT spectrum.
- Information about:
  - The current gain-configuration of the tool.
  - The number of clips.

The number of clips refers to the saturation of the analogue part of the system (caused by extremely loud acoustic signals) when the gain is set at a level that is too high.

The gain is variable to allow the detection of both quiet and loud acoustic signals and is controlled manually from the surface software when in wireline configuration. When in a memory toolstring, the gain is to be set before the tool is sent downhole. Refer to the Warrior manual (***MN-WARRIOR***).

The oil-filled hydrophone sensor-cavity is separated from the external well fluid by the Crystal Housing that allows the well-fluid vibrations to pass through with the minimal of acoustic attenuation. The internal oil-filled hydrophone sensor-cavity forms part of a pressure-balance mechanism that is actuated by a Piston arrangement. This serves to protect the Pressure Housing from excessive differential pressures.

4 OPERATIONAL PROCEDURE

4.1 Pre-Logging: Tool Checks

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

WARNING!

ELECTRICAL HAZARD!

Refer to *Section 2.2, Electrical Hazard*.

4.1.1 ELECTRICAL

For the Electrical Pre-Logging Checks, complete these steps:

1 Make sure the upper and the lower electrical connectors are clean, dry and undamaged.

2 With reference to the wiring diagram (***WD-416324*** and ***WD-416005***), use a multimeter to measure the through resistance. The measurement must be less than 0.5Ω.

3 The NTO009 must be connected to a suitable Telemetry Controller (for example UMT or XTU) and to a data acquisition or Logging System (for example DRS or ULP & PC) via a Logging Cable. Make sure a bottom end flowmeter or suitable Bullnose (BUL) with Ultrawire™ termination is fitted to the bottom of the toolstring.

4 Measure the current consumption at 18VDC. The measurement is 15mA to 20mA (typical).

4.1.2 MECHANICAL

CAUTION!

SEAL INTEGRITY!

Refer to ***Section 2.5, Tool Integrity***.

Reference:

Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
NTO009 General Assembly	***AD-416026***

Note: Item numbers below refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

For the Mechanical Pre-Logging Checks, complete these steps:

1 Make sure the O-Rings (***item 28***) and the Back-up Rings (***item 6***) are not damaged and are suitable for downhole operation. Replace the O-Rings and the Backup Rings when damaged.

2 Apply Liquid-O-Ring® (***P/N: LOR101***) to the O-Rings and the Back-up Rings.

3 Inspect visually the exterior of the Noise Tool (particularly the Sensor Section Assembly - ***item 1, 416026***) for any damage.

When **ANY** damage has occurred to the Crystal Housing (***item 11***), this component **MUST** be replaced with a serviceable component.

4 Verify the position of the Piston (***item 4***) as follows:

i With reference to ***Figure 4-1***, look into the well fluid entry holes (two are for the location for the Piston Setting Pins - ***item 3, KITT014-NTO009***) to confirm:

- The Piston (***item 4***) is aligned correctly with the two upper well fluid entry holes.
- The Compression Spring (***item 7***) is visible through the two lower well fluid entry holes.

ii Insert fully one of the Piston Setting Pins (***item 3, KITT014-NTO009***) into the upper well fluid entry holes to confirm the alignment of the Piston.

Note: When either of the above checks is not correct (for example, the Piston Setting Pin cannot be inserted fully and easily), complete an oil fill check on the NTO009. Refer to ***Section Appendix D, Oil Fill Procedure***.

3 With reference to ***Figure 4-1***, confirm the Locking Spring (***item 14***) is serviceable and the associated tang is located correctly in the slot in the Piston Housing (***item 12***).

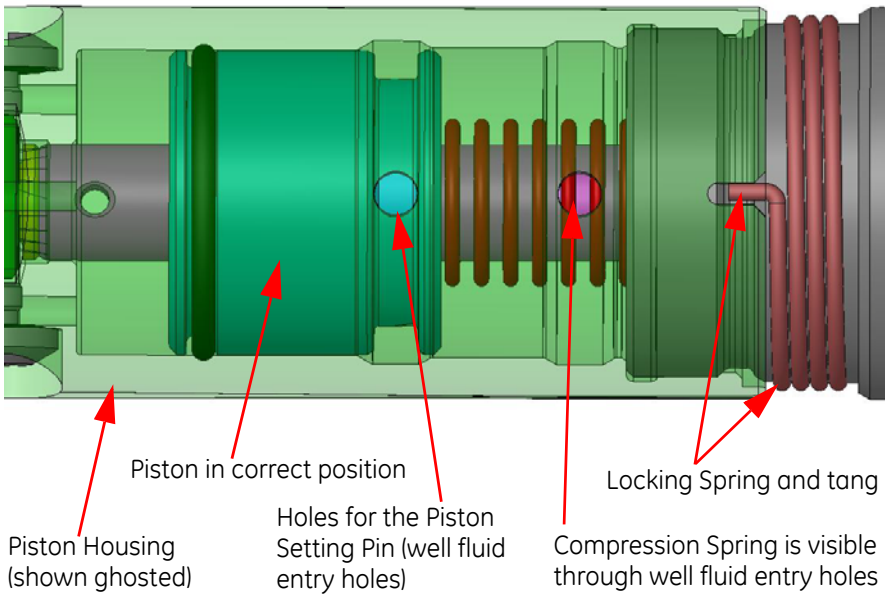


Figure 4-1 Correct alignment of the Piston and correct location of the Locking Spring

4.1.3 OPERATIONAL

WARNING! **ELECTRICAL HAZARD!**

Refer to *Section 2.2, Electrical Hazard*.

The NTO009 must be connected to a suitable Telemetry controller (UMT or XTU) and to a data acquisition or logging system (for example DRS or ULP & PC) via a logging cable or Dummy Logging Cable (DLC). Make sure a bottom end flowmeter or a suitable Bullnose (BUL) with Ultrawire™ termination is fitted to the bottom of the toolstring.

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	NTO009 General Assembly	***AD-416026***

Note: Item numbers below refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

For the Operational Pre-Logging Checks, complete these steps:

1 Power-up the tool in isolation and make sure there is correct operation at the Telemetry Controller.

2 Switch the tool to preview mode (Warrior > Edit > Tool Configuration > NTO > Preview ON) and observe the tool response.

3 Use a finger (**NOT** a tool) to tap gently on the Crystal Housing (***item 11***) to produce signals within the NTO009 that can be read in Warrior. See ***Figure 4-2*** and ***Figure 4-3*** for typical responses in Warrior. Refer also to the Warrior manual (***MN-WARRIOR***).

4 Repeat ***Step 3*** for each of the gain stages in order to make sure they function.

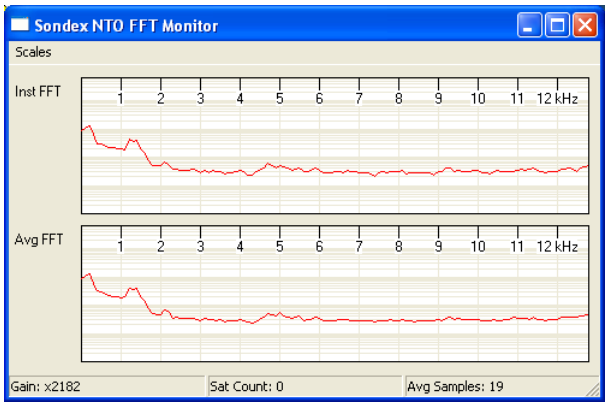


Figure 4-2 Typical FFT Monitor response in Warrior

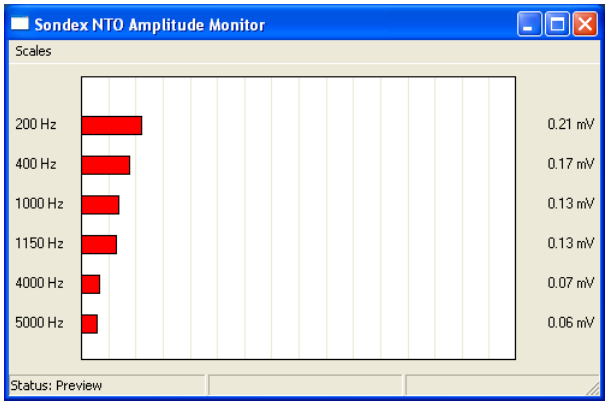


Figure 4-3 Typical Amplitude Monitor response in Warrior

5 At maximum gain (x2455) and the voltage scale set to x1, make sure the system noise levels (as indicated by the 'mV' measurements in the high-pass filter-bands) do not exceed ~1mV in acoustically quiet conditions.

6 In addition, monitor bin zero of the Fast Fourier Transform (FFT) output. This is the DC component of the signals in the tool and is purely a diagnostic measure of the electronics.

Under normal conditions, this is to read zero magnitude. Any other significant measurements will indicate an electronics problem and the In-Line Electronics Chassis Assembly (***item 2, 416026***) will require to be replaced.

Note: With reference to ***Figure 4-2***, bin zero is always to the left edge of the display.

7 When the above pre-logging checks are acceptable, the tool can be connected to a toolstring.

4.1.4 *PRESSURE BALANCE*

Reference: Sensor Section Assembly (Pressure tested assembly P/N: 417023) ***AD-416005***

A pressure balance of the chamber within the tool is achieved by the Piston (***item 4***) that moves within a Piston Housing (***item 12***).

The position of the Piston must be controlled carefully during the oil fill procedure. This is achieved through the use of the two Piston Setting Pins (***item 3, KITT014-NTO009***) and the O-Ring (***item 4, KITT014-NTO009***) to make sure the Piston is located correctly so it will have sufficient travel in the two directions of operation. This movement is to compensate for the change in oil volume caused by:

- High temperature at low pressure.
- Low temperature and high pressure.

With reference to ***Figure 4-4***, when the wide groove in the Piston (***item 4***) (inside the Piston Housing - ***item 12***) is moved to a position where it is visible correctly through the two holes for the Piston Setting Pins, the associated seals are optimised for pressure balance in the tool. This is to prevent a large difference in pressure between the inside and the outside of the tool, as this can cause damage to the Crystal Housing (***item 11***).

When the piston has moved from the filling position and the piston groove is not visible through the setting pin holes, well fluid could be mixed with the oil (spring compressed further) or oil could have been lost (spring visible through the upper holes). The noise tool must be serviced and filled with new Dow Corning® DC200® Oil, 100CST (***P/N: 415574***).

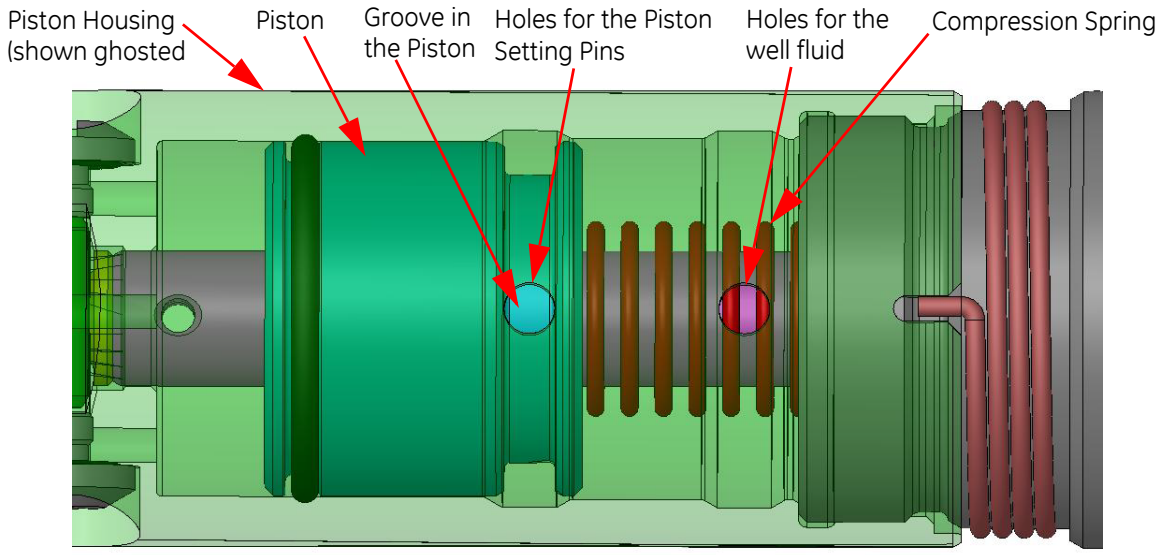


Figure 4-4 Identification of the well fluid entry holes with the Piston in the correct position

4.2 Connection to the Toolstring

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

CAUTION!

BEND STRESSES!

Refer to ***Section 2.6.1, Bend Stresses During Rig Up/Rig Down***.

To connect the NTO009 to a toolstring, make sure these advisory steps are followed:

1 The upper and the lower tool-joint seal surfaces are to be clean, undamaged and greased lightly.

2 Make sure the NTO009 is placed in the toolstring below a Telemetry Controller (XTU).

3 Because the NTO009 is **NOT** able to withstand a high level of bend stress along its length. GE Oil & Gas recommends **strongly** the rig up/rig down of either a long or a heavy toolstring by a lift at the Cable Head and with the toolstring in the **vertical** position!

4.3 Logging

4.3.1 LOGGING SPEED

Table 4-1 are guidelines only and must be used in conjunction with local policy and specific well site conditions both downhole and at surface. The table below is appropriate for near vertical wells and must be adjusted when in deviated wells. To enable the NTO009 to read accurately the well hole noise, it is recommended the tool is stationary. Do **NOT** attempt to either check for or record noise while the NTO009 is either "Running In Hole" or is "Pulling Out of Hole".

Note: Do not exceed the calculated safe work load of your selected weak point. When in doubt, use a Head Tension Unit, especially in deviated wells where calculation from surface tension is less accurate.

Table 4-1 Logging guidance

Depth (ft)	Speed Pulling Out of Hole	Speed Running in Hole
In/out of catcher (pressure rig up only)	Dead slow or manual.	
30 to 150	30ft/min	
150 to 400	60ft/min	
>400 clear cased hole	Surface tension must not exceed 120% of tension when the tool is stationary. Speed is not to exceed 150ft/min.	Surface tension must not be less than 80% of tension when the tool is stationary. Speed is not to exceed 150ft/min.
>400 clear open hole	Surface tension must not exceed 130% of tension when the tool is stationary. Speed is not to exceed 150ft/min.	Surface tension must not be less than 70% of tension when the tool is stationary. Speed is not to exceed 150ft/min.
Convergence with potential obstacles [a]	30ft/min	
Logging Data	**Do not exceed the above speeds. Recommended speed is <30ft/min.**	

[a] For example: Reduced diameters, Gas Lift Mandrels, fluid levels, Valves, Tubing Shoes, Packers, Cross Overs and other Downhole equipment.

4.4 *Post-Logging: Toolstring Disassembly*

WARNING!

WELL FLUID!

Refer to *Section 2.1.1 Well Fluid*.

WARNING!

TRAPPED PRESSURE!

Refer to *Section 2.3.1 Trapped Pressure Safety Precautions*.

CAUTION!

BEND STRESSES!

Refer to ***Section 2.6.1 Bend Stresses During Rig Up/Rig Down***.

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

Make sure the outside of the toolstring is cleaned before separation of the tools to avoid well fluid contamination of the tool electrical connectors.

When any of the circumstances that follow are encountered or it is suspected the tools have leaked, then you must proceed as if the tools contain trapped, pressurised fluid/gas until determined otherwise. The characteristics and circumstances of trapped pressure are:

- Telemetry failures downhole.
- Signs of mechanical damage.
- Unusual seepage of fluid, bubbles or gas out of the tool.
- Tools that have been fished.
- Tools that have been downhole for extended periods.
- Hard to undo Housings or Split Nuts.

To relieve the trapped pressure at the tool joint, complete these steps:

1 Place a rag over the tool joint. This will diffuse any jet of gas or fluid that can emerge from the tool joint.

2 Unscrew **SLOWLY** the tool joint. When there is trapped pressure inside the tool joint, the tool joint can be tighter than usual and require more torque than normal to undo.

3 At some point, well before the threads of the tool joint disengage, fluid or gas release will occur. As soon as gas seepage is heard or fluid appearance is noted, cease **IMMEDIATELY** to unscrew the tool joint and allow the pressure to dissipate before the joint is unscrewed further. This way, the pressure load on the tool joint can be retained safely by the threads that remain engaged.

4 Once the operator is satisfied that no more fluid or gas seepage is evident, resume to unscrew **SLOWLY** the tool joint. When further gas seepage or fluid appearance is noted, cease **IMMEDIATELY** to unscrew and allow the pressure to dissipate.

5 Repeat these steps until all trapped pressure within the tool joint is released.

6 The above procedure **DOES NOT** relieve any pressure that can be trapped within the NTO009. To relieve any pressure trapped within the NTO009, refer to ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly*** **BEFORE** disassembly, maintenance or transportation.

7 For other tools, refer to the relevant Section of their Operation & Maintenance Manual.

Note: Check the Female Monoconn Connector (***item 2, 412220***) is in place and has not been pushed out of the Upper Monoconn Bulkhead (***item 1, 412220***).

Where the Female Monoconn Connector has been pushed out, it is likely that the NTO009 has contained trapped pressurised fluid/gas that will have been released during this process. When the Female Monoconn Connector is still in place and a risk of trapped pressure is suspected, then the trapped pressure will likely be below 150psi (1034kPa). Refer to ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly*** for further information on how to make the tool safe before you continue.

Fit the upper and the lower Thread Protectors as soon as the NTO009 is separated from the toolstring to prevent contamination of the electrical connectors and to protect the threads from accidental damage.

4.5 Transport and Storage

WARNING! **WELL FLUID!**

Refer to *Section 2.1.1, Well Fluid*.

WARNING! **LIQUID-O-RING® TYPE 101 LUBRICANT**

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

Where the equipment is supplied in a carry tube and/or flight case, GE Oil & Gas recommends the equipment is stored and transported in that carry tube and/or flight case for protection.

The tool must be stored and transported with the threads and O-Rings greased lightly with Liquid-O-Ring® (***P/N: LOR101***) and thread protectors fitted.

DO NOT subject the tool to excessive shock and/or vibration.

5 MECHANICAL DESCRIPTION

5.1 Relief of Trapped Pressure - Tool Disassembly

WARNING!

WELL FLUID!

Refer to *Section 2.1.1, Well Fluid*.

WARNING!

TRAPPED PRESSURE!

Refer to *Section 2.3.1, Trapped Pressure Safety Precautions*.

Reference: NTO009 General Assembly ***AD-416026***

Note: Where tools are fitted either above or below the NTO009, refer to ***Section 4.4, Post-Logging: Toolstring Disassembly*** for instructions on how to remove safely these tools before you proceed.

Note: Any trapped pressurised fluid/gas above 150psi (1034kPa) will have been released via the connectors during toolstring disassembly. However, internal pressures below 150psi (1034kPa) could be present within the tool, the process below describes how to release this pressure:

1. Place a rag over the upper end of the Pressure Housing (***item 3***) and the upper end of the Sensor Section Assembly (***item 1***) and the joint with the Pressure Housing of the NTO009. This will diffuse any jet of gas or fluid/gas that can emerge from the joint and the upper end of the Pressure Housing.

2. Unscrew **SLOWLY** the Pressure Housing from the Sensor Section Assembly of the NTO009. When there is trapped pressure inside the Pressure Housing, the tool joint can be tighter than usual and require more torque than normal to undo.

3. At some point, well before the threads of the joint have become disengaged, fluid or gas release will occur. As soon as gas seepage is heard or fluid appearance is noted, the disconnection process must cease **IMMEDIATELY** and the pressure inside the Pressure Housing allowed to escape before the joint is unscrewed further. This way, the pressure load on the tool joint can be retained safely by the threads that remain engaged.

4. Once the operator is satisfied that no more fluid or gas seepage is evident, resume to unscrew **SLOWLY** the joint. When further gas seepage or fluid appearance is noted, cease **IMMEDIATELY** to unscrew and allow the pressure to dissipate.

5. Repeat these steps until all trapped pressure is released.

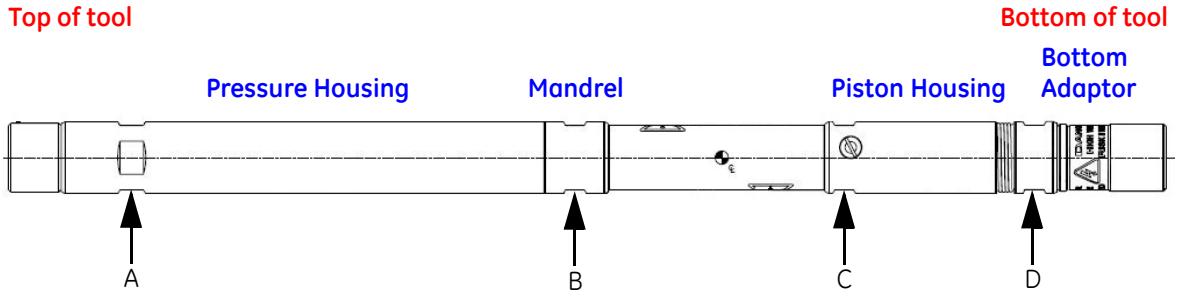
5.2 Torque Application: Spanner Flats

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

When torque is not applied correctly along the length of the NTO009, damage **will** occur to the tool. With reference to ***Figure 5-1***, apply torque (to either release or tighten) **ONLY** on the spanner flats as indicated.



To release/tighten the NTO009 from/to the tool above, use spanner flats "A" and the tool above.
To release/tighten the NTO009 from/to the tool below, use spanner flats "D" and the tool below.
To release/tighten the Pressure Housing from/to the Mandrel, use spanner flats "A" and "B".
To release/tighten the Mandrel from/to the Piston Housing, use spanner flats "B" and "C".
To release/tighten the Piston Housing from/to the Bottom Adaptor, use spanner flats "C" and "D".

Figure 5-1 Torque application spanner flats to disassemble/assemble the NTO009

5.3 In-Line Electronics Chassis Assembly

5.3.1 REMOVAL

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

WARNING!

SHOCK HAZARD!

Refer to *Section 2.7.1, Charge Build-up*.

Reference:	NTO009 General Assembly	***AD-416026***
	Sensor Section Assembly	***AD-416005***
	(Pressure tested assembly P/N: 417023)	
	In-Line Electronics Chassis Assembly	***AD-416324***

Note: Item numbers refer to the NTO009 General Assembly (AD-416026), unless stated otherwise.

To remove the In-Line Electronics Chassis Assembly, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

2 Make sure the Thread Protector (***item 5***) is removed from the upper end of the Pressure Housing (***item 3***).

3 Use two 38mm spanners (wrenches) to release the Pressure Housing from the Sensor Section Assembly (***item 1***).

With reference to ***Figure 5-1***, one spanner is to be used on the Pressure Housing and one is to be used on the Mandrel (***item 9, 416005***) (at the upper end of the Sensor Section Assembly). **DO NOT use a spanner on either the Piston Housing (*item 12*) or the Bottom Adaptor (*item 10, 416005*)!**

4 Remove the Pressure Housing from the Sensor Section Assembly.

5 With reference to ***Figure 5-2***, use an M5 Allen Key to turn clockwise (**inward**) the three Skt Hd Grub Screws (***item 6***) until they disengage from the Spacer (***Item 8, 416005***) to release the In-Line Electronics Chassis Assembly (***item 2***) from the Spacer.

DO NOT release/remove the Skt Hd Grub Screw (***item 9, 416324***) that is used to secure in position the Fischer 3-Way Connector (***item 6, 416324***) or any other Screw.

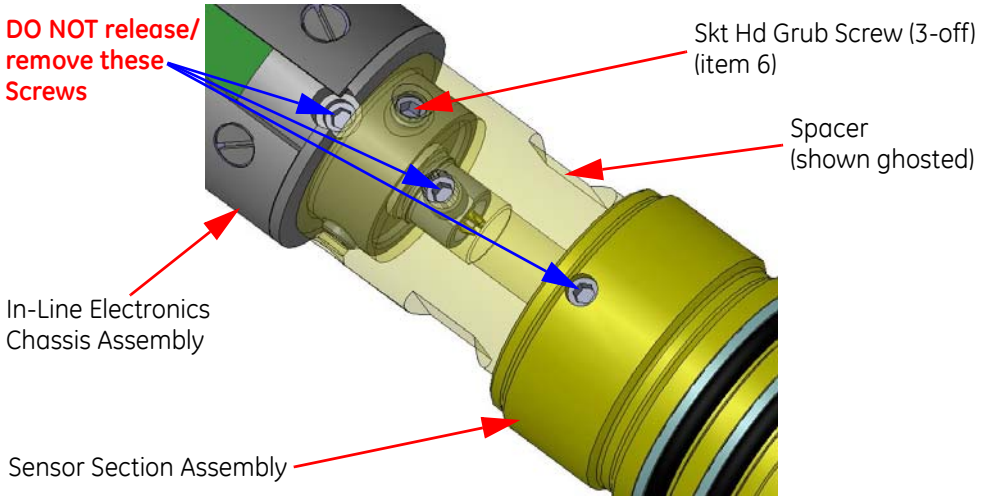


Figure 5-2 Identification of three Skt Hd Grub Screws to be removed

6 Pull carefully the In-Line Electronics Chassis Assembly (***item 2***) from the Spacer (***item 5***).

7 **DO NOT** touch the electrical contacts of the Fischer 3-Way Connector (***item 15, 416005***) in the upper end of the Sensor Section Assembly (***item 1***). An electric charge can be between Pin 1 and Pin 2.

Use a 1MΩ resistor to connect Pin 1 and Pin 2 of the Fischer 3-Way Connector to remove any electric charge between the two Pins.

5.3.2 INSTALLATION

WARNING! **ELECTRICAL HAZARD!**

Refer to *Section 2.2, Electrical Hazard*.

IRRITANT! **LIQUID-O-RING®, TYPE 101 LUBRICANT**

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

CAUTION! **TORQUE APPLICATION!**

Refer to ***Section 2.6.2, Torque Application***.

Reference:		
	NTO009 General Assembly	***AD-416026***
	Sensor Section Assembly	***AD-416005***
	(Pressure tested assembly P/N: 417023)	
	In-Line Electronics Chassis Assembly	***AD-416324***

Note: Item numbers refer to the NTO009 General Assembly (AD-416026), unless stated otherwise.

To install the In-Line Electronics Chassis Assembly, complete these steps:

1 Make sure all components are clean, dry and free of dirt and debris.

2 With reference to ***Figure 5-3***, **DO NOT** touch the electrical contacts of the Fischer 3-Way Connector (***item 15, 416005***) in the upper end of the Sensor Section Assembly (***item 1***). An electric charge can be between Pin 1 and Pin 2.

Use a 1MΩ resistor to connect Pin 1 and Pin 2 of the Fischer 3-Way Connector (***item 15, 416005***) to remove any electric charge between the two Pins.

3 With reference to ***Figure 5-3***, make sure the Fischer 3-Way Connector is installed correctly in the Spacer (***item 8, 416005***) and is secured in position with the Skt Hd Grub Screw (***item 20, 416005***).

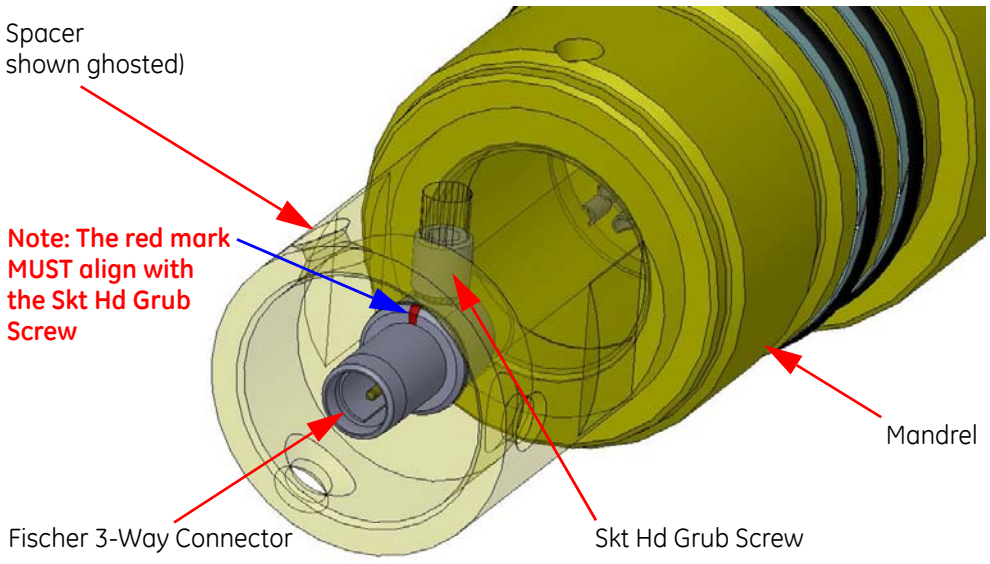


Figure 5-3 Fischer 3-Way Connector secured in the upper end of the Sensor Section

4 Locate correctly and fully the In-Line Electronics Chassis Assembly (***item 2***) in the upper end of the Sensor Section Assembly.

5 Make sure the three holes in the Spacer (***item 8, 416005***) are aligned with the three Skt Hd Grub Screws in the lower end of the In-Line Electronics Chassis Assembly.

When the three holes are **not** aligned with the three Skt Hd Grub Screws, this indicates one of the Fischer 3-Way Connectors is not installed correctly. Separate the two assemblies and check the two Fisher 3-Way Connectors are installed correctly (refer to ***Figure 5-3*** and to ***Figure 5-4***). **DO NOT attempt to release any Screw and turn one assembly relative to the other assembly!**

6 Use an M5 Allen Key to turn counter/anti-clockwise (**outward**) the three Skt Hd Grub Screws (***item 6***) until they engage fully with the Spacer (***item 8, 416005***). The three Skt Hd Grub Screws cannot be removed by this action.

7 Apply a thin film of Liquid-O-Ring™ type 101 (***P/N: LOR101***) to the two new O-Rings (***item 29, 416005***) and the two Backup Rings (***item 7, 416005***).

8 Make sure the Canted Coil Spring (***item 8, 416324***) is installed at the upper end of the In-Line Electronics Chassis Assembly.

9 Apply a thin film of Liquid-O-Ring® type 101 to the O-Ring (***item 15, 416324***) installed at the upper end of the In-Line Electronics Chassis Assembly.

10 Locate the Pressure Housing (***item 3***) over the In-Line Electronics Chassis Assembly.

11 Use two 38mm spanners (wrenches) to tighten carefully the Pressure Housing onto the Sensor Section Assembly.

With reference to ***Figure 5-1***, one spanner is to be used on the Pressure Housing and one is to be used on the Mandrel (***item 9, 416005***) (at the upper end of the Sensor Section Assembly). **DO NOT use a spanner on either the Piston Housing (*item 12*) or the Bottom Adaptor (*item 10, 416005*)!**

12 Make sure the two Thread Protectors (***item 4 & 5***) are installed on the ends of the tool.

13 Make sure the NTO009 is filled with clean Dow Corning® DC200 100CST oil (***P/N: 415574***). Refer to ***Appendix D, Oil Fill Procedure***.

5.3.3 DISASSEMBLY

Reference:	In-Line Electronics Chassis Assembly	***AD-416324***
	Monoconn Upper Bulkhead Assembly	***AD-412220***
	NTO009 General Assembly	***AD-416026***

Note: Item numbers refer to the In-Line Electronics Chassis Assembly (AD-416324), unless stated otherwise.

To disassemble the In-Line Electronics Chassis Assembly, complete these steps:

1 Make sure the In-Line Electronics Chassis Assembly (***item 2, 416026***) is separated from the Sensor Section Assembly (***item 1, 416026***). Refer to ***Section 5.3.1, Removal***.

2 Remove and retain the eight Slotted Csk Hd Screws (***item 7***) that secure the two Chassis Halfshells (***item 4***) to the Monoconn Upper Bulkhead Assembly (***item 3***) and to the Lower Electronics Bulkhead (***item 5***).

3 Separate the Monoconn Upper Assembly Bulkhead and the Lower Electronics Bulkhead from the two PCB Assemblies (***item 1 & 2***).

4 When required, remove and retain the two Skt Cap Hd Screws (***item 14***) and the associated two Crinkle Washers (***item 11***) that secure the two PCB Assemblies (***item 1 & 2***) to the Spacer (***item 13***).

5 When the Fischer 3-Way Connector (***item 3***) is to be removed, complete these steps:

i Remove and retain the Skt Hd Grub Screw (***item 9***) from the Lower Electronics Bulkhead (***item 5***).

ii Remove carefully the Fischer 3-Way Connector from the Lower Electronics Bulkhead.

iii Remove and discard the Heatshrink Sleeve from the wires connected to the Fischer 3-Way connector and then use a solder iron and ***SN100C*** solder to disconnect the wires from the Fischer 3-Way Connector.

6 When the Monoconn Upper Bulkhead Assembly (***item 3***) is to be disassembled, complete these steps:

i Remove and retain the Spiral Retaining Ring (***item 4, 412220***) from the upper end of the Monoconn Upper Bulkhead (***item 1, 412220***).

ii Pull firmly on the Monoconn Male-to-Male Adaptor Assembly (***item 3, 412220***) to remove both it and the Monoconn Female Connector (***item 2, 412220***) from the Monoconn Upper Bulkhead.

iii Remove and discard the Heatshrink Sleeve from the wire connected to the Monoconn Female Connector and then use a solder iron and ***SN100C*** solder to disconnect the wire from the Monoconn Female Connector.

iv When required, remove and discard the O-Ring (***item 5, 412220***) from the Monoconn Female Connector.

7 When the Analogue Board Assembly (***item 2***) is to be removed, complete these steps:

i Make a note of where each wire is connected to the Analogue Board Assembly.

ii Use a suitable solder iron and ***SN100C*** solder to disconnect the wires from the Analogue Board Assembly.

8 When the Digital Board Assembly (***item 1***) is to be removed, complete these steps:

i Make a note of where each wire is connected to the Digital Board Assembly.

ii Use a suitable solder iron and ***SN100C*** solder to disconnect the wires from the Digital Board Assembly.

5.3.4 ASSEMBLY

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

Reference:		
	In-Line Electronics Chassis Assembly	***AD-416324***
	Monoconn Upper Bulkhead Assembly	***AD-412220***
	NTO009 General Assembly	***AD-416026***

Note: Item numbers refer to the In-Line Electronics Chassis Assembly (AD-416324), unless stated otherwise.

To assemble the In-Line Electronics Chassis Assembly, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 When the Digital Board Assembly (***item 1***) is to be installed, complete these steps:

i With reference to the wiring diagram (***WD-416324***), use a suitable solder iron and ***SN100C*** solder to connect the wires to the Digital Board Assembly.

ii Use a suitable PCB cleaner to remove any flux residue from the solder joints.

3 When the Analogue Board Assembly (***item 2***) is to be installed, complete these steps:

i With reference to the wiring diagram (***WD-416324***), use a suitable solder iron and ***SN100C*** solder to connect the wires to the Analogue Board Assembly.

ii Use a suitable PCB cleaner to remove any flux residue from the solder joints.

4 When the Monoconn Upper Bulkhead Assembly (***item 3***) is to be assembled, complete these steps:

i Insert firmly the Monoconn Male-to-Male Adaptor Assembly (***item 3, 412220***) into the Monoconn Female Connector (***item 2, 412220***).

ii With reference to the wiring diagram (***WD-416324***), put the applicable wire through the Monoconn Upper Bulkhead (***item 1, 412220***).

iii Put 15mm of Heatshrink Sleeve (***P/N: A044-003M2***) over the wire.

iv Use a suitable solder iron and ***SN100C*** solder to connect the wire to the Monoconn Female Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

v Slide the Heatshrink Sleeve over the wires and the solder buckets and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeve.

vi Apply a thin film of Liquid-O-Ring® type 101 (***P/N: LOR101***) to the new O-Ring (***item 5, 412220***) and to the groove in the Monoconn Female Connector.

vii Insert the Monoconn Female Connector into the upper end of the Monoconn Upper Bulkhead.

viii Install the Spiral Retaining Ring (***item 4, 412220***) in the groove in the upper end of the Monoconn Upper Bulkhead to secure in position the Monoconn Female Connector.

5 When the Fischer 3-Way Connector (***item 3***) is to be installed, complete these steps:

i With reference to the wiring diagram (***WD-416324***), put the applicable wires through the Lower Electronics Bulkhead (***item 5, 416324***).

ii Put 15mm of Heatshrink Sleeve (***P/N: A044-001M2***) over the three wires and also 25mm of Heatshrink Sleeve (***P/N: A044-004M8***) over all three wires.

iii Use a solder iron and ***SN100C*** solder to connect the wires to the Fischer 3-Way Connector (***item 6, 416324***). Use a suitable PCB cleaner to remove any flux residue from the solder joint.

iv Slide the three Heatshrink Sleeves (***P/N: A044-001M2***) over the three solder joints and use a suitable Heat Gun to shrink the Heatshrink Sleeves.

v Slide the Heatshrink Sleeve (***P/N: A044-004M8***) over the three wires and use a suitable Heat Gun to shrink the Heatshrink Sleeves.

vi With reference to ***Figure 5-4***, insert the Fischer 3-Way Connector in the Lower Electronics Bulkhead. Make sure the flat surface (red mark) faces the location for the Skt Hd Grub Screw (***item 9***).

vii Install the Skt Hd Grub Screw (***item 9***) in the Lower Electronics Bulkhead to secure in position the Fischer 3-Way Connector.

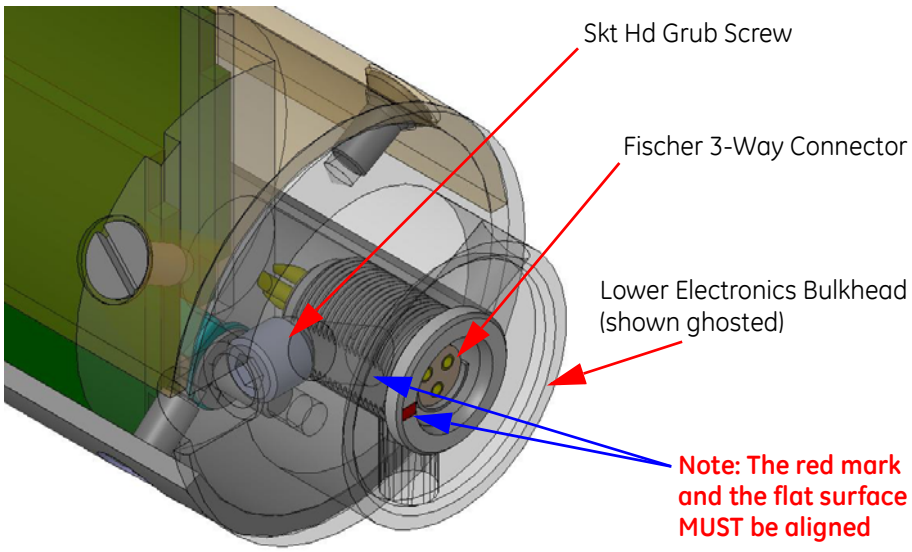


Figure 5-4 Correct installation of the Fischer 3-Way Connector

6 Make sure the two Skt Cap Hd Screws (***item 14***) and the two Lock Washers (***item 10***) secure the two Solder Tags (***item 12***) to the applicable Bulkhead (***item 3 and 5***). Make sure also there a 15mm length of Silicone Rubber Sleeving (***P/N: A013-00000***) over the connection between the wire and the Solder Tag.

7 With reference to ***Figure 5-5***, make sure the two PCB Assemblies (***item 1 and 2***) are in the correct orientation and then install the two Skt Cap Hd Screws (***item 14***) and the associated two Crinkle Washers (***item 11***) through the two PCB Assemblies (***item 1 & 2***) and into the Spacer (***item 13***).

Note: Unless the two PCB Assemblies are installed correctly, when the two Chassis Halfshells (***item 4***) are installed they **will** damage the wires to the two PCB Assemblies.

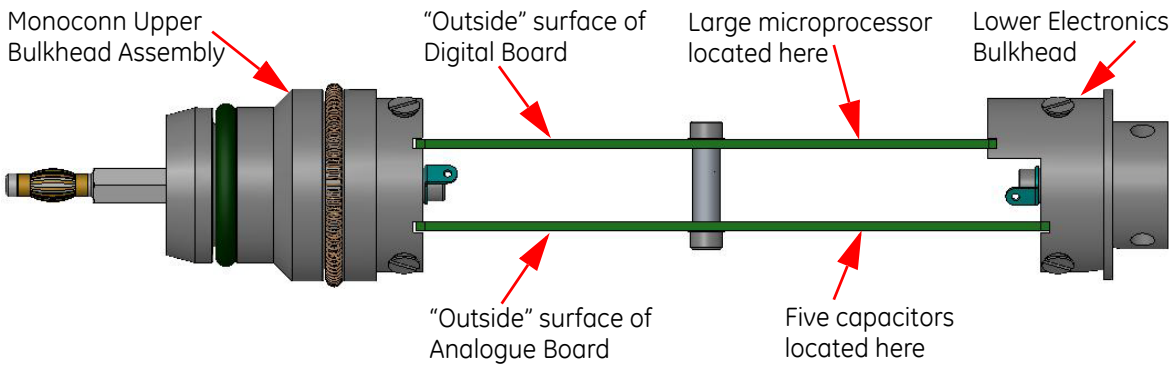


Figure 5-5 Identification of "outside" of the PCB Assemblies in the In-Line Electronics Chassis Assembly

8 Locate the ends of the two PCB Assemblies in the slots in both the Lower Electronics Bulkhead and the Monoconn Upper Bulkhead Assembly and hold in this position.

Because of the two different lengths of the two PCB Assemblies there is only one way these two PCB Assemblies will install.

9 Locate one of the Chassis Halfshells (***item 4***) between the two Bulkheads and hold in position. Make sure the screw holes in the Chassis Halfshell align with the screw holes in the two Bulkheads.

10 Insert four of the Slotted Csk Hd Screws (***item 7***) to secure the Chassis Halfshell to the two Bulkheads.

11 Locate the second Chassis Halfshell between the two Bulkheads and use the other four Slotted Csk Hd Screws (***item 7***) to secure it in position.

12 Install the In-Line Electronics Chassis Assembly. Refer to ***Section 5.3.2, Installation***.

5.4 Sensor Section Assembly

It is not necessary to remove the In-Line Electronics Chassis Assembly (***item 2, 416026***) from the Sensor Section Assembly (***item 1, 416026***) to complete these procedures:

- Removal/Installation of the Lower Connector Assembly.
- Removal/Installation of the Bottom Adaptor.
- Removal/Installation of the Pressure Isolation Connector.
- Removal/Installation of the Piston.

5.4.1 *Removal of the Lower Connector Assembly*

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	NTO009 General Assembly	***AD-416026***

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

Note: Item numbers refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

To remove the Lower Connector Assembly, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

1 Make sure the Thread Protector (***item 4, 416026***) is removed from the lower end of the Sensor Section (***item 1, 416026***).

2 With reference to ***Figure 5-6***, remove and retain the Internal Circlip (***item 18***) from the lower end of the Bottom Adaptor (***item 10***). The Internal Circlip is used to secure in position the Lower Connector Assembly (***item 2***).

3 Remove the Lower Connector Assembly from the Bottom Adaptor.

4 When damaged, remove and discard the Coiled Pin (***item 19***) from the Bottom Adaptor.

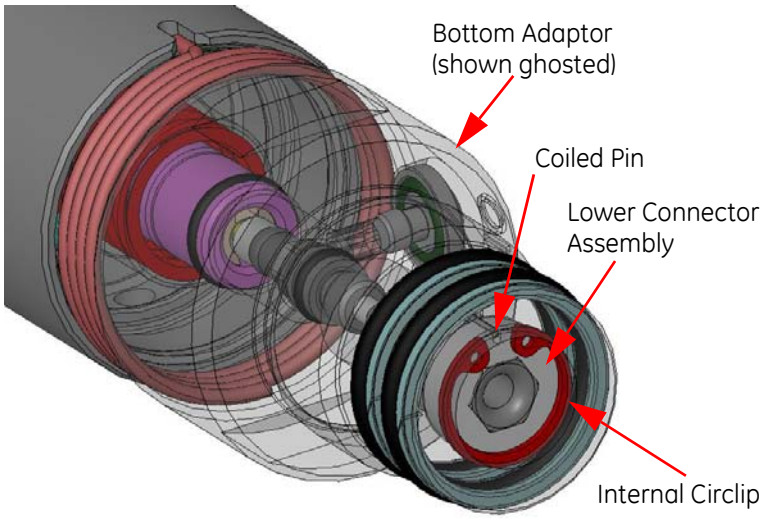


Figure 5-6 Lower Connector Assembly components

5.4.2 INSTALLATION OF THE LOWER CONNECTOR ASSEMBLY

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023) NTO009 General Assembly	***AD-416005*** ***AD-416026***

Note: Item numbers refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To remove the Lower Connector Assembly, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 With reference to ***Figure 5-6***, when required, install a new Coiled Pin (***item 19***) in the lower end of the Bottom Adaptor (***item 10***).

3 Locate carefully the Lower Connector Assembly (***item 2***) in the lower end of the Bottom Adaptor (***item 10***). Make sure the Lower Connector Assembly locates correctly with the Coiled Pin in the Bottom Adaptor.

4 Push firmly on the Lower Connector Assembly to make it engage fully with the Pressure Isolation Connector (***item 32***).

5 Make sure the Lower Connector Assembly is pushed in enough to permit the Internal Circlip (***item 18***) to be inserted in the groove in the lower end of the Bottom Adaptor.

6 Insert the Internal Circlip (***item 18***) in the groove in the lower end of the Bottom Adaptor.

7 Install the Thread Protector (***item 4, 416026***) on the lower end of the Sensor Section (***item 1, 416026***).

8 Check the continuity of the through wire as follows:

- With the Sensor Section and the Electronics Section **separated**, use a multimeter to check continuity between the Lower Connector Assembly and the Fischer 3-Way Connector (***item 15***).

  or

- With the Sensor Section and the Electronics Section **connected**, use a multimeter to check continuity between the Lower Connector Assembly and the Monoconn Connector (***item 15, 416324***) at the upper end of the Electronics Chassis Assembly (***item 2, 416026***).

5.4.3 *Removal of the Bottom Adaptor*

CAUTION!

Torque Application!

Refer to ***Section 2.6.2, Torque Application***.

Reference:

Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
NTO009 General Assembly	***AD-416026***

Note: Item numbers refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To remove the Bottom Adaptor, complete these steps:

1 **BEFORE** the Bottom Adaptor (***item 10***) is removed from the Piston Housing (***item 12***), complete **one** of these steps:

- With reference to ***Figure 5-7***, make sure the Piston (***item 4***) is aligned with the two upper well fluid holes and insert the two Piston Setting Pins (***item 3, KITT014-NTO009***) in the two upper well fluid holes. Use the O-Ring (***item 4, KITT014-NTO009***) to retain the two Piston Setting Pins.

  or

- Make sure the internal pressure of the Sensor Section Assembly (***item 1, 416026***) has been released. Refer to ***Step 1*** of ***Appendix D.1, How to Oil Fill***.

2 Make sure the lower Thread Protector (***item 4, 416026***) has been removed.

3 Lift the tang of the Locking Spring (***item 14***) from the slot in the Piston Housing (***item 4***). Make sure the tang remains out of the slot.

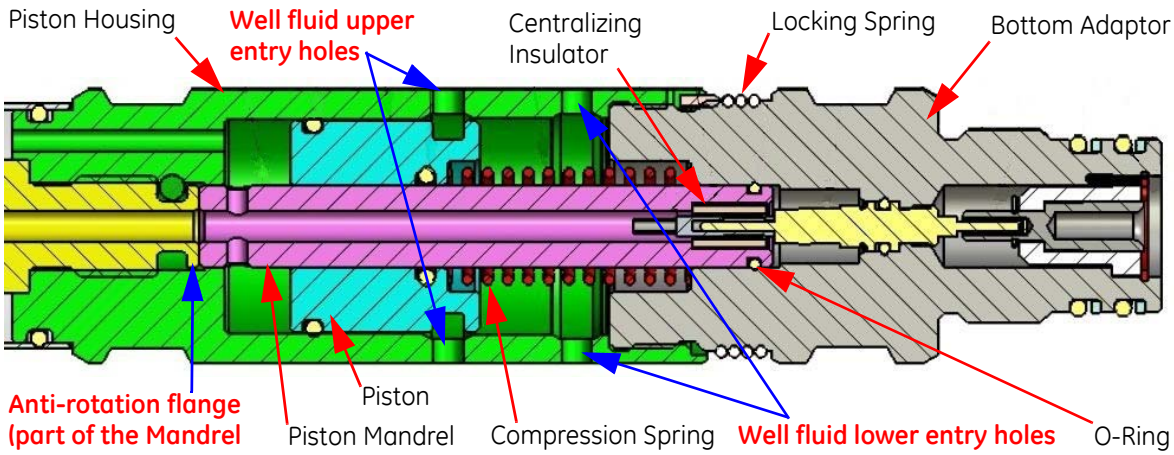


Figure 5-7 Identification of components in the assembly of the Piston Housing and the Bottom Adaptor

4 Use two 38mm spanners (wrenches) to remove and retain the Bottom Adaptor (***item 10***) from the Piston Housing (***item 12***). Make sure the tang of the Locking Spring is kept out of the slot as the Bottom Adaptor is removed.

With reference to ***Figure 5-1***, use one spanner on the Piston Housing and one on the Bottom Adaptor. **DO NOT use a spanner on the Mandrel (*item 9*)!**

5 Remove and retain the Compression Spring (***item 17***).

6 Complete one of these steps:

- Where the Piston Mandrel (***item 3***) **is** removed when the Bottom Adaptor is removed, remove it from the Bottom Adaptor. Remove and discard the O-Ring (***item 27***) from the Piston Mandrel.

  or

- Where the Piston Mandrel (***item 3***) is **not** removed when the Bottom Adaptor is removed, remove it from the Piston (***item 4***). Remove and discard the O-Ring (***item 27***) from the Piston Mandrel.

7 Remove and discard the two O-Rings (***item 28***) and remove and retain the two Backup Rings (***item 6***) from the lower end of the Bottom Adaptor.

8 When necessary, install the Piston Extraction Assembly (***item 1, KITT014-NTO009***) in the end of the Piston (***item 4***). See ***Figure 5-8***.

Note: With reference to ***Figure 5-7*** and to ***Figure 5-8***, the two upper well fluid upper entry holes are used also for the Piston Setting Pins (***item 3. KITT014-NTO009***).

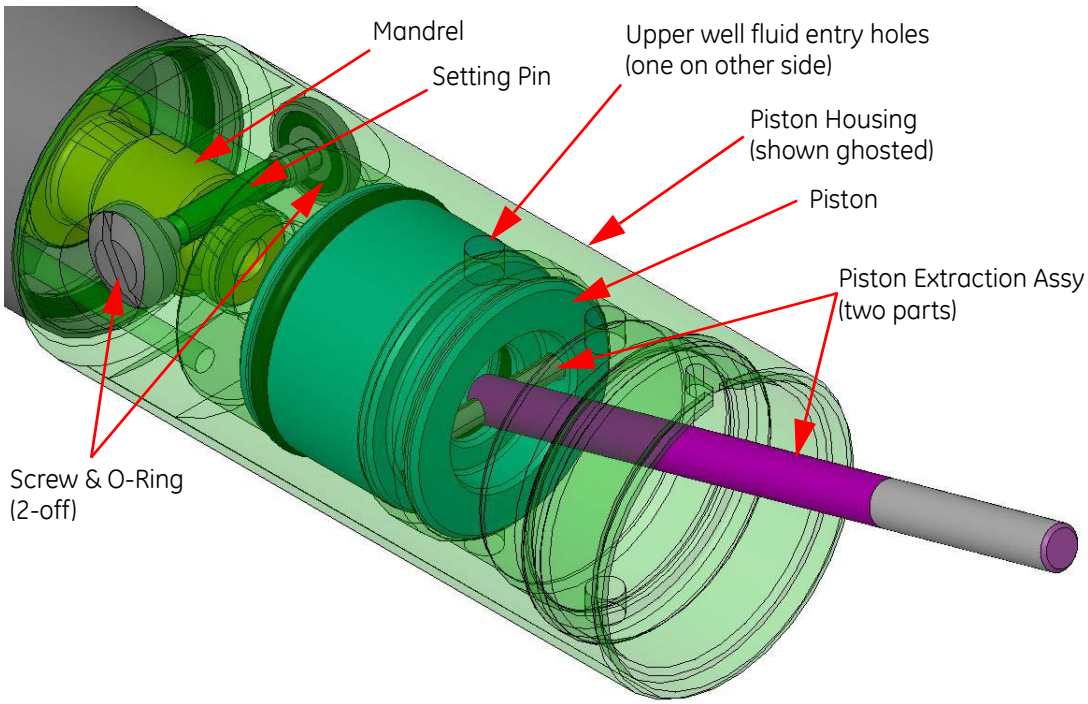


Figure 5-8 Piston Extraction Assembly installed in the Piston

5.4.4 *Installation of the Bottom Adaptor*

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

IRRITANT!

LIQUID-O-RING®, TYPE 101 LUBRICANT

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

IRRITANT!

DOW CORNING® 200® FLUID, 100CST OIL

Refer to *Section 2.4.5, Dow Corning® 200® Fluid, 100CST Oil*.

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	NTO009 General Assembly	***AD-416026***

Note: Item numbers refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To install the Bottom Adaptor, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 Complete **one** of theses steps:

- Use the Piston Extraction Assembly (***item 1, KITT014-NTO009***) to locate correctly the Piston (***item 4***) in the Piston Housing (***item 12***). See ***Figure 5-8***. Use the two Piston Setting Pins (***item 3, KITT014-NTO009***) and the O-Ring (***item 4, KITT014-NTO009***) to retain the Piston in the correct position.

  Where the Piston has been moved, it is recommended to complete an oil fill of the Sensor Section Assembly **after** it is assembled. Refer to ***Appendix D, Oil Fill Procedure***.

  OR

- Remove the Piston Extraction Assembly from the Piston.

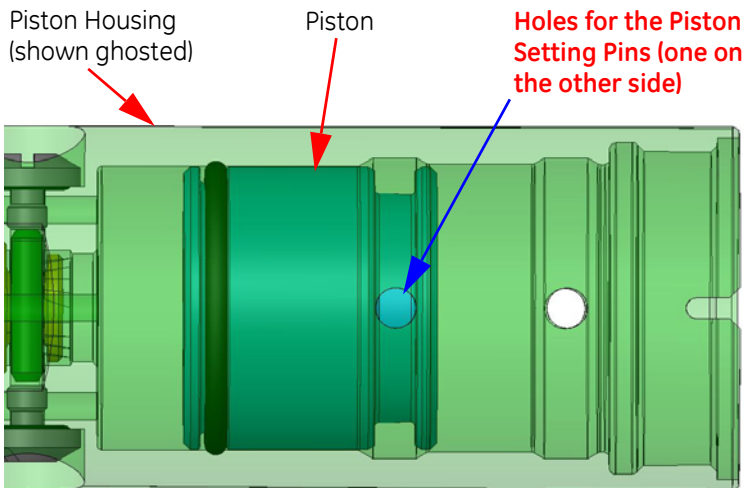


Figure 5-9 Correct location of the Piston in the Piston Housing

3 Make sure these components are installed in the Bottom Adaptor (***item 10***):

- The Lower Connector (***item 2***) in the lower end of the Bottom Adaptor. Refer to ***Section 5.4.2, Installation of the Lower Connector Assembly***.
- In this order in the upper end of the Bottom Adaptor:
  - Pressure Isolation Connector (***item 32***) complete with a new O-ring (***P/N: 99008***).
  - Centralizing Peek Isolator (***item 5***).

4 Apply a thin film of Dow Corning® DC200® Oil, 100CST (***P/N: 415574***) to the new O-Ring (***item 27***) and to the groove in the Piston Mandrel (***item 3***).

5 Install the new O-Ring in the groove in the Piston Mandrel.

6 With reference to ***Figure 5-10***, install fully the Piston Mandrel (complete with the new O-Ring - ***item 27***) in the upper end of the Bottom Adaptor (***item 10***).

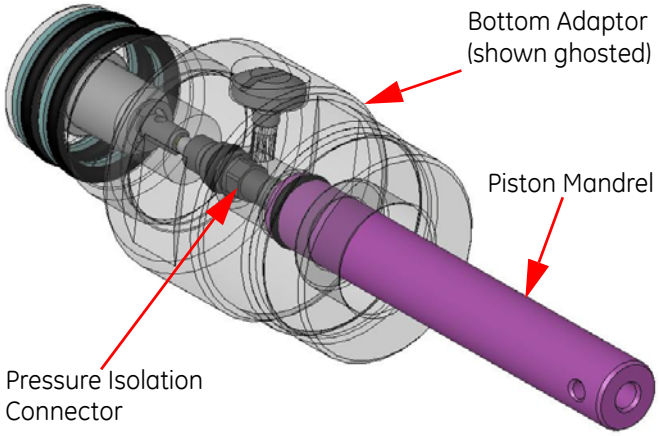


Figure 5-10 Piston Mandrel installed in the Bottom Adaptor

7 With reference to ***Figure 5-11***, locate the Locking Spring (***item 14***) on the upper end of the Bottom Adaptor.

Make sure the tang (of the Locking Spring) points toward the upper end of the Bottom Adaptor as it is to engage in a slot in the Piston Housing (***item 12***).

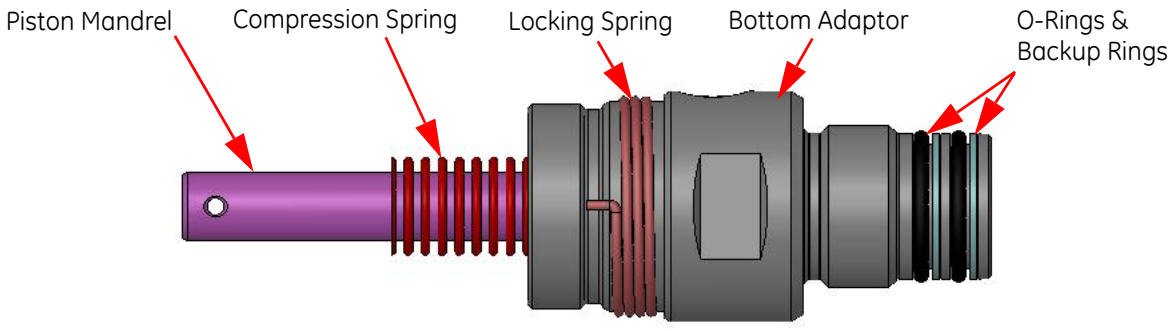


Figure 5-11 Bottom Adaptor assembled ready for installation

8 With reference to ***Figure 5-11***, locate the Compression Spring (***item 17***) over the Piston Mandrel.

9 Locate the Piston Mandrel over the Line Wire that extends from the centre of the Piston.

10 Make sure Dow Corning® 200® Fluid, 100CST Oil (***P/N: 415574***) is applied to the O-Ring (***item 24***) installed inside the Piston (***item 4***).

11 With reference to ***Figure 5-12***, push carefully the Piston Mandrel over the Line Wire and then through the Piston until the threads of the Bottom Adaptor engage with the threads of the Piston Housing.

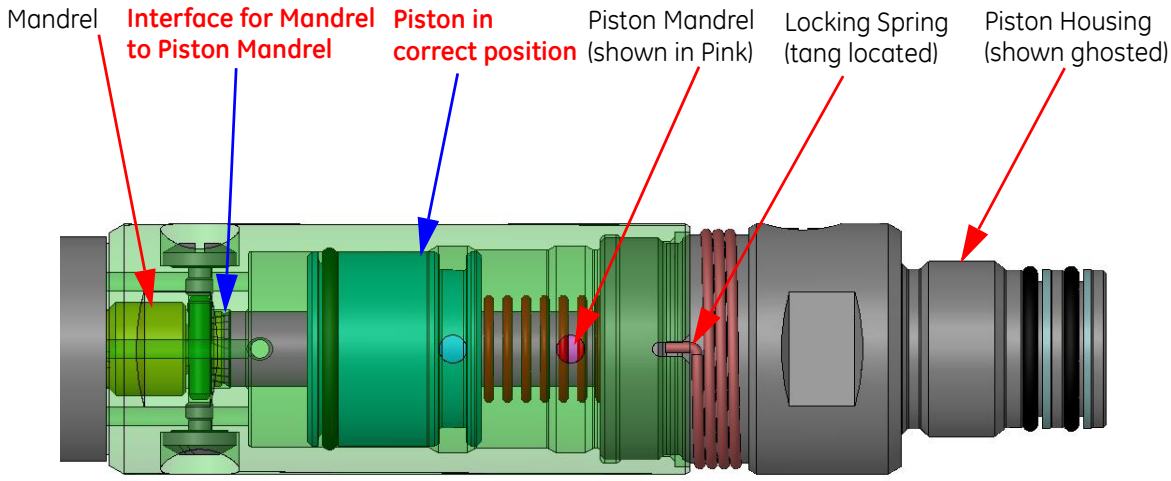


Figure 5-12 Piston Mandrel installed fully through Piston

12 Make sure the tang of the Locking Spring is held close to the slot into which it must locate after the Bottom Adaptor has been tightened fully into the Piston Housing. When the tang moves too far, it can be difficult/impossible to move the Locking Spring to the correct position. This can require the removal of the Bottom Adaptor from the Piston Housing and then for it to be re-installed.

13 Use two 38mm spanners (wrenches) to tighten the Bottom Adaptor into the Piston Housing.

With reference to ***Figure 5-1***, use one spanner on the Piston Housing and one on the Bottom Adaptor. **DO NOT use a spanner on the Mandrel (*item 9*)!**

14 To make sure the Line Wire has engaged with the Pressure Isolation Connector (***item 32***) inside the Bottom Adaptor, refer to the two wiring diagrams (***WD-416005*** and ***WD-416324***) and use a multimeter to check the continuity of the Line Wire. The measurement must be less than 0.5Ω.

15 Locate the tang of the Locking Spring in the slot in the Piston Housing.

16 Complete an oil fill procedure. Refer to ***Section D.1, How to Oil Fill***.

17 Where the Sensor Section Assembly is to be assembled to the In-Line Electronics Chassis Assembly, refer to ***Section 5.3.2, Installation***.

18 Apply a thin film of Liquid-O-Ring® type 101 (***P/N: LOR101***) to the two new O-Rings (***item 28***), the two Backup Rings (***item 6***) and to the two grooves in the lower end of the Bottom Adaptor.

19 Install the two new O-Rings and the two Backup Rings (in the correct order) in the two grooves in the lower end of the Bottom Adaptor. Refer also to ***Appendix C, Installation of Anti-Extrusion Rings***.

20 Install the lower Thread Protector (***item 4, 416026***) on the Bottom Adaptor.

5.4.5 Removal of the Pressure Isolation Connector

Reference: Sensor Section Assembly (Pressure tested assembly P/N: 417023) ***AD-416005***

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To remove the Pressure Isolation Connector, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

1 Remove the Bottom Adaptor (***item 10***). Refer to ***Section 5.4.3, Removal of the Bottom Adaptor***.

2 Complete one of these steps:

- Where the Piston Mandrel (***item 3***) **is** removed when the Bottom Adaptor is removed, remove it from the Bottom Adaptor. Remove and discard the O-Ring (***item 27***) from the Piston Mandrel.

  OR

- Where the Piston Mandrel (***item 3***) is **not** removed when the Bottom Adaptor is removed, remove it from the Piston (***item 4***). Remove and discard the O-Ring (***item 27***) from the Piston Mandrel.

3 When the Lower Connector Assembly (***item 2***) is to be removed from the lower end of the Bottom Adaptor, refer to ***Section 5.4.1, Removal of the Lower Connector Assembly***.

4 Do not remove the Centralizing Peek Insulator (***item 5***) unless it is damaged.

5 Use the Hex Nut Socket (***P/N: 10051***) to unscrew the Pressure Isolation Connector (***item 32***) and to push it out of the Bottom Adaptor.

6 Remove and discard the O-Ring (***P/N: 99008***) from the Pressure Isolation Connector.

7 Remove and retain the Centralizing Peek Insulator from the Pressure Isolation Connector.

5.4.6 Installation of the Pressure Isolation Connector

IRRITANT! **LIQUID-O-RING®, TYPE 101 LUBRICANT**

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

Reference: Sensor Section Assembly (Pressure tested assembly P/N: 417023) ***AD-416005***

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To install the Pressure Isolation Connector, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 Where removed, install the Lower Connector Assembly (***item 2***) in the lower end of the Bottom Adaptor (***item 10***). Refer to ***Section 5.4.2, Installation of the Lower Connector Assembly***.

3 Apply a thin film of Liquid-O-Ring® type 101 (***P/N: LOR101***) to the new O-Ring (***P/N: 99008***) and to the groove in the Pressure Isolation Connector (***item 32***).

4 Install the new O-Ring in the groove in the Pressure Isolation Connector.

5 With reference to ***Figure 5-13***, locate carefully and in the correct orientation the Pressure Isolation Connector in the upper end of the Bottom Adaptor.

6 Use the Hex Nut Spanner (***P/N: 10051***) to install fully the Pressure Isolation Connector.

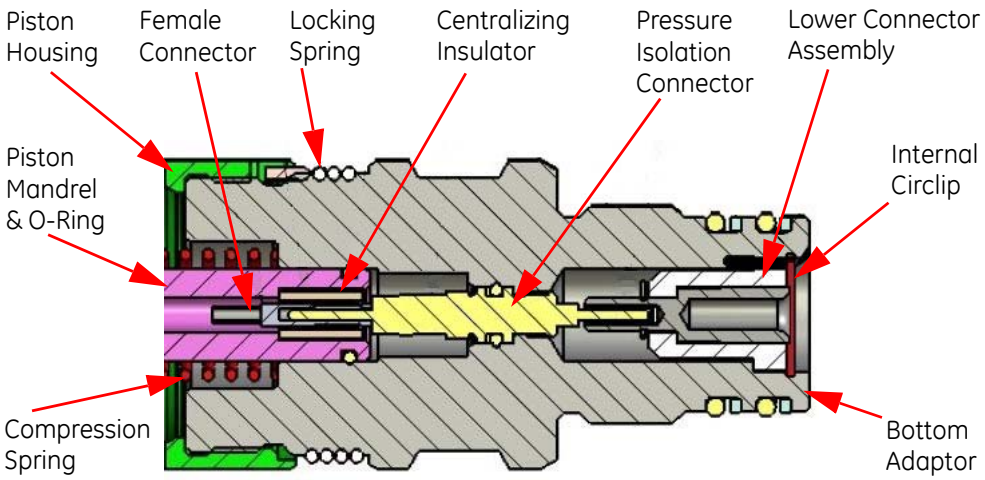


Figure 5-13 Location of components inside the Bottom Adaptor

7 Make sure the Centralizing Peek Insulator (***item 5***) is inserted inside the lower end of the Piston Mandrel (***item 3***).

8 Apply a thin film of Dow Corning® DC200® Oil, 100CST (***P/N: 415574***) to the new O-Ring (***item 27***) and to the groove in the end of the Piston Mandrel (***item 3***).

9 Install the new O-Ring in the groove in the Piston Mandrel.

10 Insert the Piston Mandrel (O-Ring end first) into the upper end of the Bottom Adaptor.

11 Locate the Compression Spring (***item 17***) over the Piston Mandrel.

12 Install the Bottom Adaptor. Refer to ***Section 5.4.4, Installation of the Bottom Adaptor***.

5.4.7 REMOVAL OF THE PISTON

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To remove the Piston, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

2 Remove and retain the Bottom Adaptor. Refer to ***Section 5.4.3, Removal of the Bottom Adaptor***.

3 Install the Piston Extraction Assembly (***item 1, KITT014-NTO009***) in the end of the Piston (***item 4***). See ***Figure 5-14***.

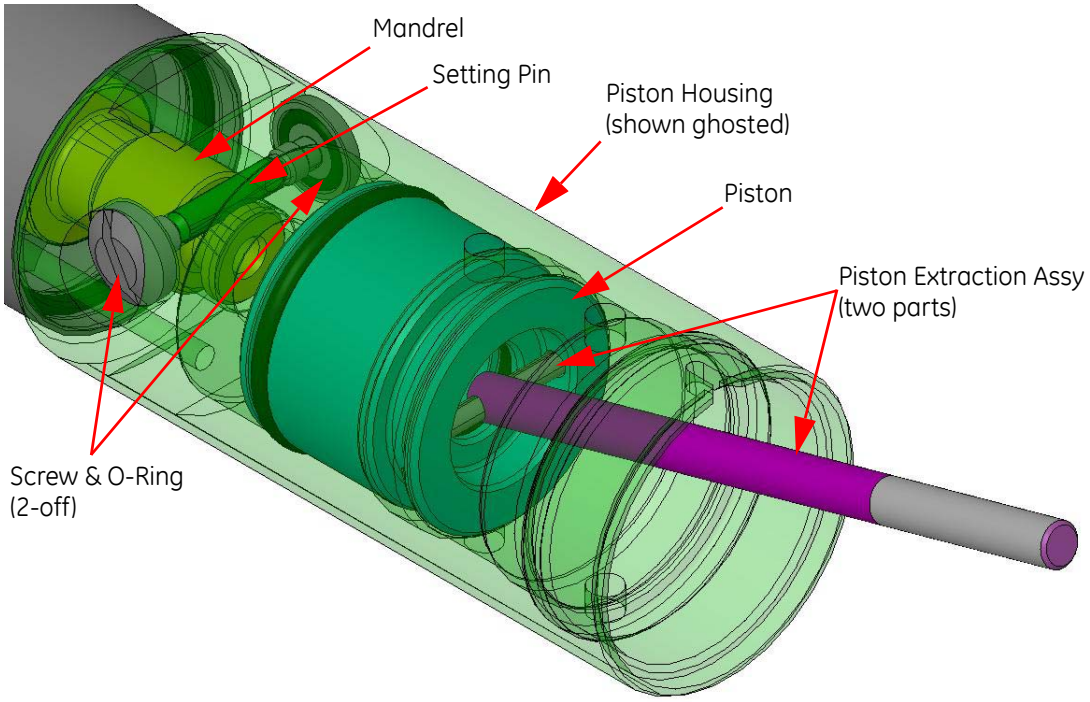


Figure 5-14 Piston Extraction Assembly installed in the Piston

4 Use the Piston Extraction Assembly to remove carefully the Piston from the Piston Housing (***item 12***).

5 Remove and discard the two O-Rings (***item 24 and 25***) from the Piston.

5.4.8 *INSTALLATION OF THE PISTON*

IRRITANT!

DOW CORNING® DC200® Oil, 100CST

Refer to *Section 2.4.5, Dow Corning® 200® Fluid, 100CST Oil*.

Reference: Sensor Section Assembly (Pressure tested assembly P/N: 417023) ***AD-416005***

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To install the Piston, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 Apply a thin film of Dow Corning® DC200® Oil, 100CST (***P/N: 415574***) to the two new O-Rings (***item 24 and 25***) and to the two grooves in the Piston (***item 4***).

3 Install the new O-Ring (***item 24***) in the internal groove of the Piston and then install the new O-Ring (***item 25***) to the external groove of the Piston.

4 Install the Piston Extraction Assembly (***item 1, KITT014-NTO009***) in the Piston. See ***Figure 5-14***.

5 With reference to ***Figure 5-15***, use the Piston Extraction Assembly to install carefully the Piston in the Piston Housing (***item 12***). Make sure the two new O-Rings are not damaged as the Piston is inserted.

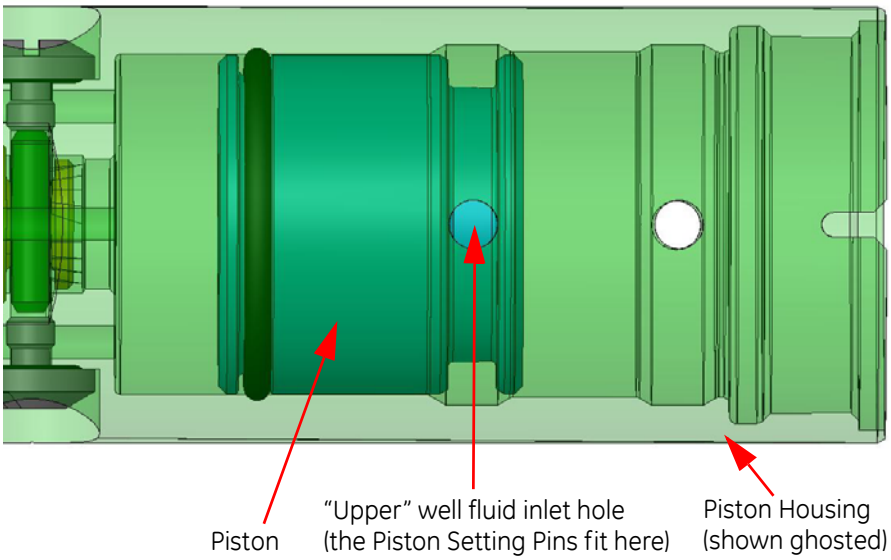


Figure 5-15 Piston only installed correctly in the Piston Housing

6 Use the two Piston Setting Pins (***item 3, KITT014-NTO009***) and the O-Ring (***item 4, KITT014-NTO009***) to retain the Piston in the correct position.

7 Remove the Piston Extraction Assembly (***item 1, KITT014-NTO009***) from the Piston.

8 Install the Bottom Adaptor (***item 10***) in the Piston Housing. Refer to ***Section 5.4.4, Installation of the Bottom Adaptor***.

9 Complete an Oil Fill procedure. Refer to ***Appendix D, Oil Fill Procedure***.

5.4.9 *Removal of the Fischer 3-Way Connector*

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	NTO009 General Assembly	***AD-416026***

To remove the Fischer 3-Way Connector, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

2 Make sure the In-Line Electronics Chassis Assembly (***item 2, 416026***) is removed. Refer to ***Section 5.3.1, Removal***.

3 Remove and retain the Skt Hd Grub Screw (***item 20***) from the Spacer (***item 8***) to release the Fischer 3-Way Connector (***item 15***).

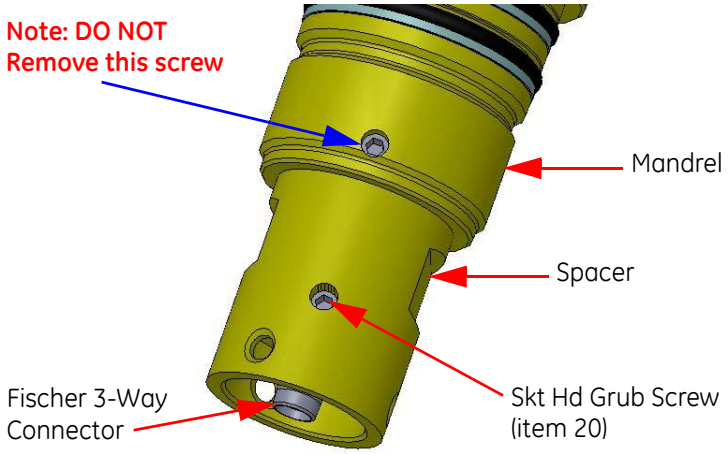


Figure 5-16 Identification of the security screw for the Fischer 3-Way Connector

4 Pull carefully on the Fischer 3-Way Connector to remove it from the Spacer.

5 Remove and discard the Heatshrink Sleeve from the wires connected to the Fischer 3-Way connector. Make sure the wires are not damaged as the Heatshrink Sleeve is removed.

6 Use a solder iron and ***SN100C*** solder to disconnect the wires from the Fischer 3-Way Connector.

5.4.10 Installation of the Fischer 3-Way Connector

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	Sensor Section Wiring Diagram	***WD-416005***
	NTO009 General Assembly	***AD-416026***

To install the Fischer 3-Way Connector, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 Place a 15mm length of Heatshrink Sleeve (***P/N: A011-001M2***) over each wire to be connected to the Fischer 3-Way Connector (***item 15***).

3 With reference to the wiring diagram (***WD-416005***), use a solder iron and ***SN100C*** solder to connect the wires to the Fischer 3-Way Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

4 Slide the Heatshrink Sleeve over the wires and the solder buckets and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeve.

5 With reference to ***Figure 5-17***, insert carefully and fully (make sure the wires are not trapped) the Fischer 3-Way Connector in the Spacer (***item 8***). Make sure the flat surface (red mark) faces the location for the Skt Hd Grub Screw (***item 20***).

6 With reference to ***Figure 5-16***, install the Skt Hd Grub Screw (***item 20***) to secure the Fischer 3-Way Connector in the Spacer.

7 When required, install the In-Line Electronics Chassis Assembly (***item 2, 416026***). Refer to ***Section 5.3.2, Installation***.

8 With the Sensor Section and the Electronics Section connected, use a multimeter to check continuity between the Lower Connector Assembly and the Monoconn Connector (***item 15, 416324***) at the upper end of the Electronics Chassis Assembly (***item 2, 416026***).

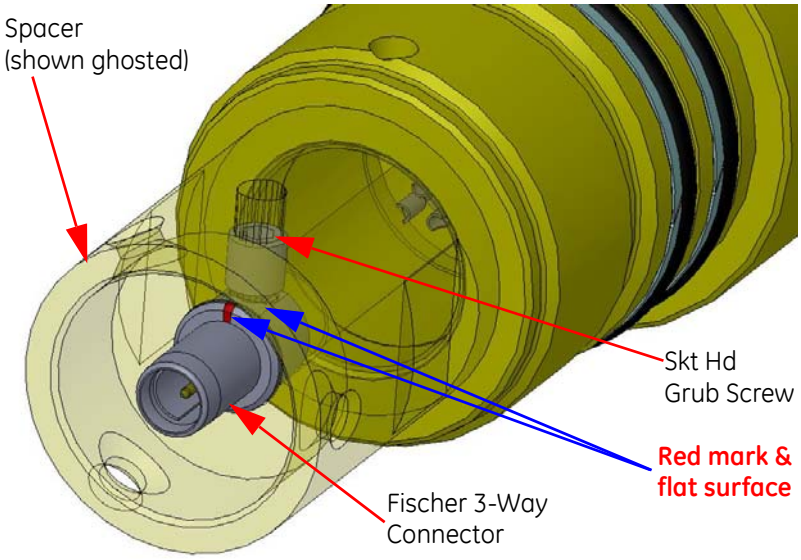


Figure 5-17 Correct installation of the Fischer 3-Way Connector

5.4.11 REMOVAL OF THE SPACER

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023) NTO009 General Assembly	***AD-416005*** ***AD-416026***

Note: Item numbers refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

To remove the Spacer, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

2 Make sure the In-Line Electronics Chassis Assembly (***item 2, 416026***) is removed. Refer to ***Section 5.3.1, Removal***.

3 Remove and retain the Fischer 3-Way Connector (***item 15***) from the Spacer (***item 8***). Refer to ***Section 5.4.9, Removal of the Fischer 3-Way Connector***.

4 With reference to ***Figure 5-18***, remove and retain the Skt Hd Grub Screw (***item 20***) from the Mandrel (***item 9***) to release the Spacer.

5 Use two spanners (wrenches) (24mm and 38mm) to remove the Spacer from the Mandrel.

With reference to ***Figure 5-1***, use the 24mm spanner on the Spacer and the 38mm spanner on the Mandrel. **DO NOT use a spanner on either the Piston Housing (*item 12*) or the Bottom Adaptor (*item 10*)!**

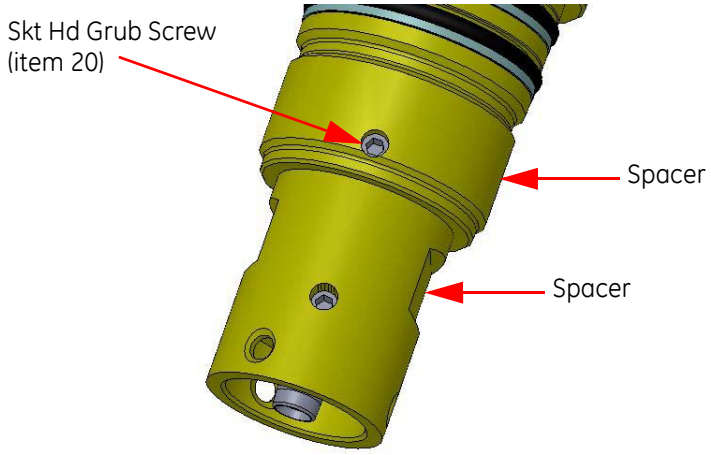


Figure 5-18 Identification of the security screw for the Spacer

5.4.12 *Installation of the Spacer*

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

Reference:

Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
Sensor Section Wiring Diagram	***WD-416005***

To install the Spacer, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 Make sure the Kemlon 3-Way Connector (***item 33***) is installed correctly in the upper end of the Mandrel (***item 9***). Refer to ***Section 5.4.14, Installation of the Kemlon 3-Way Connector***.

3 With reference to the wiring diagram (***WD-416005***), make sure wires are connected to and Heatshrink Sleeve (***P/N: A011-002M4***) is installed on the wires connected to the Kemlon 3-Way Connector that is installed in the upper end of the Mandrel.

When the wires are **not** installed, complete these steps:

i Place a 15mm length of Heatshrink Sleeve (***P/N: A011-002M4***) over each wire to be connected to the Kemlon 3-Way Connector (***item 33***).

ii With reference to the wiring diagram (***WD-416005***), use a solder iron and ***SN100C*** solder to connect the wires to the Kemlon 3-Way Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

iii Slide the Heatshrink Sleeve over the wires and the solder buckets and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeve.

4 Place the Spacer (***item 8***) over the wires and engage with the threads in the upper end of the Mandrel.

5 Use two spanners (wrenches) (24mm and 38mm) to install the Spacer in the Mandrel.

Withe reference to ***Figure 5-1***, use the 24mm spanner on the Spacer and the 38mm spanner on the Mandrel. **DO NOT use a spanner on either the Piston Housing (*item 12*) or the Bottom Adaptor (*item 10*)!**

6 With reference to ***Figure 5-18***, install the Skt Hd Grub Screw (***item 20***) to secure in position the Spacer.

7 Install the Fischer 3-Way Connector (***item 15***). Refer to ***Section 5.4.10, Installation of the Fischer 3-Way Connector***.

8 When required, install the In-Line Electronics Chassis Assembly (***item 2, 416026***). Refer to ***Section 5.3.2, Installation***.

5.4.13 *Removal of the Kemlon 3-Way Connector*

CAUTION!

TORQUE APPLICATION!

Refer to ***Section 2.6.2, Torque Application***.

Reference:		
	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	NTO009 General Assembly	***AD-416026***

To remove the Kemlon 3-Way Connector, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

2 Make sure the In-Line Electronics Chassis Assembly (***item 2, 416026***) is removed. Refer to ***Section 5.3.1, Removal***.

3 With reference to ***Figure 5-19***, remove and retain the two Screws (***item 30***) from the Piston Housing (***item 12***).

4 Use a suitable rod to remove and retain the Setting Pin (***item 16***) from the Piston Housing.

The Setting Pin is used to "lock" together the Mandrel (***item 9***) and the Piston Housing. **DO NOT attempt to separate the Mandrel from the Piston Housing BEFORE the Setting Pin is removed!**

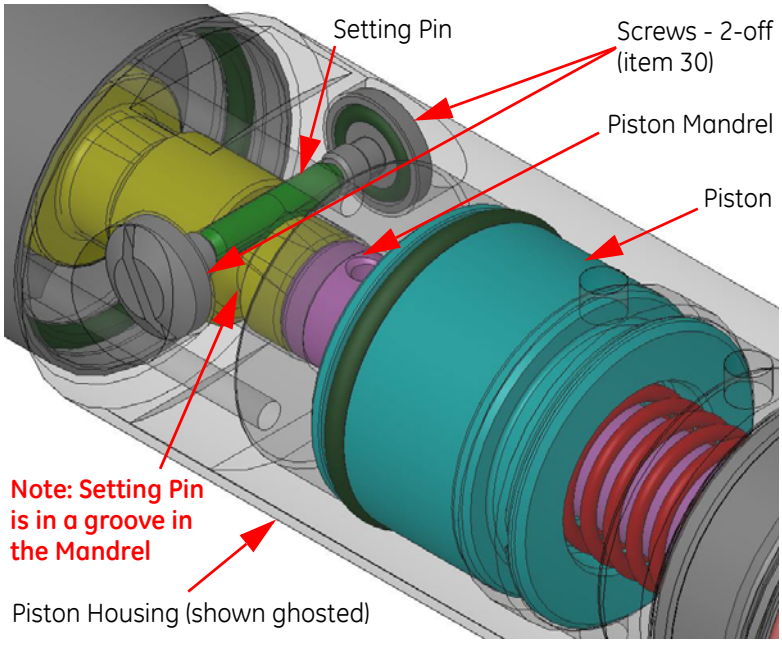


Figure 5-19 Location of the Setting Pin

5 Use two 38mm spanners (wrenches) on the Mandrel and the Piston Housing to separate the two components. The two components are tightened to a torque of 150Nm (110ft-lbf).

6 Remove and discard the O-Ring (***item 26***) from the upper end of the Piston Housing.

7 Remove and retain the Crystal Housing (***item 11***) from the Mandrel.

8 Remove and retain the Canted Coil Spring (***item 34***) and then remove and discard the O-Ring (***item 26***) from the Mandrel.

9 Use suitable pliers to pull carefully on the Kemlon 3-Way Connector and at the same time push the wires from the Sensor Assembly (***item 1***) through the hole in the Mandrel. Make sure the O-Ring (***P/N: 99011***) (on the Kemlon 3-Way Connector) is removed at the same time.

Note: One of the wires connected to the Kemlon 3-Way Connector is the Line Wire. As the Kemlon 3-Way Connector is removed the Line Wire will be disconnected automatically from the Pressure Isolating Connector (***item 32***) that is located in the Bottom Adaptor (***item 10***). This connection will be made automatically during reassembly.

10 Remove and discard the O-Ring (***P/N: 99011***) from the Kemlon 3-Way Connector.

11 Remove and discard the Heatshrink Sleeve from the three wires and the Bleed Resistor (***P/N: R0001-0001M***) connected to the Kemlon 3-Way connector. Make sure the three wires and the Bleed Resistor are not damaged as the Heatshrink Sleeve is removed.

12 Use a suitable solder iron and ***SN100C*** solder to disconnect the three wires and the Bleed Resistor from the Kemlon 3-Way Connector. Make sure the Bleed Resistor is retained.

13 Twist together the two wires from the Sensor Assembly (***item 1***) to make sure a charge build-up cannot occur in the Sensor Assembly.

5.4.14 *Installation of the Kemlon 3-Way Connector*

WARNING! **ISOPROPYL ALCOHOL (IPA)**

Refer to *Section 2.4.6, Isopropyl Alcohol (IPA)*.

WARNING! **FLAMMABLE!**

Refer to *Section 2.4.6, Isopropyl Alcohol (IPA)*.

IRRITANT! **LIQUID-O-RING®, TYPE 101 LUBRICANT**

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

IRRITANT! **LOCTITE® 290 THREADLOCKER**

Refer to *Section 2.4.2, Loctite® 290 Threadlocker*.

Reference:		
	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	*AD-416005*
	Sensor Section Wiring Diagram	*WD-416005*
	NTO009 General Assembly	*AD-416026*

To install the Kemlon 3-Way Connector, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 With reference to *WD-416005*, connect the two wires from the Sensor Assembly (*item 1*), the Bleed Resistor (*P/N: R001-0001M*) and the Line Wire as follows:

i Slide a 30mm length of Heatshrink Sleeve (*P/N: A011-004M8*) over the two wires from the Sensor Assembly (*item 1*) and the Line Wire.

ii Slide a 15mm length of Heatshrink Sleeve (*P/N: A011-002M4*) over both the Bleed Resistor (*P/N: R001-0001M*) and one of the wires from the Sensor Assembly (*item 1*).

iii Use a solder iron and *SN100C* solder to connect the wire and the Bleed Resistor to the connection on the Kemlon 3-Way Connector that matches the connection on the other side of the Kemlon 3-Way Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

iv Slide the 30mm length of Heatshrink Sleeve (*P/N: A011-004M8*) over the wire, the Bleed Resistor and the solder bucket and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeve.

v Slide a 15mm length of Heatshrink Sleeve (*P/N: A011-002M4*) over both the Bleed Resistor (*P/N: R001-0001M*) and the other wire for the Sensor Assembly (*item 1*).

vi Use a solder iron and *SN100C* solder to connect the other wire and the Bleed Resistor to the connection on the Kemlon 3-Way Connector that matches the second connection on the other side of the Kemlon 3-Way Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

vii Slide the 15mm length of Heatshrink Sleeve (*P/N: A011-002M4*) over the other wire, the Bleed Resistor and the solder bucket and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeve.

viii Make sure the Female Connector (***item 31***) is attached to the end of the Line Wire and there is no damage to the Heatshrink Sleeve (***P/N: BOO0107-2***) that covers the Line Wire. When the Heatshrink Sleeve is damaged, remove it and apply three new layers of Heatshrink Sleeve.

ix Insert the Line Wire into the hole through the Mandrel. Make sure the end with the Female Connector attached is inserted first. **DO NOT** insert fully the Line Wire!

x Slide a 15mm length of Heatshrink Sleeve (***P/N: A011-002M4***) over the Line Wire.

xi Use a solder iron and ***SN100C*** solder to connect the Line Wire to the third connection on the Kemlon 3-Way Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

xii Slide the 15mm length of Heatshrink Sleeve over the Line Wire and the solder bucket and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeve.

xiii Slide the 30mm length of Heatshrink Sleeve (***P/N: A011-004M8***) over the two wires from the Sensor Assembly and the Bleed Resistor and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeve onto the two wires, the Bleed Resistor and the solder buckets.

3 Apply a thin film of Liquid-O-Ring type 101 (***P/N: LOR101***) to the new O-Ring (***P/N: 99011***) and to the groove in the Kemlon 3-Way Connector (***item 33***).

4 Install the O-Ring on the Kemlon 3-Way Connector.

5 Push firmly but carefully the Kemlon 3-Way Connector into the Mandrel (***item 9***) and at the same time pull carefully on the two wires for the Sensor Assembly.

Note: One of the wires connected to the Kemlon 3-Way Connector is the Line Wire.

6 Use a solder iron and ***SN100C*** solder to connect the three wires to the Kemlon 3-Way Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

7 Slide a 15mm length of Heatshrink Sleeve (***P/N: A011-002M4***) over each of the three wires.

8 Slide the three 15mm lengths of Heatshrink Sleeves over the three wires and the three solder buckets and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeves.

9 Install the Spacer (***item 8***) into the upper end of the Mandrel. Refer to ***Section 5.4.12, Installation of the Spacer***.

10 With reference to the wiring diagram (***WD-416005***), identify the two wires connected to the Sensor Assembly and make a note of which wire connects to where.

This will require the use of a multimeter connected to the two wires from the Sensor Assembly and the three wires from the Kemlon 3-Way Connector.

11 Use a solder iron and ***SN100C*** solder to connect correctly the three wires to the Fischer 3-Way Connector (***item 15***). Use a suitable PCB cleaner to remove any flux residue from the solder joint.

12 Slide the three 15mm lengths of Heatshrink Sleeves over the three wires and the three solder buckets and then use a suitable Heat Gun to apply sufficient heat to shrink the Heatshrink Sleeves.

13 Install the Fischer 3-Way Connector in the upper end of the Spacer. Refer to ***Section 5.3.2, Installation***. Use the note made in ***Step 10*** above to connect correctly to the Fischer 3-Way Connector (***item 15***) the wires from the Kemlon 3-Way Connector (***item 33***).

14 Apply a thin film of Liquid-O-Ring® type 101 to the new O-Ring (***item 26***) and to the groove for the new O-Ring in the upper end of the Mandrel.

15 Install the new O-Ring in the groove in the upper end of the Mandrel.

16 Make sure the groove for the Canted Coil Spring (***item 34***) in the upper end of the Mandrel is free of any grease and then install the Canted Coil Spring in the groove. The Canted Coil Spring is used to supply an earth return for the Crystal Housing (***item 11***).

17 Install the Crystal Housing (***item 11***) over the Crystal Assembly (***item 1***), the Canted Coil Spring (***item 34***) and the new O-Ring (***item 26***). Make sure the wires to the Crystal Assembly are not damaged as the Crystal Housing is installed.

18 Apply a thin film of Liquid-O-Ring® type 101 to the new O-Ring (***item 26***) and to the groove in the upper end of the Piston Housing (***item 12***).

19 Install the new O-Ring in the groove in the upper end of the Piston Housing.

20 Use ***Isopropyl Alcohol*** to de-grease the threads on:

- The lower end of the Mandrel.
- The inside of the upper end of the Piston Housing.

21 Apply Loctite® 290 Threadlocker (***P/N: 91068***) to the threads on the lower end of the Mandrel.

22 Locate the Piston Housing over the lower end of the Mandrel.

23 Use two 38mm spanners (wrenches) on the Piston Housing and the Mandrel to torque tighten to 150Nm (110ft-lbf) the two components. Make sure the O-Ring on the upper end of the Piston Housing is not damaged as the Piston Housing engages with the Crystal Housing. **DO NOT use a spanner on either the Pressure Housing (*item 3, 416026*) or the Bottom Adaptor (*item 10*)!**

Note: As the Piston Housing is tightened onto the Mandrel, the Line Wire will be connected automatically to the Pressure Isolating Connector (***item 32***) that is located in the Bottom Adaptor (***item 10***).

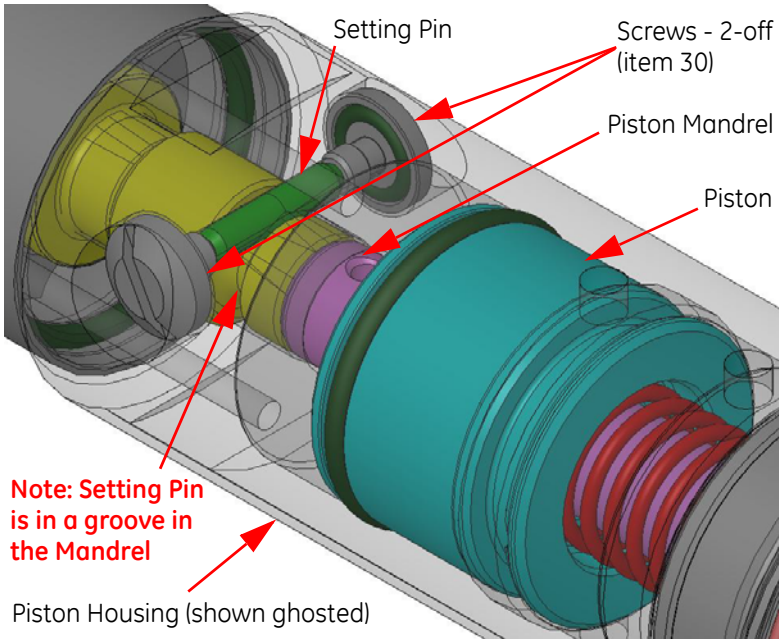


Figure 5-20 Correct installation of the Setting Pin

24 With reference to ***Figure 5-20***, install one of the Screws (***item 30***) in the upper end of the Piston Housing.

25 Insert the Setting Pin (***item 16***) in the upper end of the Piston Housing. Make sure it is located in the groove in the lower end of the Mandrel. The Setting Pin is used to "lock" together the Mandrel and the Piston Housing.

26 Install the second Screw (***item 30***) in the upper end of the Piston Housing to secure in position the Setting Pin.

27 With reference to the wiring diagram (***WD-416005***), use a multimeter to check the resistance/ continuity between the Lower Connector Assembly (***item 2***) and Pin 3 of the Fischer 3-Way Connector (***item 15***). The measurement is to be less than 0.5Ω.

28 Use a multimeter to check the insulation of the end connectors. The measurement is to be greater than 5MΩ.

29 When required, install the In-Line Electronics Chassis Assembly (***item 2, 416026***). Refer to ***Section 5.3.2, Installation***.

5.4.15 *Removal of the Sensor Assembly*

WARNING! **SHOCK HAZARD!**

Refer to *Section 2.7.1, Charge Build-up*.

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	NTO009 General Assembly	***AD-416026***

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To remove the Sensor Assembly, complete these steps:

1 Make sure the tool is supported in suitable V-blocks.

2 Make sure the In-Line Electronics Chassis Assembly (***item 2, 416026***) is removed. Refer to ***Section 5.3.1, Removal***.

3 Refer to ***Step 3*** through ***Step 8*** of ***Section 5.4.13, Removal of the Kemlon 3-Way Connector*** to remove and retain the Piston Housing (***item 12***) from the Mandrel (***item 9***).

4 With reference to ***Figure 5-21***, release but do **not** remove the Skt Cap Hd Screw (***item 22***) in the Retaining Ring (***item 13***) that secures the Sensor Assembly (***item 1***) on the Mandrel (***item 9***).

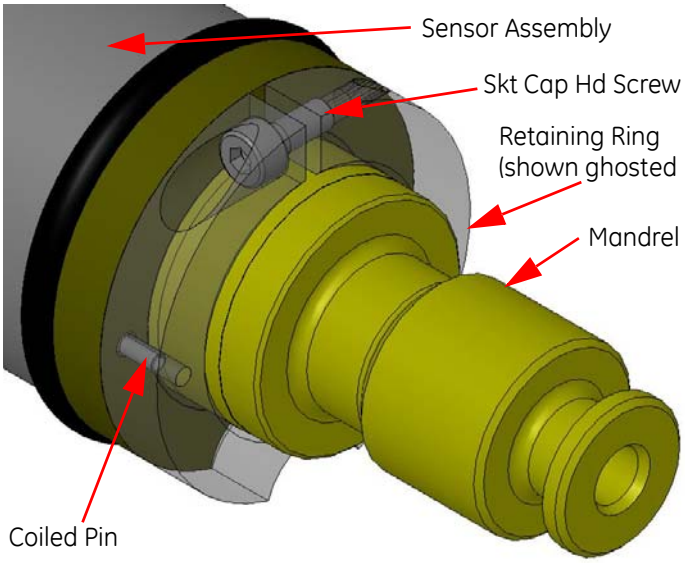


Figure 5-21 Retaining Ring installation

5 Remove and retain the Retaining Ring from the Mandrel. It is possible for the Coiled Pin (***item 21***) to be removed with the Retaining Ring. Discard the Coiled Pin when it is damaged.

6 Use a solder iron and ***SN100C*** solder to disconnect the wires from the Sensor Assembly (***item 1***) to the wires that go the Kemlon 3-Way Connector (***item 33***).

7 Remove and retain the Sensor Assembly from the Mandrel.

DO NOT drop or hit the Sensor Assembly! **DO NOT** disassemble the Sensor Assembly!

8 Use a solder iron and SN100C solder to connect a 1MΩ resistor (***P/N: R001-0001M***) to the two wires attached to the Sensor Assembly. The resistor is used to prevent a charge build-up across the crystals of the Sensor Assembly.

5.4.16 *Installation of the Sensor Assembly*

WARNING! **SHOCK HAZARD!**

Refer to *Section 2.7.1, Charge Build-up*.

IRRITANT! **LIQUID-O-RING®, TYPE 101 LUBRICANT**

Refer to ***Section 2.4.1, Liquid-O-Ring® type 101 Lubricant***.

Reference: Sensor Section Assembly (Pressure tested assembly P/N: 417023) ***AD-416005***

Note: Whenever the Bottom Adaptor (***item 10, 416005***) is removed, it **WILL** be necessary to fill the Sensor Section (***item 1, 416026***) with oil. Refer to ***Appendix D, Oil Fill Procedure***.

To install the Sensor Assembly, complete these steps:

1 Make sure all components are clean, dry and free of debris.

2 Where applicable, use a solder iron and ***SN100C*** solder to disconnect any 1MΩ resistor (***P/N: R001-0001M***) that is attached to the two wires of the Sensor Assembly (***item 1***). The resistor is used to prevent a charge build-up across the crystals of the Sensor Assembly.

3 With reference to ***Figure 5-22***, locate the Sensor Assembly on the Mandrel (***item 9***) with the connection wires toward the upper end of the Mandrel.

DO NOT drop or hit the Sensor Assembly!

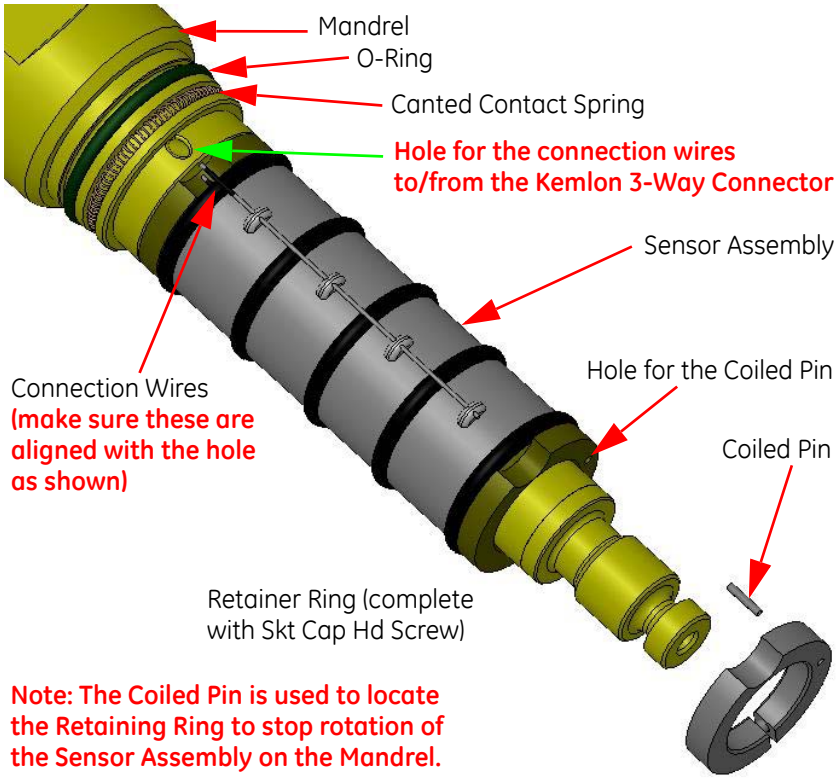


Figure 5-22 Sensor Assembly located correctly on the Mandrel

4 Make sure the Coiled Pin (***item 21***) is installed in the Retainer Ring (***item 13***) and is not pushed through the Retaining Ring (see ***Figure 5-21***).

5 Locate the Retaining Ring on the lower end of the Mandrel (***item 9***) and make sure the Coiled Pin inserts correctly in the Sensor Assembly (***item 1***).

6 With reference to ***Figure 5-22***, make sure the wires from the Sensor Assembly are aligned with the wires from the Kemlon 3-Way Connector (***item 33***).

7 Make sure both the Sensor Assembly and the Retaining Ring are pushed fully toward the upper end of the Mandrel and hold them in this position.

8 Tighten the Skt Cap Hd Screw (***item 22***) to secure the Retaining Ring on the Mandrel. Make sure there is **no** movement of the Sensor Assembly after the Retaining Ring has been secured in position.

9 Use a solder iron and ***SN100C*** solder to connect the wires of the Sensor Assembly to the wires that go to the Kemlon 3-Way Connector. Use a suitable PCB cleaner to remove any flux residue from the solder joint.

10 Apply a thin film of Liquid-O-Ring® type 101 (***P/N: LOR101***) to the new O-Ring (***item 26***) and to the groove for the O-Ring on the upper end of the Mandrel.

11 Refer to ***Step 14*** through ***Step 29*** of ***Section 5.4.14, Installation of the Kemlon 3-Way Connector*** to install and retain the Piston Housing on the Mandrel.

6 ELECTRICAL DESCRIPTION

Reference:	NTO009 General Assembly	***AD-416026***
	Electronics Chassis Assembly	***AD-416324***
	Electronics Wiring Diagram	***WD-416324***
	Sensor Section Wiring Diagram	***WD-416005***

The NTO009 Electronics Chassis Assembly (***item 2, 416026***) comprises two printed circuit boards (***item 1 and 2, 416324***) and interconnection wiring.

6.1 Digital Circuit Board (P/N: 87445)

The main functional blocks of the Digital Board circuit are the power supply, the Ultrawire™ interface and a microcontroller with a communications interface to the Analogue Board.

The Ultrawire™ line carries the telemetry signals and the 18VDC (nominal) power supply. The tool is protected by a fuse, which in conjunction with a diode gives over-voltage and reverse polarity protection. The Switched Mode Power Supply (SMPS) provides a regulated 3.3VDC and an unregulated 7VDC output. The microcontroller and the CPLD control the tool interface to the Ultrawire™ toolbus and communication with the Analogue Board.

6.2 Analogue Circuit Board (P/N: 87466)

The main functional blocks of the circuit are the amplifier chain, the digitisation and the signal processing. The Analogue Board Assembly draws power at 3.3VDC and 7VDC (approx.) from the Ultrawire™ Digital Board Assembly. The 7VDC feed is regulated down to 5VDC by a linear regulator and a precision 5VDC reference chip.

Audio band signals from the Sensor Section Assembly are presented to an amplifier and filter chain, Zener diodes protect the amplifier inputs from excessive signal amplitude and ESD. To allow the tool to cope with a large dynamic range of input signals, an electronically variable attenuator is provided.

Surface software can set the gain of the amplifier chain or it can be set so that the tool gain is automatic. The amplified signal is fed to the analogue-to-digital convertor inputs of a DSP. This device digitises the analogue signal and computes its Fourier transform. The frequency domain data is passed to another DSP that computes an averaged magnitude spectrum. This is in turn is passed to the Ultrawire™ Digital Board through the use of an asynchronous serial interface and inter-board wiring.

7 EXTENDED CHECKS

7.1 Preventative Maintenance

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.4.1, Liquid-O-Ring® type 101 Lubricant*.

CAUTION!

SEAL INTEGRITY!

Refer to ***Section 2.5, Tool Integrity***.

IRRITANT!

DOW CORNING® 3140 RTV COATING

Refer to *Section 2.4.3, Dow Corning® 3140 RTV Coating*.

IRRITANT!

DOW CORNING® 3145 RTV ADHESIVE/SEALANT

Refer to *Section 2.4.4, Dow Corning® 3145 RTV Adhesive/Sealant*.

7.1.1 ELECTRICAL

WARNING!

ELECTRICAL HAZARD!

Refer to *Section 2.2, Electrical Hazard*.

For the Electrical Preventative Maintenance checks, complete these steps:

1. With reference to the wiring diagram (***WD-416324*** and ***WD-416005***), use a multimeter to check the continuity of the through wires. The measurement must be less than 0.5Ω.
2. With reference to the wiring diagram (***WD-416324*** and ***WD-416005***), use a multimeter to check the insulation of the end connectors. The measurement must be greater than 5MΩ.
3. The NTO009 must be connected to a suitable Telemetry controller (UMT or XTU) and to a data acquisition or logging system (for example DRS or ULP and a PC) via a logging cable or a Dummy Logging Cable (DLC). Make sure either a bottom end flowmeter or suitable Bullnose (BUL) with Ultrawire™ termination is fitted to the bottom of the toolstring.
4. Measure the tool current at 18VDC. The measurement is 15mA to 20mA (typical).
5. Perform a visual inspection of the electronics for debris, damaged components and wires.

7.1.2 MECHANICAL

For the Mechanical Preventative Maintenance checks, complete these steps:

1. Remove dirt and old grease from the Pressure Housing threads and the Seals.
2. Seals that have become hardened or damaged **MUST** be replaced. Apply fresh grease to the threads and seals as required. Refer to ***Section 7.1.4, Seal Replacement Recommendations***.

3 Carry out a general inspection, check the points listed below as a minimum:

- Replace or repair damaged wires.
- Wires that are loose or likely to be damaged during reassembly must be secured.
- Damaged components must be replaced.
- Heat or chemical damage (discoloured components) must be replaced.
- Incorrect thread grease or excessive quantity must be removed, refer to ***Section 2.5, Tool Integrity***.
- Connectors must be clean and any damaged/loose pins must be replaced.
- Screws/nuts/components/connectors must be secure.

Note: When RTV3140 (***P/N: T006-03140***) or RTV3145 (***P/N: T006-03145***) is used to secure loose components, it must be cured fully before the Pressure Housing is replaced.

7.1.3 Operational

Refer to ***Section 4.1.3, Operational*** to make sure the NTO009 operates correctly.

7.1.4 Seal Replacement Recommendations

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	In-Line Electronics Chassis Assembly	***AD-416324***
Refer also:	***Section 4.4, Post-Logging: Toolstring Disassembly***.	

Note: GE Oil & Gas recommends that all the Primary Pressure Barrier Seals are replaced after every run or six months when the tool is not in use:

- **Primary Pressure Barrier Seals** are those seals that are either in contact with well fluid/ gas or that are required to withstand well pressures. Generally, these consist of a pair of seals mounted one behind the other. Sometimes, these seals will be fitted with associated Anti-Extrusion Rings (Back-up Rings).
- **Secondary Pressure Barrier Seals** are internal to the tool and do not (under normal operation) see well fluid or well pressure. Generally, these consist of a single seal.

Secondary Pressure Barrier Seals must be replaced under these situations:

- 25 runs or sooner when damaged.
- One year when not in use.
- When the tool has been exposed to H_2S or CO_2.
- When the tool is run in a well with temperatures >150°C (302°F).

Anti-Extrusion Rings (Back-up Rings) must be cleaned and checked every time the seals are replaced. It is recommended that they are replaced every 25 runs or sooner when damaged. Refer to ***Appendix C, Installation of Anti-Extrusion Rings*** for instructions to fit the Anti-Extrusion Rings.

Primary Pressure Barrier Seals and Anti-Extrusion Rings (Back-up Rings):

- Four O-Rings (***item 23, 416005***).
- One O-Ring (***item 24, 416005***).
- One O-Ring (***item 25, 416005***).
- Two O-Rings (***item 26, 416005***).
- One O-Ring (***item 27, 416005***).
- Two O-Ring (***item 28, 416005***).
- Two O-Rings (***item 29, 416005***).
- Two Backup Rings (***item 6, 416005***).
- Two Backup Rings (***item 7, 416005***).

Secondary Pressure Barrier Seals:

- One O-Ring (***item 15, 416324***).
- One O-Ring (***item 5, 412220***).
- One O-Ring (***P/N: 99008, 416005***).

7.1.5 Life Expectancy of the Electronics

At 150°C (302°F), significant electronic failures are expected after 4000hrs typical use, hence PCB replacement must be considered at this point. Every additional 10°C (18°F) halves the time. The life expectancy of the electronics is also reduced by vibration and corrosive gas inside the chassis. Visual inspection and logs of previous history is recommended, but is unlikely to predict premature failure. Tools that are suspected of reliability problems due to age or unusual log response can be heated to 120°C (248°F), which would not normally age the electronics, and afterwards subjected to moderate vibration. A moderately hard blow from a wooden hammer is recommended.

Note: **DO NOT USE METAL HAMMERS.**

7.1.6 Heat Tests Above 120°C (248°F)

Generally this is not recommended since it shortens tool life expectancy. A heat test can be required for contractual reasons, because the tool has been out of use for a long period or is for a job with an unusually high well temperature. The test must be carried out slightly above expected well temperature only and the tool must not be kept at temperature for more than one hour. Do not exceed the maximum rated temperature for the tool.

7.2 Extraordinary Maintenance

Make sure the Piston **IS** visible through the upper inlet hole for the well fluid. Refer to ***Section 4.1.4, Pressure Balance***. When the Piston is **NOT** visible, the NTO009 **MUST** be disassembled and the inside cleaned of well fluid. Refer to ***Section 5, Mechanical Description***.

After Disassembly/Assembly, complete an Oil Fill Procedure. Refer to ***Appendix D, Oil Fill Procedure***.

7.3 Troubleshooting

Refer to ***Section 5, Mechanical Description*** and ***Appendix B, Drawings & Parts Lists***.

An oscilloscope, multimeter and other basic test equipment will be required.

Table 7-1 Troubleshooting checklist

Symptom	Possible Fault	Assembly
Crystal Housing damaged	Incorrect oil fill of the tool. This will require the tool to have other checks for oil ingress or actual damage to the Crystal Housing (***item 11, 416005***). Replace the Crystal Housing. Check the position of the Piston (***item 4, 416005***). This is to make sure the tool was filled correctly with oil and the Crystal Housing only has actual damage. Replace the Crystal Housing.	***AD-416005*** (Pressure tested assembly P/N: 417023) Refer also to ***Section 5.4, Sensor Section Assembly***. ***AD-416005*** (Pressure tested assembly P/N: 417023) Refer also to ***Section 5.4, Sensor Section Assembly***.

Table 7-1 Troubleshooting checklist *(continued)*

Symptom	Possible Fault	Assembly
Failure of the Power Supply Disconnect all electrical and telemetry systems before a service	When there is a failure of the power supply, either the tool connectors or the tool body can become energised at a high voltage. **ALWAYS** disconnect fully the tool from all electrical supplies before it is serviced.	Refer to: • ***Section 5.3, In-Line Electronics Chassis Assembly***. • ***Section 5.4, Sensor Section Assembly***.
Telemetry failure in the well	When the telemetry system fails while the toolstring is in the well, it is almost certain that well fluid has entered one of the Tools and produced a short-circuit for the Ultrawire™. In some failure modes the well fluid can enter the Tool, become trapped inside the Tool and remain at a high pressure (<150psi/ 1034kPa) even when the Tool is brought to the surface. Telemetry failure is an immediate warning that trapped pressure can be within the toolstring and extreme care must be taken when tools in the toolstring are separated and serviced.	Refer to: • ***Section 4.4, Post-Logging: Toolstring Disassembly***. • ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly***.
Position of the Piston is not correct	**ALWAYS** complete ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly*** **BEFORE** a service of the NTO009. When the Piston (***item 4, 416005***) is in the correct position, it must not be across the well fluid entry holes in the Piston Housing (***item 12, 416005***). When the Piston is displaced toward the bottom of the tool and/ or is positioned across the well fluid entry holes, the NTO009 will have experienced high internal pressure while downhole. It is possible for this high internal pressure to have been vented by the Piston. **BEFORE** the Screws (***item 30, 416005***) are loosened, refer to ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly***.	--- Sensor Section Assembly (***item 2, 416026***). See ***Figure 4-4***. Refer to: • ***Section 5.4, Sensor Section Assembly***. • ***Appendix D, Oil Fill Procedure***. Sensor Section Assembly (***item 2, 416026***).

Table 7-1 Troubleshooting checklist *(continued)*

Symptom	Possible Fault	Assembly
Monoconn Adaptor Assembly (upper connector) not seated correctly	This is an indication the NTO009 will have experienced high internal pressure while downhole. In some failure modes the well fluid can become trapped inside the Tool and remain at a high pressure (<150psi/1034kPa) even when the Tool is brought to the surface.	*AD-416324* Refer to: • *Section 5.4, Sensor Section Assembly*. • *Appendix D, Oil Fill Procedure*.

APPENDIX A EQUIPMENT & SPARES

A.1 Main Equipment

Part No	Description	Qty	Remarks
NTO009	Noise Tool, Ultrawire™, Ø1 $^{11}/_{16}$", In-Line, SX	1	---

A.2 Maintenance Equipment

A.2.1 CONSUMABLES

Part No	Description	Qty	Remarks
LOR101	Liquid-O-Ring® type 101 Lubricant	1	5oz pot
LOR101L	Liquid-O-Ring® type 101 Lubricant	1	16oz pot
91064	Loctite® 243 Thread locker	1	10ml bottle
91068	Loctite® 290 Threadlocker	1	250ml bottle
415574	Dow Corning® DC200® Oil, 100CST	1	1ltr
T006-03140	Dow Corning® 3140 RTV	1	90ml
T006-03145	Dow Corning® 3145 RTV	1	90ml
N/A	Isopropyl Alcohol	N/A	Not available from GE Oil & Gas
N/A	SN100C, Flux Cored Solder Wire	N/A	Not available from GE Oil & Gas
A011-001M2	Sleeving, Heatshrink, PVDF, +175°C, Ø1.2mm (ID)	1mtr	---
A011-002M4	Sleeving, Heatshrink, PVDF, +175°C, Ø2.4mm (ID)	1mtr	---
A011-003M2	Sleeving, Heatshrink, Polyvinylidene Fluoride (PVDF), +175C, Ø3.2mm (ID)	1mtr	---
A011-004M8	Sleeving, Heatshrink, Polyvinylidene Fluoride (PVDF), +175°C, Ø4.8mm (ID)	1mtr	---
A013-00000	Sleeving, Silicone Rubber, Cl H 180C, W 0.5, Black	1mtr	---
BOO0107-2	Sleeving, Heatshrink, Hi-Temp Teflon, Ø $^{1}/_{8}$" (ID)	4ft	---

A.2.2 SERVICE TOOLS

Part No	Description	Qty	Remarks
91050	Tool Kit for $1^{11}/_{16}$" tools	1	---
KITB-UW-Earth Clip	Tool Safety Clamp (Earthing kit)	1	Refer to the Tool Safety Clamp manual (***MN-TSC001***)
10051	Socket, Hex Nut, 4BA (Modified)	1	---

A.3 Recommended Spares

Part No	Description	Qty	Remarks
KITB-NTO009	Basic Spares Kit	1	For After Each Run
KITO-NTO009	O-Ring Spares Kit	1	---
KITT014-NTO009	Kit, Tooling, Oil Fill, Noise Tool	1	Used for the oil fill of the tool. Refer to ***Appendix D, Oil Fill Procedure***.
99008	O-Ring	1	For use on the Pressure Isolation Connector (***item 32, 416005***). Refer to ***Section 5.4.6, Installation of the Pressure Isolation Connector***.
99011	O-Ring	1	For use on the Kemlon 3-Way Connector (***item 33, 416005***). Refer to ***Section 5.4.14, Installation of the Kemlon 3-Way Connector***.
R001-0001M	Resistor, 1MΩ	1	For use with the Sensor Assembly (***item 1, 416005***). Refer to: • ***Section 5.3.1, Removal***. • ***Section 5.3.2, Installation***. • ***Section 5.4.15, Removal of the Sensor Assembly***. • ***Section 5.4.16, Installation of the Sensor Assembly***.

A.4 Kit Details

PARTS LISTING	
Part PL-91050	*Issue* C
Description Tool Kit for all 1 11/16 Tools SX and GO	

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	91005	Spanner Open Ended 42mmx38mm	2	1	
0002	91019	Spanner C 50mm 35mm	2	1	
0003	10038	Spanner Box 3/8 x 5/16 Modified	2	1	
0004	91028	Spanner O/E 3/8x5/16	1	1	
0005	93876	Spanner Single Open End 18mm	1	1	
0006	91029	Key, Hex Metric (Set)	1	1	
0007	91030	Punch Pin Parallel set	1	1	
0008	00615	Assy Spanner PKJ	1	1	
0009	91293	Screwdriver Parallel tip (3 0 x 75)	1	1	
0010	91105	Toolroll With SX Badge Large Black	1	1	
0011	91104	Screwdriver Parallel tip (5 5 x 200)	1	1	
0012	91103	Pliers Circlip 812 Chrome/Van	1	1	
0013	91102	Pliers Mini Flat Nose 5 Inch	1	1	
0014	10037	Bar Tommy	2	1	
0015	10051	Kemlon tool Sondex - 4BA Hex Socket	1	1	
0016	91280	Hammer, 4oz ball pein	1	1	
0017	91130	Pin C Spanner 35-50mm	1	1	
0018	91822	Medium Flat Blade Screwdriver, 5mm	1	1	
0019	91255	T15 Torx driver, Sandvik Belzer 8915	2	1	

PARTS LISTING

Part	*Issue*
KITB-NTO009	B

Description

Kit, Spares, Basic, NTO009

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
1	410084	RING BACKUP FOR 118 O RING	1	EA	
2	415574	OIL SILICONE PMX-200-100 CSTOKE^	55	ML	
3	416092	Pin Setting Noise Tool	1	EA	
4	8299	OIL FILL PLUG FOR 1 11/16 BOND	1	EA	
5	1047	Circlip Internal 5/8 SS N1300	1	EA	
6	91068	Adhesive Loctite 290	1	ML	
7	91875	Spring canted contact	2	EA	
8	93893	Ring Retaining Int 14mm SS 2T AeroS	1	EA	
9	95011	O-ring 011 Viton 75	4	EA	
10	95012	O-ring 012 Viton 75	1	EA	
11	95112	O-RING 112 VITON 75	1	EA	
12	95122	O-RING 122 VITON 75	1	EA	
13	95124	O-RING 124 VITON 75	2	EA	
14	95211	O-ring 211 Viton 75	1	EA	
15	99008	O-ring 008 Viton 90	1	EA	
16	99011	O-ring 011 Viton 90	1	EA	
17	99012	O-ring 012 Viton 90	1	EA	
18	99118	O-ring 118 Viton 90	2	EA	
19	99124	O-RING 124 VITON 90	2	EA	

PARTS LISTING

Part	*Issue*
KITO-NTO009	B

Description

Kit, Spares, O-Rings, NTO009

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
1	95011	O-ring 011 Viton 75	4	EA	
2	95012	O-ring 012 Viton 75	1	EA	
3	95112	O-RING 112 VITON 75	1	EA	
4	95122	O-RING 122 VITON 75	1	EA	
5	95124	O-RING 124 VITON 75	2	EA	
6	95211	O-ring 211 Viton 75	1	EA	
7	99008	O-ring 008 Viton 90	1	EA	
8	99011	O-ring 011 Viton 90	1	EA	
9	99012	O-ring 012 Viton 90	1	EA	
10	99118	O-ring 118 Viton 90	2	EA	
11	99124	O-RING 124 VITON 90	2	EA	

PARTS LISTING

Part	*Issue*
KITT014-NTO009	A

Description

Kit, Tooling, Oil Fill, Noise Tool

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	415956	Assy Piston Extraction Noise Tool	1	EA	
0002	415940	Adaptor Oil Filling	2	EA	
0003	415986	Pin Piston Setting Noise Tool	2	EA	
0004	95129	O-ring 129 Viton 75	1	EA	
0005	99007	O-ring 007 Viton 90	2	EA	
0006	10051	Kemlon tool Sondex - 4BA Hex Socket	1	EA	

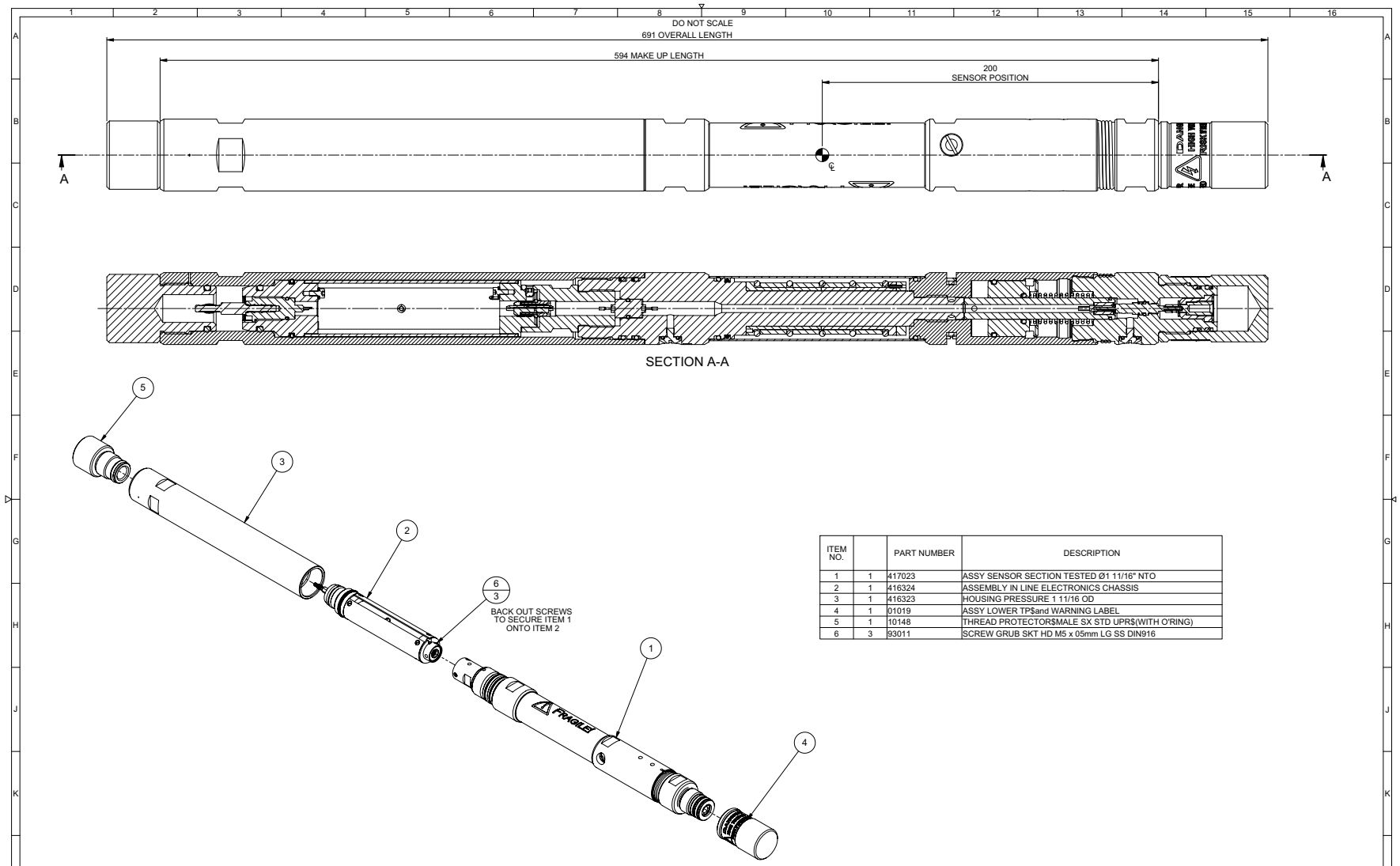
APPENDIX B DRAWINGS & PARTS LISTS

B.1 Mechanical Drawings

Description	Drawing	Parts List
NTO009 General Assembly	*AD-416026-B*	See drawing
In-Line Electronics Chassis	*AD-416324-A*	See drawing
Monoconn Upper Bulkhead Assembly	*AD-412220-A*	See drawing
Sensor Section Assembly	*AD-416005-B*	See drawing
Lower Connector	*AD-10036-F*	See drawing
Thread Protector (Upper)	*AD-10148-B*	See drawing

B.2 Electrical Drawings

Description	Type	Drawing
In-Line Electronics Section	Wiring Diagram	*WD-416324-A*
Sensor Section (Sheet 1 only)	Wiring Diagram	*WD-416005-C*



ITEM NO.		PART NUMBER	DESCRIPTION
1	1	417023	ASSY SENSOR SECTION TESTED Ø1 11/16" NTO
2	1	416324	ASSEMBLY IN LINE ELECTRONICS CHASSIS
3	1	416323	HOUSING PRESSURE 1 11/16 OD
4	1	01019	ASSY LOWER TP$and WARNING LABEL
5	1	10148	THREAD PROTECTOR$MALE SX STD UPR$(WITH O'RING)
6	3	93011	SCREW GRUB SKT HD M5 x 05mm LG SS DIN916

Rev	Date	Approver	ECR Comments
B	23 Apr 14	RTM	ECR 5-143081
A	20 Aug 13	TG	Initial Release

UNLESS OTHERWISE STATED:
DRAWN TO BS 8888 & LOCAL STANDARDS PS-166
GENERAL TOLERANCES IN ACCORDANCE WITH ISO 2768-mK
METRIC THREADS TO BE COARSE SERIES H6/g6 FIT
UNDERCUTS TO BS1936
SURFACE TEXTURE TO BE 1.6 µm MAXIMUM INTERNAL RADII 0.5

MARK THE COMPONENT WITH ITS PART No & ISSUE IN / ON THE AREA IDENTIFIED THUS: IF NO SYMBOL IS SHOWN THE COMPONENT DOES NOT REQUIRE MARKING AND SHOULD BE IDENTIFIED BY BAGGING & LABELLING. ALL TO PROCESS SPEC: PS-075

REMOVE ALL BURRS & SHARP EDGES.

THIRD ANGLE PROJECTION

ALL DIMENSIONS IN MM

USED ON: NTO

MASS: 4.75 kg

	MODELLED	DRAWN	CHECKED	APPROVED
	GJD	GJD	GC	TG
	29Apr13	05May13	19 Aug 13	20 Aug 13

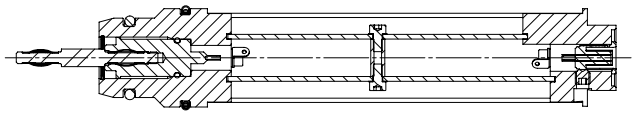
MATERIAL: SEE PARTS LIST

HEAT TREATMENT

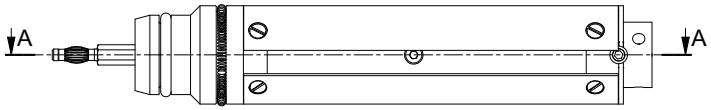
TITLE: ASSY NOISE TOOL 1 11/16 OD IN-LINE UW SX

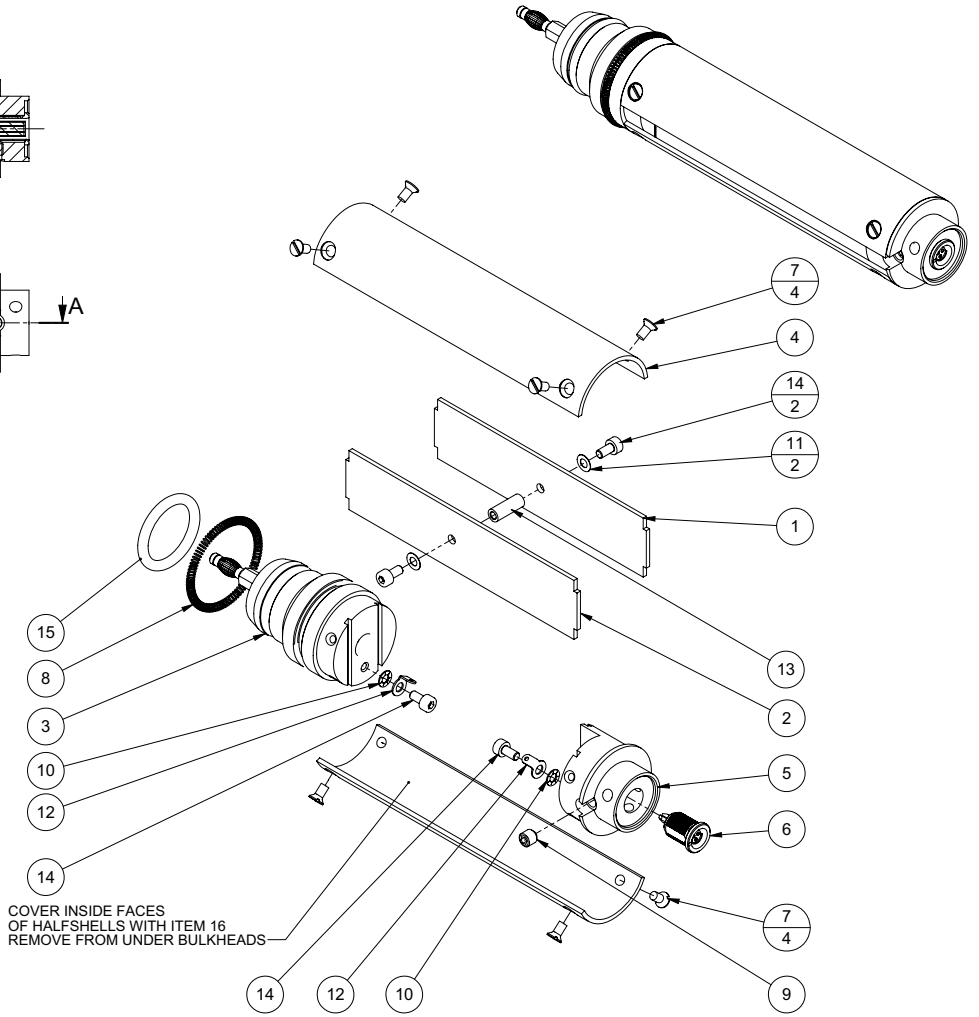
SCALE: 1:1 | DRAWING No.: AD-416026 | REVISION: B | SHEET: 1 OF 1 | A1

DO NOT SCALE



SECTION A-A





COVER INSIDE FACES
OF HALFSHELLS WITH ITEM 16
REMOVE FROM UNDER BULKHEADS

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	87445	ASSY DIGITAL BOARD NTO PROGRAMMED
2	1	87446	ASSY ANALOGUE BOARD NTO PROGRAMMED
3	1	412220	ASSY BULKHEAD MONOCONN UPPER
4	1	416325	HALFSHELLS CHASSIS
5	1	416326	BULKHEAD LOWER ELECTRONICS (FISCHER)
6	1	J002-0003W	CONNECTOR FISCHER 3 WAY SOCKET PANEL MTD
7	8	01029	SCREW CSK HD SLOTTED M3 X 06mm LG SS
8	1	91875	SPRING CANTED CONTACT
9	1	93011	SCREW GRUB SKT HD M5 x 05mm LG SS DIN916
10	2	93028	WASHER LOCK SERRATED INTERNAL M3 SS (DIN6798J)
11	2	93085	WASHER CRINKLE M3 SS
12	2	93097	Tag Solder M3
13	1	93261	SPACER - M3 THRU$4.75mm OD x 12.7mm LG
14	4	93281	SCREW SKT CAP HD M3 x 06mm LG SS
15	1	95211	O'RING 211 VITON 75
16	1	t004-008ap	tape tygaflor 208ap/03t 80 x 30mm

Rev	Date	Approver	ECR Comments
A	20 Aug 13	TG	Initial Release

UNLESS OTHERWISE STATED:
DRAWN TO BS 8888 & LOCAL STANDARDS PS-166
GENERAL TOLERANCES IN ACCORDANCE WITH ISO 2768-mK
METRIC THREADS TO BE COARSE SERIES H6/g6 FIT
UNDERCUTS TO BS1936
SURFACE TEXTURE TO BE 1.6 µm MAXIMUM INTERNAL RADII 0.5

MARK THE COMPONENT WITH ITS PART No & ISSUE IN / ON THE AREA IDENTIFIED THUS: ▭ IF NO SYMBOL IS SHOWN THE COMPONENT DOES NOT REQUIRE MARKING AND SHOULD BE IDENTIFIED BY BAGGING & LABELLING. ALL TO PROCESS SPEC: PS-075
REMOVE ALL BURRS & SHARP EDGES.

THIRD ANGLE PROJECTION

ALL DIMENSIONS IN MM

USED ON: NTO

MASS: kg

MODEL'D	DRAWN	CHECK'D	APPV'D
GJD	GJD	GC	TG
07/06/13	13 Jun 13	19 Aug 13	20 Aug 13

MATERIAL: SEE DETAIL DRAWINGS

HEAT TREATMENT

GE Oil & Gas

TITLE: ASSEMBLY IN LINE ELECTRONICS CHASSIS

SCALE: 1:1

DRAWING No.: AD-416324

REVISION: A

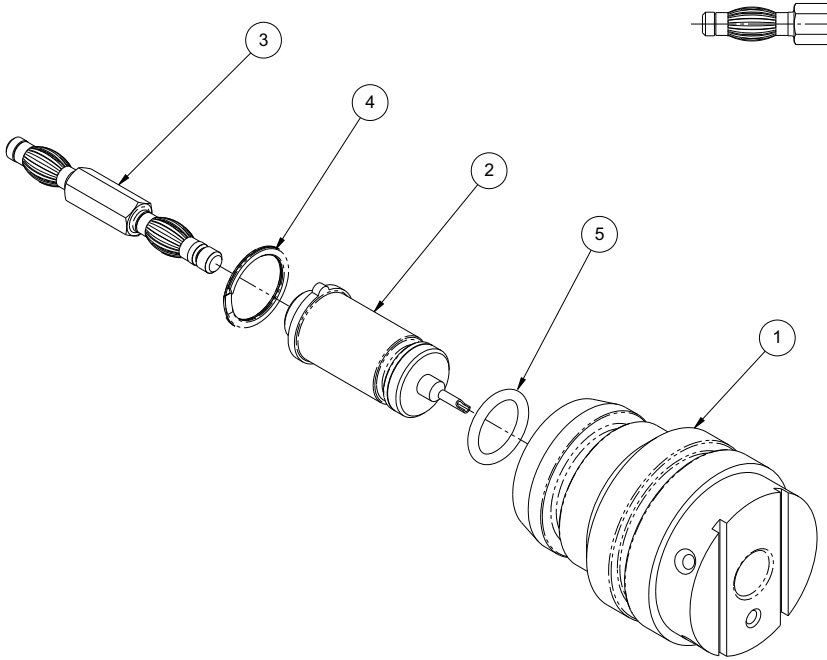
SHEET: 1 OF 1

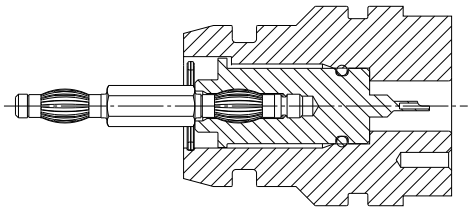
A2

[printed on &[date]]

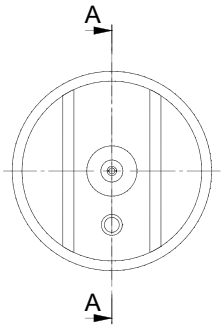
DO NOT SCALE

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	412221	BULKHEAD MONOCONN UPPER
2	1	93890	CONNECTOR FEMALE MONOCONN
3	1	412222	ASSY ADAPTOR MALE TO MALE MONOCONN
4	1	93893	RING RETAINING SPIRAL INT 14mm
5	1	95012	O'RING 012 VITON 75





SECTION A-A



UNLESS OTHERWISE STATED:
DRAWN TO BS 8888
GENERAL TOLERANCES IN ACCORDANCE WITH ISO 2768-mK
METRIC THREADS TO BE COARSE SERIES H6/g6 FIT
UNDERCUTS TO BS1936
SURFACE TEXTURE TO BE 1.6 µm MAXIMUM INTERNAL RADII 0.5

MARK THE COMPONENT WITH ITS PART No & ISSUE IN / ON THE AREA IDENTIFIED THUS: IF NO SYMBOL IS SHOWN THE COMPONENT DOES NOT REQUIRE MARKING AND SHOULD BE IDENTIFIED BY BAGGING & LABELLING. ALL TO PROCESS SPEC: PS-075
REMOVE ALL BURRS & SHARP EDGES.

THIRD ANGLE PROJECTION
ALL DIMENSIONS IN MM

USED ON: 40587
MASS: 0.20 kg

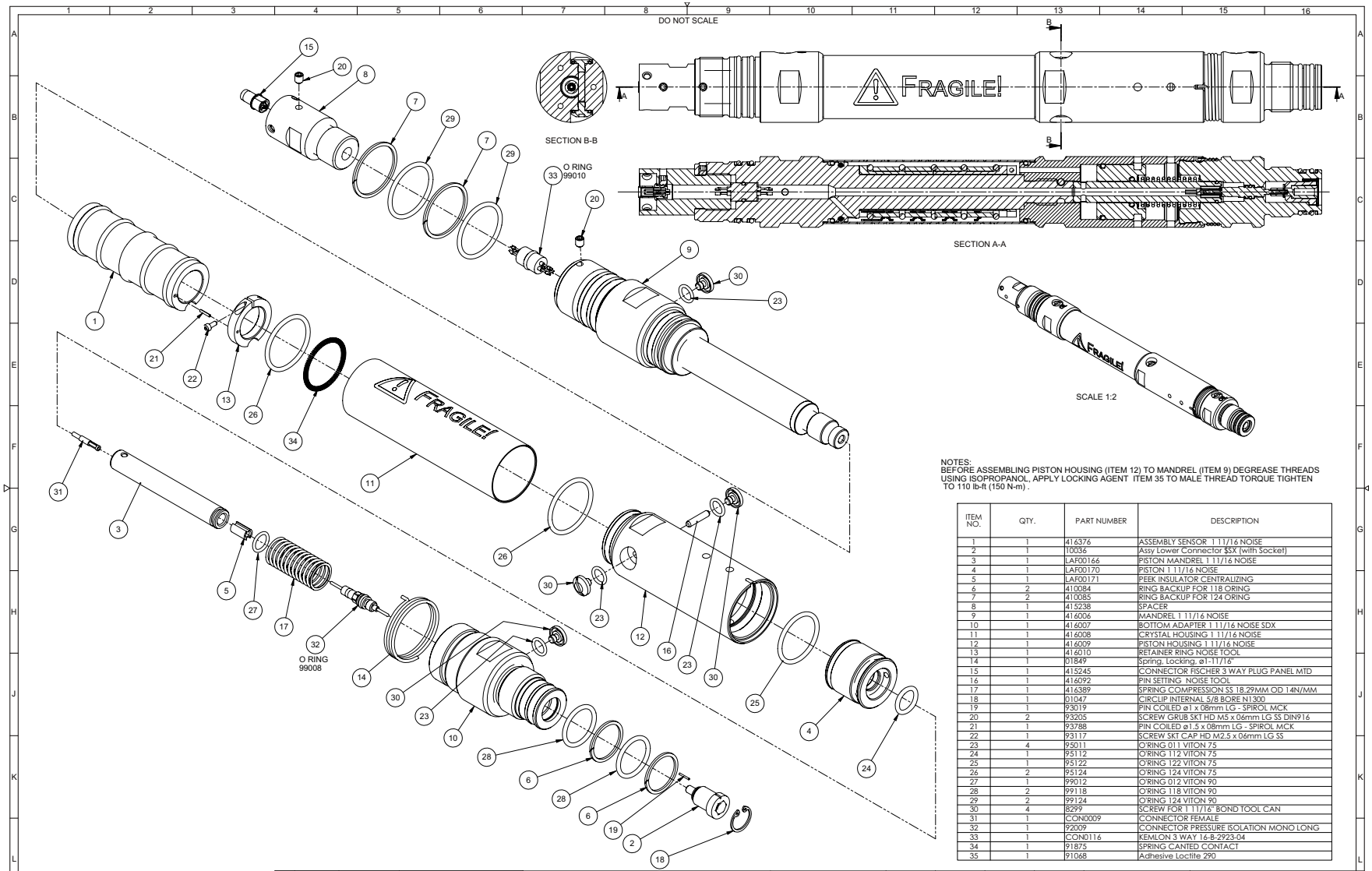
MODEL'D	DRAWN	CHECK'D	APPV'D
	RTM	IH	CD
09/08/10	15/11/10	02/12/10	12/01/11

MATERIAL: N/A
HEAT TREATMENT: N/A

TITLE: ASSY BULKHEAD MONOCONN UPPER

SCALE	DRAWING No.	ISSUE	SHEET	
2:1	AD-412220	A	1 OF 1	A2

ISS	DESCRIPTION	APPR'D	DATE
A	REF ECR5-74783		12/01/2011



NOTES:
BEFORE ASSEMBLING PISTON HOUSING (ITEM 12) TO MANDREL (ITEM 9) DEGREASE THREADS USING ISOPROPANOL, APPLY LOCKING AGENT ITEM 35 TO MALE THREAD TORQUE TIGHTEN TO 110 lb-ft (150 N-m) .

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	416376	ASSEMBLY SENSOR 1 11/16 NOISE
2	1	10036	Assy Lower Connector $SX (with Socket)
3	1	LAF00166	PISTON MANDREL 1 11/16 NOISE
4	1	LAF00170	PISTON 1 11/16 NOISE
5	1	LAF00171	PEEK INSULATOR CENTRALIZING
6	2	410084	RING BACKUP FOR 118 ORING
7	2	410085	RING BACKUP FOR 124 ORING
8	1	415238	SPACER
9	1	416006	MANDREL 1 11/16 NOISE
10	1	416007	BOTTOM ADAPTER 1 11/16 NOISE SDX
11	1	416008	CRYSTAL HOUSING 1 11/16 NOISE
12	1	416009	PISTON HOUSING 1 11/16 NOISE
13	1	416010	RETAINER RING NOISE TOOL
14	1	01849	Spring, Locking, ø1-11/16"
15	1	415245	CONNECTOR FISCHER 3 WAY PLUG PANEL MTD
16	1	416092	PIN SETTING NOISE TOOL
17	1	416389	SPRING COMPRESSION SS 18.29MM OD 14N/MM
18	1	01047	CIRCLIP INTERNAL 5/8 BORE N1300
19	1	93019	PIN COILED ø1 x 08mm LG - SPIROL MCK
20	2	93205	SCREW GRUB SKT HD M5 x 06mm LG SS DIN916
21	1	93788	PIN COILED ø1.5 x 08mm LG - SPIROL MCK
22	1	93117	SCREW SKT CAP HD M2.5 x 06mm LG SS
23	4	95011	O'RING 011 VITON 75
24	1	95112	O'RING 112 VITON 75
25	1	95122	O'RING 122 VITON 75
26	2	95124	O'RING 124 VITON 75
27	1	99012	O'RING 012 VITON 90
28	2	99118	O'RING 118 VITON 90
29	2	99124	O'RING 124 VITON 90
30	4	8299	SCREW FOR 1 11/16" BOND TOOL CAN
31	1	CON0009	CONNECTOR FEMALE
32	1	92009	CONNECTOR PRESSURE ISOLATION MONO LONG
33	1	CON0116	KEMLON 3 WAY 16-B-2923-04
34	1	91875	SPRING CANTED CONTACT
35	1	91068	Adhesive Loctite 290

UNLESS OTHERWISE STATED ALL DIMENSIONS ON THIS DRAWING SHOULD CONFORM TO THE FOLLOWING TOLERANCES.
0.X ±0.020"
0.XX ±0.010"
0.XXX ±0.005"
ANGLE ±0.5°

Rev	Date	Approver	ECR Comments
B	28 Apr 14	MPR	ECR 5-144468
A	20 Aug 13	TG	Initial Release

UNLESS OTHERWISE STATED:
DRAWN TO BS 8888 & LOCAL STANDARDS PS-166
METRIC THREADS TO BE COARSE SERIES H6/g6 FIT
UNDERCUTS TO BS1936
SURFACE TEXTURE TO BE 63µin MAXIMUM INTERNAL RADII 0.02
MARK THE COMPONENT WITH ITS PART No & ISSUE IN / ON THE AREA IDENTIFIED THUS: IF NO SYMBOL IS SHOWN THE COMPONENT DOES NOT REQUIRE MARKING AND SHOULD BE IDENTIFIED BY BAGGING & LABELLING. ALL TO PROCESS SPEC: PS-075
REMOVE ALL BURRS & SHARP EDGES.

THIRD ANGLE PROJECTION
ALL DIMENSIONS IN INCHES
USED ON: NTO
MASS: 3.271 kg

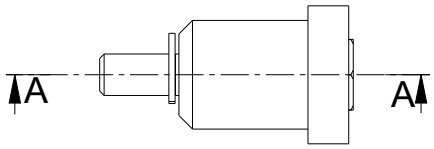
MODELLED	DRAWN	CHECKED	APPROVED
GJD	GJD	GC	TG
29Apr13	04/03/2013	19 Aug 13	20 Aug 13

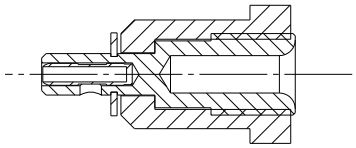
MATERIAL: SEE PARTS LIST
HEAT TREATMENT:

TITLE: ASSY SENSOR SECTION Ø1 11/16" NOISE TOOL
SCALE 1:1 | DRAWING No. AD-416005 | REVISION B | SHEET 1 OF 1 | A1

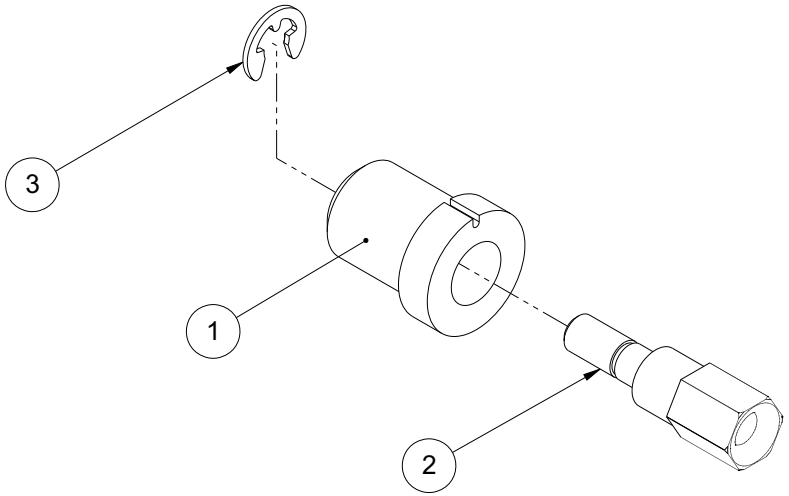
DO NOT SCALE

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	01025	Insulator, Lower Head
2	1	414309	ASSY PIN CONNECTOR LOWER SX
3	1	414315	CIRCLIP RADIAL E DIN 6799-4 SS





SECTION A-A



NOTES:

1. PRESS FIT ITEM 2 INTO ITEM 1.
2. ENSURE CIRCLIP ITEM 3 IS FULLY ENGAGED IN GROOVE OF ITEM 2
3. MARK THE COMPONENT WITH ITS PART No
   & ISSUE IN / ON THE AREA IDENTIFIED THUS:
   IF NO SYMBOL IS SHOWN THE COMPONENT IS TOO SMALL
   AND SHOULD BE IDENTIFIED BY BAGGING & LABELLING.
   ALL TO PROCESS SPEC: PS-075

DRAWN: JC	CHECKED: GC	APP'D: NPB
DATE: 18/07/05	DATE: 18/07/05	DATE: 18/07/05

DIM IN: INCHES
MATL: SEE DETAIL DRAWINGS
SCALE: 2:1 A3
HEAT TREATMENT/CONDITION: NOT APPLICABLE

ISS	DESCRIPTION	APPD	DATE
F	REF. ECR 5-86194	NPB	25/04/12
E	ECR 5564 REFERS	NPB	13/10/10
D	REF ECR 2798 INSTRUCTIONS ADDED	NPB	18/07/05

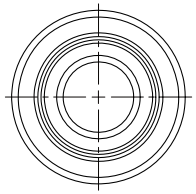
Sondex
Tel. 0118 932 6755

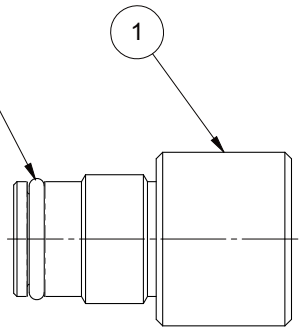
THIRD ANGLE PROJECTION

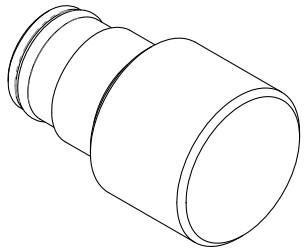
USED ON: COM
MACHINE FINISH: 63
GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

TITLE: ASSY LOWER CONNECTOR SX (WITH SOCKET)
SHEET: 1/1
DRAWING No.: AD 10036
ISSUE: F
S W

DO NOT SCALE







ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	01018	Thread Protector, Male, Std, Upper
2	1	95211	O'RING 211 VITON 75

B	ECR 5-79547 REFERS (REDRAWN)		10/02/2011
NC			08/02/2011
ISS	DESCRIPTION	APPR'D	DATE

UNLESS OTHERWISE STATED:
DRAWN TO BS 8888
GENERAL TOLERANCES IN ACCORDANCE WITH ISO 2768-mK
METRIC THREADS TO BE COARSE SERIES H6/g6 FIT
UNDERCUTS TO BS1936
SURFACE TEXTURE TO BE 1.6 µm MAXIMUM INTERNAL RADII 0.5

MARK THE COMPONENT WITH ITS PART No & ISSUE IN / ON THE AREA IDENTIFIED THUS: ▱ IF NO SYMBOL IS SHOWN THE COMPONENT DOES NOT REQUIRE MARKING AND SHOULD BE IDENTIFIED BY BAGGING & LABELLING. ALL TO PROCESS SPEC: PS-075
REMOVE ALL BURRS & SHARP EDGES.

THIRD ANGLE PROJECTION
ALL DIMENSIONS IN MM.

USED ON: COM
MASS: 0.120 kg

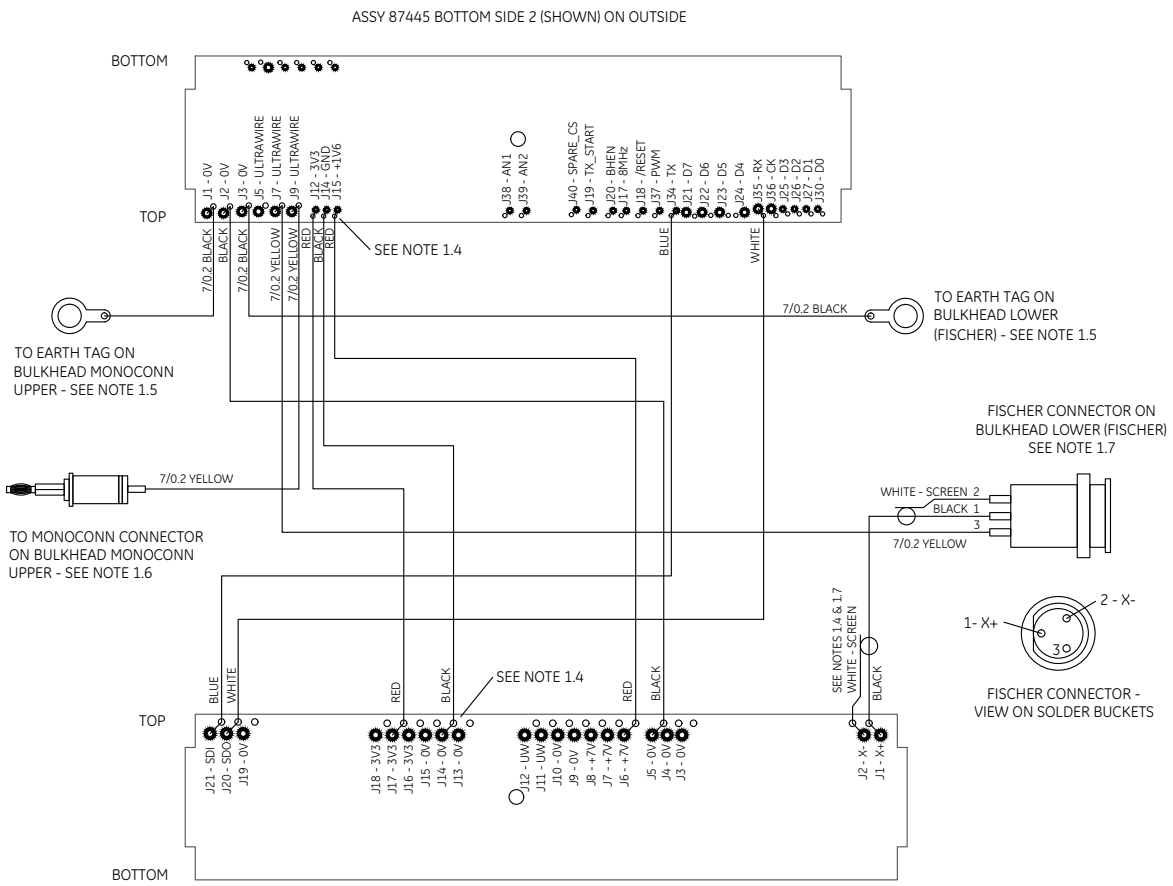
MODELLED	DRAWN	CHECKED	APPR'D
RTM	NGH	GJD	NPB
08/02/11	07/04/04	09/02/11	10/02/11

MATERIAL: N/A
HEAT TREATMENT: N/A

Sondex

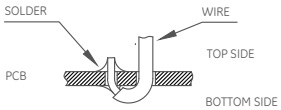
TITLE: THREAD PROTECTOR MALE SX STD UPR (WITH O'RING)

SCALE	DRAWING No.	ISSUE	SHEET	
1:1	AD-10148	B	1 OF 1	A3

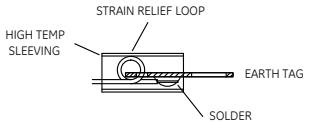


NOTES:-

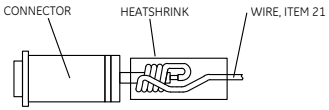
1.1. ALL WIRES TO BE 7/0.12 PTFE TYPE 'A' UNLESS OTHERWISE STATED.
1.2 ALL WIRING WITHIN THE ELECTRONIC CHASSIS IS TO BE AS SHORT AS POSSIBLE. THEREFORE ONLY ENOUGH SURPLUS WIRING IS TO BE LEFT SO IT IS POSSIBLE TO REMAKE THE CONNECTION ONLY ONCE.
1.3. FOR SOLDERING REFER TO PROCESS SPEC. PS118 AND SOLDERING SPEC. J-STD-001 (PS118 TAKES PRECEDENCE.
1.4. PASS WIRES THROUGH STRAIN RELIEF HOLES FROM SIDE 1 TO SIDE 2 OF BOARD THEN BACK THROUGH SOLDER PADS FROM SIDE 2 TO SIDE 1 OF BOARD ENSURING SOLDER COMPLETELY FILLS HOLE.



1.5. SOLDER TAG STRAIN RELIEF:-
STRIP AND PREPARE END OF WIRE TO CONNECT TO TAG.
PASS THE INSULATION AND WIRE THROUGH THE EYELET OF THE TAG.
SOLDER THE WIRE TO THE TAG. ENSURE SOLDER HAS FLOWED AROUND BOTH SIDES OF THE TAG. USE HEATSHRINK TO COVER JOINT.



1.6. METHOD OF ATTACHING INSULATED WIRE TO 'MONO-CONN' CONNECTOR:-
SOLDER WIRE TO CONNECTOR; CLEAN SOLDER JOINT.
BRING WIRE IMMEDIATELY BACK TO CONNECTOR AND WRAP 4 TURNS TIGHTLY AROUND IT'S SOLDER BUCKET BEFORE ROUTING WIRE IN ORIGINAL DIRECTION.
FIT HEATSHRINK SLEEVING, (LENGTH TYPICALLY 15mm), OVER INSULATOR OF CONNECTOR AND WIRE.



1.7. FISCHER CONNECTOR WIRING:-
STRIP COAX OUTER TO APPROX. 15MM.
TRIM BACK SCREEN TO APPROX. 10MM.
STRIP COAX INNER TO APPROX. 5MM.
SOLDER WHITE 7/0.12 TYPE 'A' WIRE TO SCREEN AND FOLD BACK ALONG LENGTH OF COAX. SLEEVE WITH HEATSHRINK.
SLEEVE OVER JOINT.
FOLD WIRE TAILS BACK TOWARD JOINT AND SLEEVE WITH HEATSHRINK TO FORM STRAIN RELIEF.

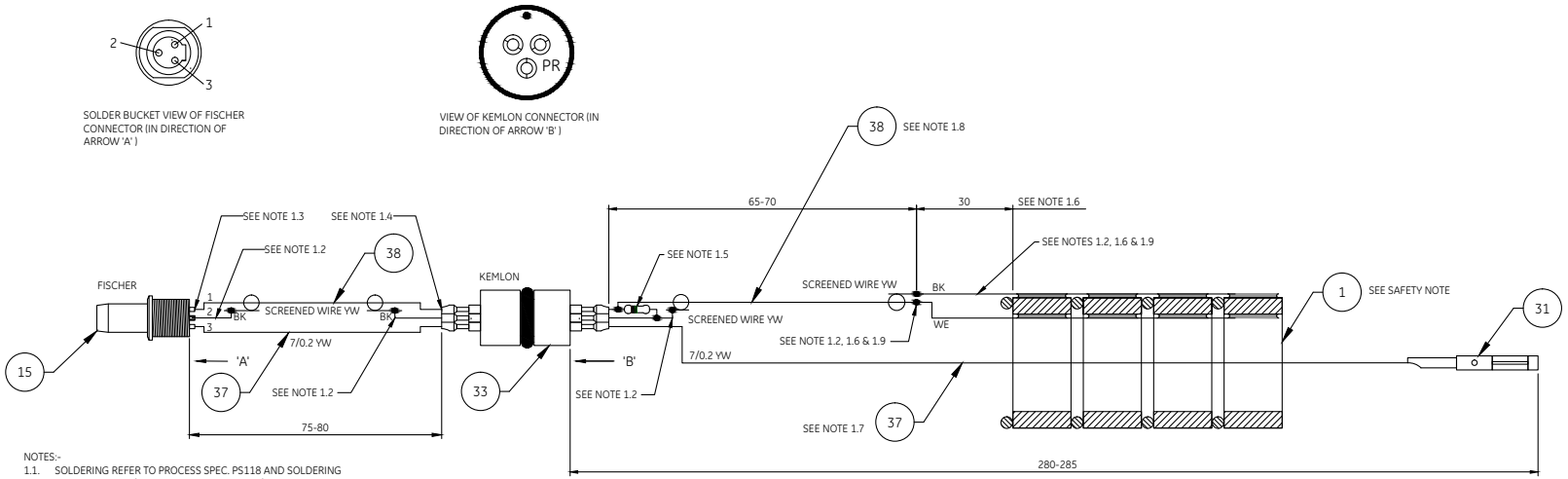
REV	CHANGE	APPD	DATE
A	ECR 5-113362 REFERS	MN	06-08-2013

GE Oil & Gas

TITLE
NTO
ELECTRONICS SECTION
WIRING DIAGRAM

DRAWN	CHECKED	APPROVED
PC	MP	MN
DATE	DATE	DATE
22-07-2013	06-08-2013	06-08-2013

DRAWING No. WD-416324
REVISION A
SHEET 1 of 1
A3



NOTES:-

1.1. SOLDERING REFER TO PROCESS SPEC. PS118 AND SOLDERING SPEC. J-STD-001 (PS118 TAKES PRECEDENCE)

1.2. FOR SOLDERING OF WIRE TAILS SEE Fig 1 SHEET 2.

1.3 SOLDER INNER OF SCREENED WIRE ITEM 38 TO PIN 1 OF FISCHER CONNECTOR AND SLEEVE WITH HEATSHRINK ITEM 40.
SOLDER SCREEN WIRE TAIL OF SCREENED WIRE ITEM 38 TO PIN 2 OF FISCHER CONNECTOR AND SLEEVE WITH HEATSHRINK ITEM 40.
SOLDER WIRE ITEM 37 TO PIN 3 OF FISCHER CONNECTOR AND SLEEVE WITH HEATSHRINK ITEM 40.

1.4. SOLDER INNER OF SCREENED WIRE ITEM 38 TO ANY PIN OF KEMLON CONNECTOR AND SLEEVE WITH HEATSHRINK ITEM 36.
SOLDER SCREEN WIRE TAIL OF SCREENED WIRE ITEM 38 TO ANOTHER PIN ON KEMLON CONNECTOR AND SLEEVE WITH HEATSHRINK ITEM 36.
SOLDER OTHER END OF WIRE ITEM 37 TO REMAINING PIN OF KEMLON CONNECTOR AND SLEEVE WITH HEATSHRINK ITEM 36.

1.5. TRIM ONE LEAD OF RESISTOR ITEM 39 TO APPROX 8mm.
TWIST THE SCREENED WIRE INNER ITEM 38 AROUND THE LONG LEAD OF THE RESISTOR AND SOLDER.
SOLDER RESISTOR ACROSS THE TWO PINS WHICH MATCH THE SCREENED WIRE TERMINATIONS ON THE OTHER SIDE OF THE KEMLON (SO THAT THE SCREENED WIRE INNER CONNECTS THROUGH THE KEMLON CONNECTOR TO THE SCREENED WIRE INNER ETC.)
SOLDER THE SCREEN WIRE TAIL TO THE KEMLON CONNECTOR AND OTHER END OF RESISTOR.
SLEEVE THE INNER OF SCREENED WIRE, CONNECTOR PIN AND RESISTOR LEAD WITH HEATSHRINK ITEM 42. SEE Fig 2 SHEET 2.
SLEEVE THE RESISTOR, THE SCREENED WIRE INNER, SCREEN WIRE TAIL AND PINS OF CONNECTOR WITH HEATSHRINK ITEM 42. SEE Fig 2 SHEET 2.

1.6. LEAVING APPROX 30mm OF INSULATION, SOLDER WHITE WIRE TO SCREENED WIRE INNER ITEM 38 AND SLEEVE WITH TWO LAYERS OF HEATSHRINK ITEM 41. SEE Fig 3 SHEET 2.
LEAVING APPROX 30mm OF INSULATION, SOLDER BLACK WIRE TO SCREEN WIRE TAIL OF SCREENED WIRE ITEM 38 AND SLEEVE WITH TWO LAYERS OF HEATSHRINK ITEM 41. SEE Fig 3 SHEET 2. SEE SAFETY NOTE.

1.7. SOLDER ONE END OF WIRE ITEM 37 TO REMAINING PIN ON KEMLON CONNECTOR (PR SIDE) AND OTHER END TO SINGLE CONNECTOR PIN ITEM 31.
SLEEVE SOLDER JOINTS AND THE COMPLETE LENGTH OF WIRE WITH THREE LAYERS OF HEATSHRINK ITEM 36.

1.8. SLEEVE SCREENED WIRE WITH HEATSHRINK ITEM 36. SEE Fig 4 SHEET 2.

1.9. SOLDER WIRES TO CRYSTAL AS DETAILED IN SPECIFICATION PS179. SEE Fig.5 SHEET 2.

SAFETY NOTE -

PIEZO-CERAMIC CRYSTALS CAN GENERATE HIGH VOLTAGES WHEN SUBJECT TO MECHANICAL STRESS OR TEMPERATURE CHANGE. WHEN HANDLING THE CRYSTALS ASSEMBLY ENSURE THAT THE STRIPPED ENDS OF THE FLYING LEADS ARE TWISTED TOGETHER TO PREVENT CHARGE BUILD UP. ONLY UNTWIST THESE WIRES WHEN MAKING THE TERMINATION TO THE SCREENED CABLE. NOTE THAT WHEN CONNECTED TO THE SENSOR ASSEMBLY WIRING LOOM, A BLEED RESISTOR PREVENTS CHARGE BUILD UP.

NTS - ALL DIMENSIONS IN mm

REV	CHANGE	APPD	DATE
C	ECR 5-124081 REFERS	PEJR	11-02-2014
B	ECR5-122296	PEJR	18-10-13

GE Oil & Gas

TITLE
NOISE TOOL
SENSOR SECTION
WIRING DIAGRAM

DRAWN	CHECKED	APPROVED
DMC	PEJR	MN
DATE	DATE	DATE
20-08-2013	20-08-2013	20-08-2013

DRAWING No. WD-416005 | REVISION C | SHEET 1 of 2

A3

APPENDIX C INSTALLATION OF ANTI-EXTRUSION RINGS

At high temperatures O-Rings become very soft, this with the addition of high pressures can cause the O-Rings to extrude into the gap between the Housing and the bore. Eventually this can lead to failure and a subsequent tool flood. To prevent this, Anti-Extrusion Rings have been added to some Seals on this tool, both static and dynamic. These rings are made of plastic and have been designed to prevent extrusion of the O-Ring into the gap.

Note: Anti-Extrusion Rings are often referred to as Back-up Rings, particularly when used with standard O-Rings.

When a single Anti-Extrusion Ring is used, it must always be fitted on the side **AWAY** from well pressure (see ***Figure C-1*** below).

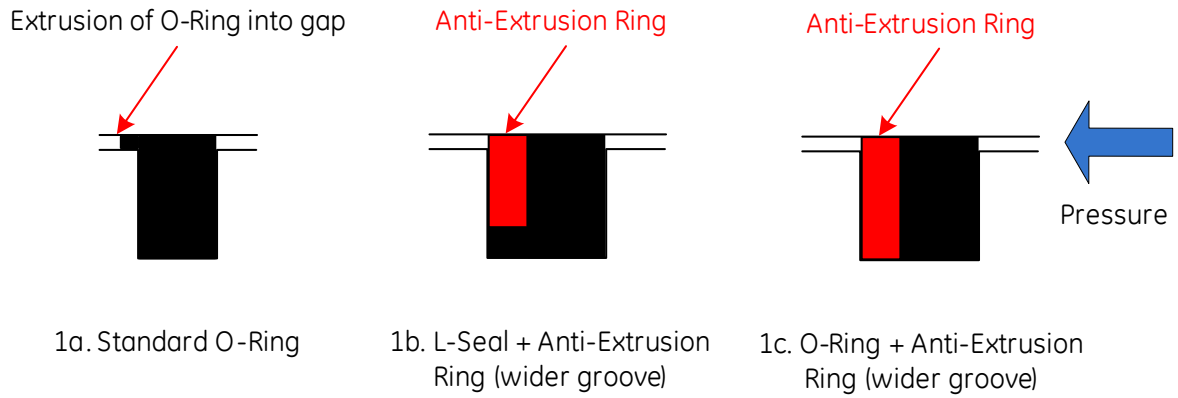


Figure C-1 Installation of a single Anti-Extrusion Ring

When two Anti-Extrusion Rings are used, they must be positioned one on each side of the O-Ring (see ***Figure C-2*** below).

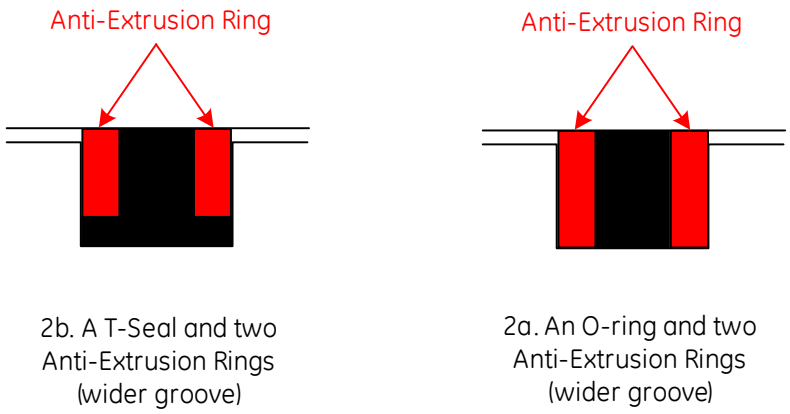


Figure C-2 Installation of two Anti-Extrusion Rings

Anti-Extrusion Rings are scarf cut to allow assembly. Make sure the gap between the scarf cut is no more than 1mm.

Make sure the Anti-Extrusion Rings are concentric in their groove and are seated uniformly.

Note: Due to the increased friction, all joints that contain Anti-Extrusion Rings will be slightly more difficult to tighten than previously with just the O-Rings. However, do **NOT** force the joint together. **ANY** excessive force indicates that part of the Anti-Extrusion Ring has caught on either the bore or the lead-in chamfer and excessive force can damage the Anti-Extrusion Ring and/or the Seal. Unscrew slowly the joint, check the Anti-Extrusion Ring is seated correctly and then retighten the joint.

APPENDIX D OIL FILL PROCEDURE

A full service (refer to ***Section 5, Mechanical Description***) must be performed when either:

- Well-fluid is suspected to have leaked into the tool.
- Oil has leaked out of the tool.

When either of the above has occurred:

- All O-Rings **MUST** be replaced. Refer to ***Section 7.1.4, Seal Replacement Recommendations*** and to ***Section 5, Mechanical Description***.
- Internal parts that have been contaminated with well-fluid **MUST** be cleaned or replaced when required.
- The In-Line Electronics Chassis Assembly **MUST** be cleaned and checked to make sure it functions correctly.
- The reassembled tool **MUST** be vacuum filled with fresh Dow Corning® DC200® 100CST Oil (***P/N: 415574***). Refer to ***Appendix D.1, How to Oil Fill***.

D.1 How to Oil Fill

WARNING!

TRAPPED PRESSURE!

Refer to *Section 2.3.1, Trapped Pressure Safety Precautions*.

Reference:	Sensor Section Assembly (Pressure tested assembly P/N: 417023)	***AD-416005***
	NTO009 General Assembly	***AD-416026***
	NTO009 Oil Fill Kit	***KITT014-NTO009***

Note: Item numbers refer to the Sensor Section Assembly (AD-416005), unless stated otherwise.

GE Oil & Gas recommends the NTO009 tool is assembled fully before this oil fill procedure is completed.

The purpose of this procedure is to remove air from the internal chambers of the Sensor Section Assembly (***item 1, 416026***) and to fill correctly the Sensor Section Assembly with clean Dow Corning® DC200 100CST Oil (***P/N: 415574***).

In addition, the position of the Piston (***item 4***) is set to make sure there is the correct volume (52.6ml) of oil inside the Sensor Section Assembly to provide protection to the Sensor Assembly (***item 1***) from the effects of changes to temperature and to pressure.

To fill the NTO009 with clean Dow Corning® DC200 100CST oil, complete these steps:

1 Make sure any internal pressure of the Sensor Section Assembly is released as follows:

i With reference to ***Figure D-1***, place a rag over the two Screws (***item 30***) and put a suitable size container (to collect the oil) under the two Screws.

Note: With reference to ***Figure D-1***, **DO NOT** remove the two Screws indicated as this will permit the Setting Pin (***item 16***) to fall out of the Piston Housing (***item 12***).

ii Use a suitable screwdriver to remove and retain the two Screws (***item 30***). Make sure the associated O-Rings (***item 23***) are removed and the oil drains into the container.

When necessary, move/tilt the Sensor Section Assembly to make sure all possible oil is drained from the tool.

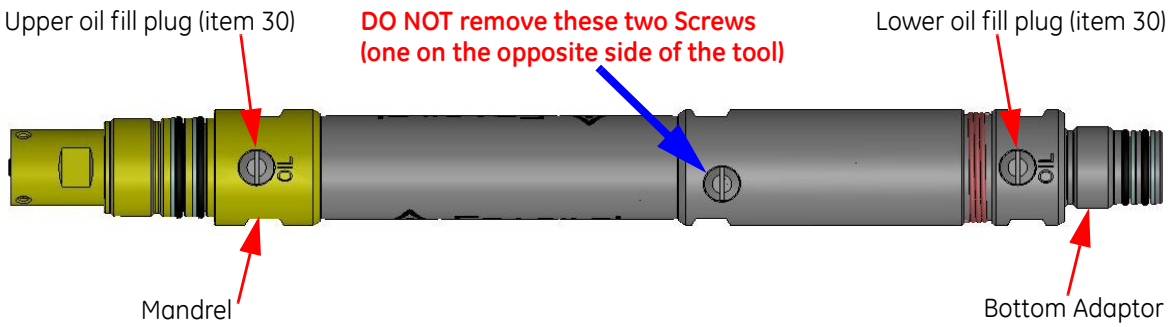


Figure D-1 Location of the two oil fill plugs

2 With reference to ***Figure D-2***, make sure the Piston (***item 4***) is located correctly inside the Piston Housing (***item 12***) and then continue with ***Step 3***.

ONLY when the Piston is **NOT** located correctly, complete these steps:

i Remove the Bottom Adaptor (***item 10***). Refer to ***Section 5.4.3, Removal of the Bottom Adaptor***.

ii Attach the Piston Extraction Tool Assembly (***item 1, KITT014-NTO009***) to the Piston.

iii Move the Piston to align the groove with the upper well fluid entry hole in the Piston Housing.

iv Insert the two Piston Setting Pins (***item 3, KITT014-NTO009***) in the two upper well-fluid entry holes and make sure they engage with the groove in the Piston. This is to restrict any movement of the Piston.

v Use the O-Ring (***item 4, KITT014-NTO009***) to hold in position the two Piston Setting Pins.

vi Remove the Piston Extraction Tool Assembly from the Piston.

vii Install the Bottom Adaptor. Refer to ***Section 5.4.4, Installation of the Bottom Adaptor***.

viii Continue with ***Step 5***.

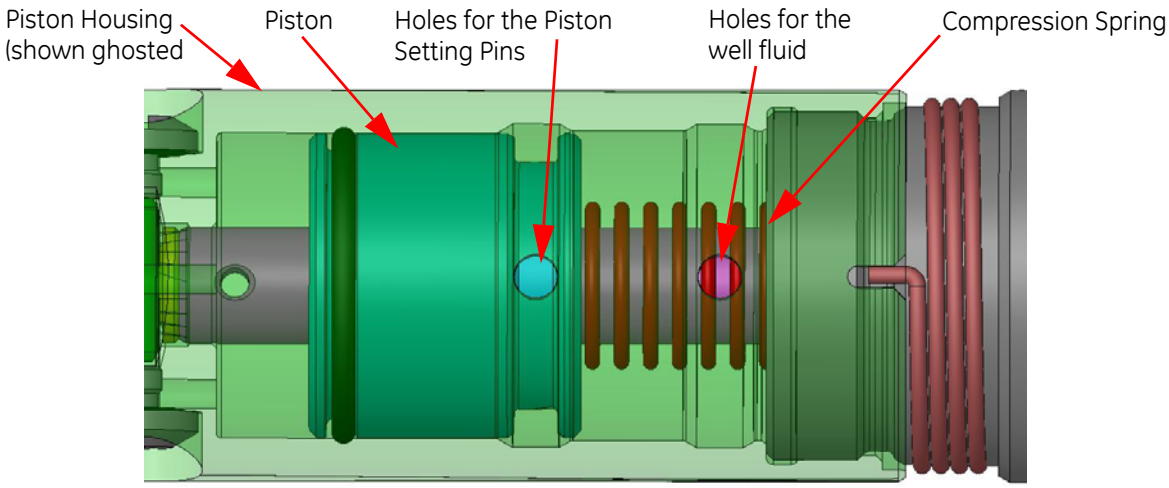


Figure D-2 Identification of the Piston alignment holes with the Piston in the correct position

3 Insert the two Piston Setting Pins (***item 3, KITT014-NTO009***) in the two upper well-fluid entry holes and make sure they engage with the groove in the Piston. This is to restrict any movement of the Piston.

4 Use the O-Ring (***item 4, KITT014-NTO009***) to secure in position the two Piston Setting Pins.

5 With reference to ***Figure D-3***, install the two Oil Filling Adapters (***item 2, KITT014-NTO009***) (complete with the two O-Rings - ***item 5, KITT014-NTO009***) in the two oil fill ports and make sure a clean, tight connection is made.

The two oil fill ports (marked "OIL") are one in the Mandrel and one in the Bottom Adaptor.

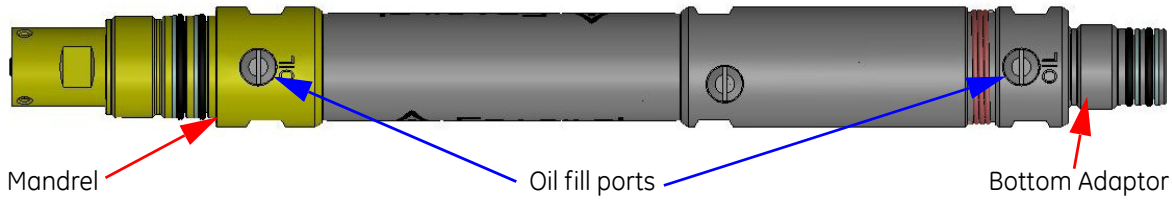


Figure D-3 Location of the two oil fill ports

6 Position the tool on suitable V-block supports with the lower end of the tool at the higher lever as shown in ***Figure D-4***.

7 With reference to ***Figure D-4***, connect a suitable vacuum-type Oil Fill Rig to the two Oil Filling Adapters. Make sure the Oil Fill Rig contains Dow Corning® DC200 100CST Oil (***P/N: 415574***).

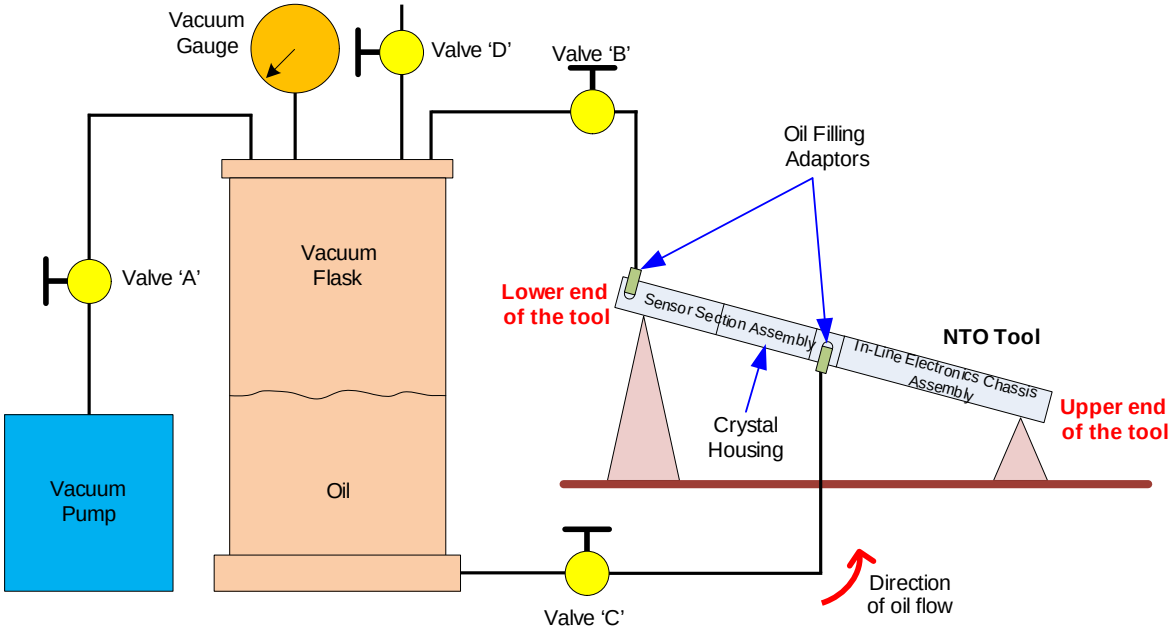


Figure D-4 Basic setup of the Oil Fill Rig and the NTO009

NOTE: Make sure the **lower** end of the tool is positioned **higher** than the upper end of the tool. This is to help with the removal of air from the tool while it is filled with oil.

8 Use the Oil Fill Rig to evacuate air from the tool until no air bubbles appear in the pipes connected to the tool.

9 Maintain the vacuum to transfer oil into the tool and stop the fill at 52.6ml, but **DO NOT** close the system.

Note: Use the Oil Fill Rig to measure the 52.6ml quantity of oil.

10 Tap gently on the tool (**EXCEPT** on the Crystal Housing - ***item 11***) with a soft-faced mallet to free any trapped pockets of air.

DO NOT tap on the Crystal Housing as this will cause damage!

11 When possible, observe the oil fill tubes to check bubbles are not present when the tool appears full. The fill process can take 30 minutes to 45 minutes (approx.).

12 Close all the valves on the oil fill rig and then remove the Oil Filling Adaptor (complete with its O-Ring) from the oil fill port that is closest to the **lower end of the tool** (see ***Figure D-4***).

13 Install one of the Screws (***item 30***) (complete with a new O-Ring - ***item 23***) and tighten to seal the oil fill port.

14 Turn the tool to make sure the Oil Filling Adaptor (closest to the **upper end of the tool**) is now at the highest position. This is to prevent the loss of oil from the Sensor Section Assembly.

15 Remove the Oil Filling Adaptor from the oil fill port that is closest to the **upper end of the tool**.

16 Install the second Screw (***item 30***) (complete with the new O-Ring - ***item 23***) and tighten to seal the oil fill port.

17 Remove and retain the O-Ring (***item 4, KITT014-NTO009***) and the two Piston Setting Pins (***item 3, KITT014-NTO009***).

18 Where applicable, attach the In-Line Electronics Chassis Assembly (***item 2, 416026***) to the Sensor Section Assembly.

19 Install the Pressure Housing (***item 3, 416026***).

20 Complete an Operational check of the fully assembled NTO009. Refer to ***Section 4.1.3, Operational***.

21 Install the two thread Protectors (***item 4 & 5***).

GE Oil & Gas
Drilling & Surface

GE Oil & Gas
Building X107
Range Road
Cody Technology Park
Farnborough
Hampshire
GU14 0FG
United Kingdom

Tel: +44 (0)1252 862200
Fax: +44 (0)1252 862349

For complete contact information, please refer to our website:

www.geoilandgas.com/downholetechnology

Customer support: +44 (0)1252 862200

www.ge.com/oilandgas