GE Oil & Gas
Drilling & Surface

Sondex* Wireline

Radial Bond Tool

$1^{11}/_{16}$", Ultrawire™

Operation & Maintenance Manual

CE

Tool Code: RBT003
Document: MN-RBT003
Revision: 2
Date: 14 February 2013

GE imagination at work

* Denotes a trademark of the General Electric Company

Contents

0 ABOUT THIS MANUAL

0.1 Manual History

Date	Issue	Description	Auth	Chk	App
16/10/05	1	Initial	HL		
22/12/05	1	Sell off Issue	HL		AE
14/02/13	2	New GE Oil & Gas template. Revised complete manual to suit.	SL	MM/ PS/JF	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***).
- RBT Calibration Tool (RCT001) manual (***MN-RCT001***).
- Bullnose manual (***MN-BUL***).
- Ultralink™/Ultrawire™ Crossover (XTU002) manual (***MN-XTU002***).
- Dummy Logging Cable (DLC007) manual (***MN-DLC007***).
- Ultralink™ Logging Panel (ULP002) manual (***MN-ULP002***).
- Warrior Software manual (***MN-WARRIOR***).

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

Please help us to improve future issues of this manual by adding your comments or corrections to ***www.geoilandgas.com/downholetechnology***, referencing the document number.

Thank you.

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

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

1 OVERVIEW

The RBT evaluates cement bond integrity. In addition the RBT radial receiver generates a map of the cement, by measuring the amplitude of sonic signal passing along the casing.

The RBT is equipped with one transmitter and two sensors constructed of piezoelectric crystals. The receiver (Rx1) nearest the transmitter, is constructed of an six sector radial receiver. Each sector provides bond data covering a 60^{O} section of casing. The primary amplitude is constructed from radial signals at the receiver (Rx1). The receiver (Rx2) farthest from the transmitter, is used to generate a Variable Density Log (VDL).

The RBT can be deployed in deviated/horizontal wells, is Memory/SRO capable, and combines readily with any of the complete range of Ultrawire™ tools. Its slotted sleeve technology imparts sound isolation, rigidity and tool strength. The tool is comprised of corrosion resistant materials throughout.

Figure 1-1 RBT003

1.1 Applications

- Cement Bond Evaluation.

1.2 Interfacing & Tool Combinations

- Simultaneous operation with other Ultrawire™ tools.
- Compatible telemetry controller (for example, UMT & XTU).
- Bottom Flowmeter or Bullnose with Ultrawire™ termination.

1.3 Receiver Descriptions

In the field, the receiver descriptions can vary. The table below indicates the descriptions this manual uses and the alternative descriptions that could be used in the field.

Table 1-1 Receiver Descriptions

This manual:	Alternatives:	Signals:
Rx1	3ft	Near & Radial
Rx2	5ft	Far

1.4 Specification

Table 1-2 RBT003 Specifications

Parameter	Specification	Remarks
Temperature Rating	177°C (350°F)	
Pressure Rating	15,000psi (103MPa)	
Diameter	$1^{11}/_{16}$" (43mm)	
Make-Up Length	9.93ft (3.03m)	
Measure Point:		
Rx1	60.58" (153.87cm)	From bottom of tool
Rx2	48.58" (123.39cm)	From bottom of tool
Weight	40lbs (18.1kg)	
Assembled Length	10.28ft (3.13m)	Thread protectors fitted
Operating Voltages:		
Nominal	18V DC	
Range	+14 to +23VDC	
Maximum	+24VDC	
Current consumption at 18V	50mA	
Receivers	Piezoelectric Crystal	
Signal Output	Rx1 (91.4cm) amplitude, Rx2 (152.4cm) VDL and a cement quality map generated by the calibrated six segment receiver array	
Ultrawire™ Tool Address	27	Factory default address
Maximum Casing Diameter	7.5" (19cm)	
End Threads:		
Upper	$1^{3}/_{16}$" 12 UN 2A Sondex female	
Lower	$1^{3}/_{16}$" 12 UN 2B 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 and used in accordance with the specifications of GE Oil & Gas, protection will likely be impaired.

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, monitoring for gas leaks, site inspection, fire fighting equipment, 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.

2.2 Electrical Hazard

WARNING!

ELECTRICAL HAZARD!

To protect operators whilst maintaining or servicing the downhole tools, make sure the Tool Safety Clamp (*P/N: KITB-UW-Earth Clip* for Ultrawire™ tools) is attached to the toolstring and correctly grounded. Refer to the Tool Safety Clamp manual (*MN-TSC001*).

2.3 Stored Energy

WARNING!

STORED ENERGY!

The tool has components/areas that can store energy. This energy can be released without warning.

Refer to *Section 4.4.1, Relief of Trapped Pressure at the Tool Joints* for instructions to safely release this stored energy.

2.3.1 Trapped Pressure Safety Precautions

WARNING!

TRAPPED PRESSURE!

Spaces in the tool can retain trapped pressure after a downhole leakage. As this pressure can be released without warning, always:

- **Follow the instructions in the manual.**
- **Should trapped pressure be suspected, 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.**

Wear a protective face shield.

Wear a protective apron.

2.3.2 Management of Trapped Pressure

Logging tools are subjected to harsh conditions downhole. High hydrostatic-pressure, high-temperature, shock, vibration and contact with corrosive substances can all contribute to causing 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 quantity of fluid/gas leaking 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 servicing 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 out of the tool or bubbling/hissing noises.
- Tools that have been fished.
- Tools that have been downhole for extended periods.
- Hard to undo housings or housing split nuts.

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

2.3.2.1 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 removing 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 transportation packaging. 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 being transported in an aircraft.

4 **DO NOT** open the tool in a confined space or building. There is a possibility of toxic chemicals being released.

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

2.3.2.2 *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** let the tool stand in a cordoned-off safe area (outdoors is recommended) with hazard signs indication, 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 more manageable level.

3 **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. It is recommended also to display (at a safe distance from the tool) large signs that can be read clearly and convey the same warning.

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 use toxic-chemical monitoring equipment.

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 or sparking.

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 Checks***.

2.3.3 *Compressed Air*

WARNING!

COMPRESSED AIR!

Compressed air MUST be used with caution.

Wear protective goggles/glasses.

Wear protective gloves.

DO NOT point compressed airlines nozzles at your body or other personnel.

All Local Rules & Regulations (Directives) for the correct use of an airline and compressed air MUST be followed.

2.3.4 COMPRESSED SPRINGS

WARNING!

COMPRESSED SPRINGS!

The RBT003 contains a compressed Inconel Spring (*item 22*, 9-4-03-30S3501) with the Sonde Section.

Refer to *Section 5, Mechanical Description* for safe disassembly/assembly.

Wear protective goggles/glasses.

2.4 Danger from Machinery

2.4.1 WEIGHT

WARNING!

HEAVY EQUIPMENT!

The equipment and some associated subassemblies are heavy. Care MUST be taken when the equipment is lifted, moved or maintained.

GE Oil & Gas recommends the use of correct lifting apparatus in accordance with local directives and safety standards.

Make sure all heavy items are supported correctly at all times.

Wear applicable Personal Protective Equipment (PPE) for the task to be undertaken.

Refer to the specification table in the relevant manual for the equipment weight.

2.5 Irritants

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

- **ALWAYS** refer to the applicable Material Safety Data Sheet (MSDS) 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.

2.5.1 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.

2.5.2 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 Material Safety Data Sheet (MSDS) for Dow Corning® 3140 RTV Coating.

2.5.3 Dow Corning® 3145 RTV Coating

IRRITANT!

DOW CORNING® 3145 RTV COATING

Wear protective gloves.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Dow Corning® 3145 RTV Coating.

2.5.4 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.

2.5.5 Duralco™ 120 Epoxy

IRRITANT!

DURALCO™ 120 EPOXY!

Wear protective gloves.

Wear protective goggles/glasses.

Wash hands after use.

For further safety information, refer to the Material Safety Data Sheet (MSDS) for Duralco™ 120 from your supplier.

2.6 Tool Integrity

2.6.1 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.

GE Oil & Gas recommend to use **ONLY** the greases and sealants specified for the Tool.

GE Oil & Gas recommends the use of Liquid-O-Ring®, type 101 (***P/N: LOR101***) to grease lightly:

- The pressure seals.
- All threads for the tool joints and the pressure housings.
- All seals.

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 grease entering the tool. **DO NOT** use too much grease. **DO NOT** use copper loaded greases unless specified in the related tool manual.

2.6.2 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 7.1.3, Seal Replacement Recommendations***.

2.6.3 Fluid/Gas Ingress

CAUTION!

FLUID/GAS INGRESS!

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

2.7 Electrostatic Discharge (ESD)

CAUTION!

ELECTROSTATIC DISCHARGE!

The tool contains electronic circuits and devices that can suffer permanent damage if 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 sufficiently grounded.

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: ***www.weeerohsinfo.com***.

2.9 EMC Classification

CAUTION!

EMC CLASSIFICATION

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

2.10 Transportation and Storage

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

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

3 THEORY OF OPERATION

The RBT003 operates based upon the principle of Sonic Wavetrain Attenuation.

The acoustic source - the transmitter's piezoelectric crystal - converts the electrical energy of the trigger pulse into acoustic energy. The energy radiates out from the transmitter in all directions as a wavefront of compressional waves. The wavefront travels at differing speeds through various media, attenuating during travel. When the wavefront reaches the tool's sensors, the resulting acoustic energy is captured and transduced into electrical signals.

The signals are processed at surface against the RBT calibration, an ideal of zero (or near zero) wavetrain attenuation, to generate the following full wave sonic information:

- First arrival amplitude of the wavefront at the radial receiver and the ***Rx1*** Receiver.
- Travel time of the wavefront at the ***Rx1*** receiver.
- Variable Density Log (VDL) information based on the full wavetrain at the ***Rx2*** Receiver.
- An amplitude map drawn from the radial data received from the ***Rx1*** Receiver.

3.1 Electronics

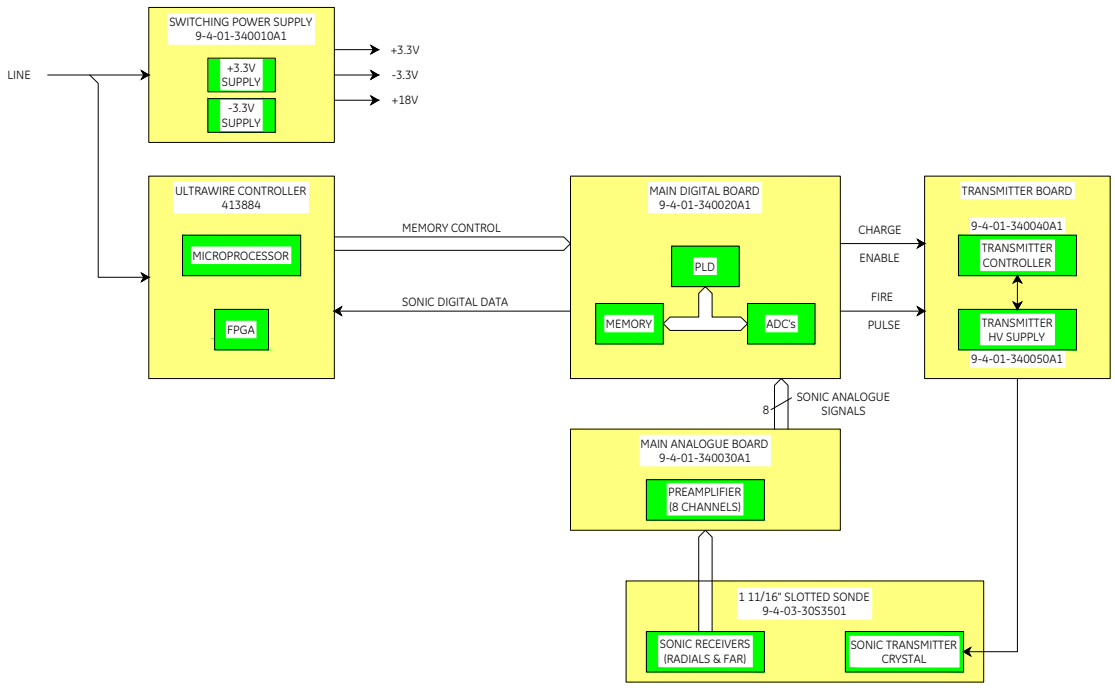


Figure 3-1 RBT Simplified Tool Diagram

The RBT003 power supply is a switching mode type that provides the tool with +3.3 VDC and -3.3 VDC from 18 VDC line voltage. The Ultrawire™ Controller plugs on the back of the power supply. Control and data signals from and to the Ultrawire™ Controller are routed via the power supply to the rest of the tool.

The Main Analogue board receives and conditions the sonic signal from the radial and far receivers. It then routes it to the Main Digital board for digitisation.

The Main Digital board performs the following tasks:

- Digitise the Sonic waveforms.
- Stores the digitised waveforms in memory to be read later by the Ultrawire™ controller.
- Responds to the Ultrawire™ controller commands and transfers the digitised sonic data to it.
- Sends the firing pulse to the Transmitter circuit.

The RBT003 Transmitter circuit board contains two stacked boards (a Control board and a Power board) which control firing of the transmitter crystal.

4 OPERATING PROCEDURE

4.1 Pre-Logging Checks

WARNING! **ELECTRICAL HAZARD!**

Refer to *Section 2.2, Electrical Hazard*.

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

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

4.1.1 ELECTRICAL

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

1 Remove Upper Protective Plug and Bottom End Cap and make sure that the upper and the lower electrical connectors are clean, dry and undamaged.

2 Use a multimeter to measure the through resistance. The reading should be <0.5Ω.

4.1.2 MECHANICAL

CAUTION! **SEAL INTEGRITY!**

Refer to *Section 2.6, Tool Integrity*.

Reference: RBT Sonde Assembly *AD-9-4-03-30S3501*

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

1 Clean and apply Liquid-O-Ring® (*P/N: LOR101*) to the two lower O-Ring seals (*item 41*). Replace the O-Rings when damaged.

4.1.3 OPERATIONAL

WARNING! **ELECTRICAL HAZARD!**

Refer to *Section 2.2, Electrical Hazard*.

GE Oil & Gas recommend the tool is tested in a RBT Calibration Tank (RCT001) before the site visit. Software calibration is optional. Refer to Warrior Manual (*MN-WARRIOR*) and *Section 7.1.6, Software Calibration* for setup and calibration details.

4.2 Connecting to Toolstring

WARNING!

HEAVY TOOLS AND EQUIPMENT

Refer to *Section 2.4.1, Weight*.

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

Check that the upper and lower tool joint seals and seal surfaces are clean, undamaged and have been lightly greased (***P/N: LOR101***).

The RBT003 may be inserted in any position below the telemetry controller.

It is recommended that centralisers are fitted above and below the RBT003.

An Ultrawire™ Bullnose Terminator (for example BUL013) or a suitable Ultrawire™ bottom end flowmeter must be fitted to the lower end of the Ultrawire™ toolstring. Toolstrings without Ultrawire™ terminators fitted are likely to suffer from data loss.

For a suitable toolstring configuration, see ***Figure 4-1***.

The RBT **MUST** be rigged-up vertically and in sections. Make sure the toolstring is suitably supported during rig-up.

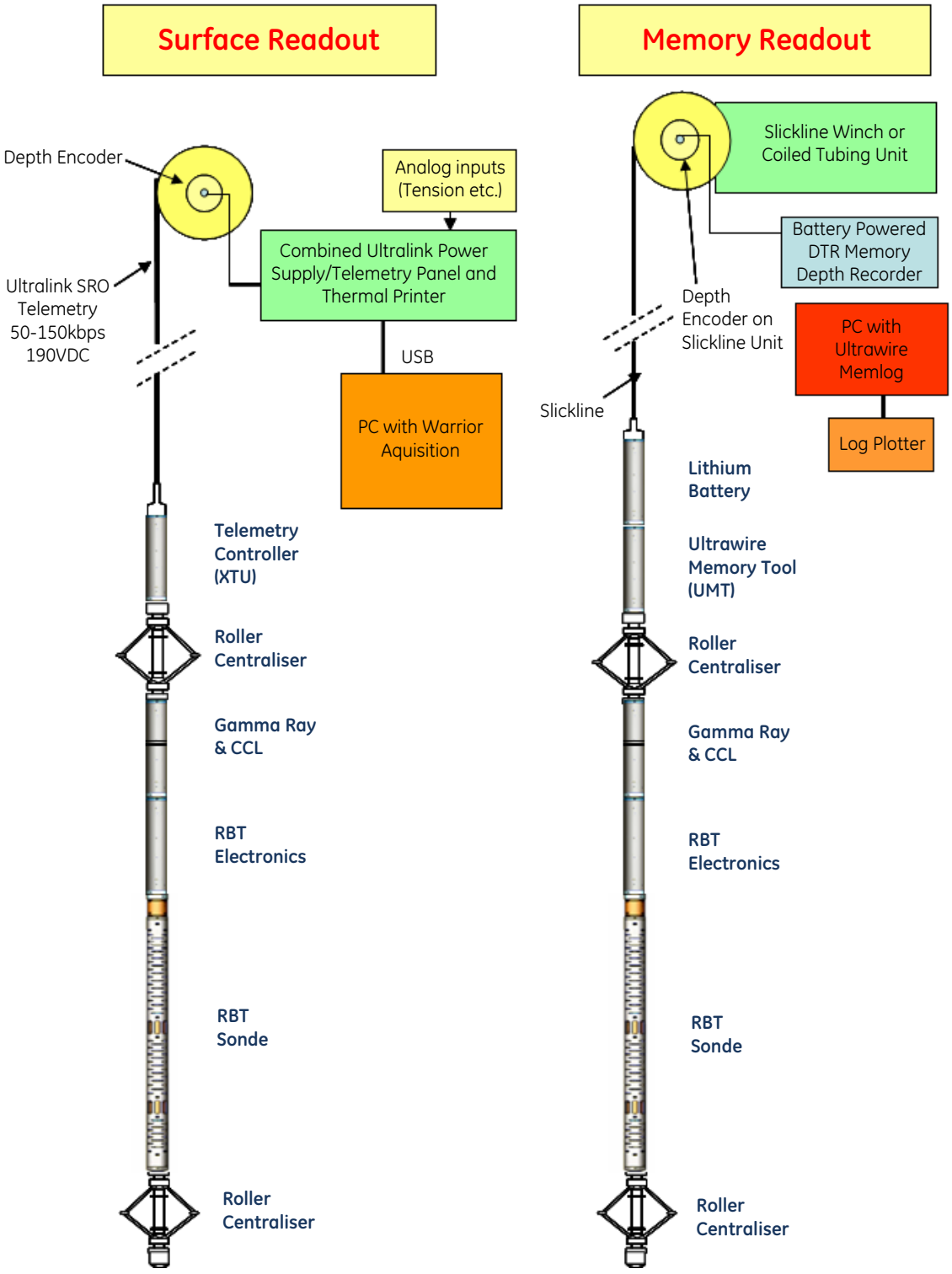


Figure 4-1 Suggested Toolstring Configuration

4.3 Logging

4.3.1 Wellsite Zero Calibration

A Wellsite Zero Calibration (tool hanging in air) is not usually required, but is optional. If there is a section of free pipe in the logged interval, then a Free Pipe Calibration can be performed. The target value for this will depend on the casing size, obtained from Interpretation Charts, refer to ***Appendix E, Interpretation Chart***.

Note: The calibration is overwritten, unless the tool is given an additional serial number.

Refer to the Warrior Manual (***MN-WARRIOR***) for instructions.

If unable to complete a Wellsite Zero Calibration, use the Master Calibrations obtained during Software Calibration, refer to ***Section 7.1.6***.

4.3.2 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 accordingly when in deviated wells. The use of a Head Tension Unit is highly recommended.

Note: Do not exceed the calculated safe working 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 not to exceed 120% of tension when tool stationary. Speed not to exceed 150ft/min.	Surface tension should not be less than 80% of tension when tool stationary. Speed not to exceed 150ft/min.
>400 clear open hole	Surface tension not to exceed 130% of tension when tool stationary. Speed not to exceed 150ft/min.	Surface tension should not be less than 70% of tension when tool stationary. Speed not to exceed 150ft/min.
Approaching 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 Checks

WARNING! **TRAPPED PRESSURE!**

Refer to *Section 2.3.1 Trapped Pressure Safety Precautions*.

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

- Telemetry failures downhole.
- Signs of mechanical damage.
- Unusual seepage of fluid out of the tool or bubbling/hissing noises.
- Tools that have been fished.
- Tools that have been downhole for extended periods.
- Hard to undo housings or housing split-nuts.

4.4.1 Relief of Trapped Pressure at the Tool Joints

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 may emerge from the tool joint.

2 Unscrew **SLOWLY** the tool joint. Should there be trapped pressure inside the tool joint, the tool joint may well 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 any hissing or fluid appearance is noted, cease **IMMEDIATELY** to unscrew the tool joint and allow the pressure to dissipate before unscrewing 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 is escaping, resume to unscrew **SLOWLY** the tool joint. When further hissing or signs of fluid escape are evident, cease **IMMEDIATELY** the unscrewing and allow the pressure to dissipate.

5 Repeat these steps until all trapped pressure within the tool joint is released and there is no pressure loading.

6 The above procedure **DOES NOT** relieve any pressure that may be trapped within the RBT003. To relieve any pressure trapped within the RBT003, refer to ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly*** **BEFORE** proceeding with either Post Logging Disassembly or Transportation.

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

4.4.2 Toolstring Disassembly

The tool should be cleaned before the toolstring is disassembled.

Make sure that well fluid does not reach the electrical connectors.

The RBT **MUST** be disassembled vertically and in sections wherever possible. Make sure the toolstring is suitably supported during disassembly.

Refit top Protective Plug and bottom End Cap as soon as possible after disassembling the toolstring to prevent damage to the O-Rings and sealing surfaces.

4.5 Transport and Storage

WARNING!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

Store with end threads lightly greased with Liquid-O-Ring® (***P/N: LOR101***) and fitted with the upper Protective Plug and the bottom End Cap.

The tool should be transported to site in the transport case provided.

Do not subject the tool to extreme shock, such as dropping or hitting with a hard object.

5 MECHANICAL DESCRIPTION

Reference: General Assembly *AD-3403501*

This section details the necessary disassembly and reassembly procedures required to maintain the RBT003 tool.

The RBT003 has two main sections.

1 Electronics Section (situated at the top of the tool) consisting of:

- Top Sub SX (***item 4***).
- RBT UW Electronics (***item 1***).

2 Sonde Section (situated at the bottom of the tool) consisting of:

- Sonde Slotted (***item 2***).
- Connect Hyper Bottom SX (***item 3***).

The Top Sub SX (***item 4***) is connected to the RBT UW Electronics (***item 1***). The Top Sub contains a Pressure Relieving Feed Thru to allow any trapped pressure contained within the Electronics Section to safely escape.

The RBT UW Electronics contains the boards providing power and telemetry to run the Sonde Section and communicate with the toolstring Ultrawire™ Telemetry Controller (for example XTU and UMT).

The Sonde Slotted (***item 2***) is filled with silicone oil to prevent pressure damage during operation downhole. The Sonde Slotted contains the transmitter, two receivers and the Connect Hyper Bottom SX (***item 3***).

Note: **DO NOT** fire the transmitter circuitry when the Electronics Section (***item 1***) is separated from the Transmitter in the Sonde Section (***item 2***).

The RBT003 should first be separated into the two main parts. The individual sections are then explained in detail to enable the replacement of damaged seals and parts. Note that once the sections are separated it does not matter which section, Electronics Section or Sonde Section, is serviced first.

The two receivers are described in this section as Rx1 and Rx2. Refer to ***Table 1-1*** for alternative descriptions.

5.1 Relief of Trapped Pressure - Tool Disassembly

WARNING!

TRAPPED PRESSURE!

Refer to *Section 2.3.1 Trapped Pressure Safety Precautions*.

Reference:		
	General Assembly	***AD-3403501***
	Electronic Assembly	***AD-9-4-03-34E3501***
	Pressure Relieving Feed Thru Assembly	***AD-413380***

Note: Where tools are fitted either above or below the RBT003, refer to ***Section 4.4.1 Relief of Trapped Pressure at the Tool Joints*** for instructions on how to remove safely these tools before you proceed.

CHECK the Valve Shaft (***item 1***, 413380) is fully seated in the Valve Body (***item 2***, 413380). Where the Valve Body has been pushed out so that the Valve Shaft is **NOT** protruding, the tool is likely to have had well fluid inside and any trapped pressure released through the Pressure Relieving Feed Thru in the Top Sub (***item 4***, 3403501). For further information contact ***GE Oil & Gas Technical Services***.

Although trapped pressure should have been released through the Pressure Relieving Feed Thru in the Tob Sub (***item 4***, 3403501), where trapped pressure is still suspected, complete these actions:

1. Place a rag around the joint between the Top Sub (***item 4***, 3403501) and the Electronics Housing (***item 6***, 9-4-03-34E3501) of the RBT003. This will diffuse any jet of gas or fluid/gas that may emerge from the joint and the upper end of the Top Sub (***item 4***, 3403501).

2. Unscrew **SLOWLY** the Top Sub (***item 4***, 3403501) from the Electronics Housing (***item 6***, 9-4-03-34E3501) of the RBT003. Should there be trapped pressure inside the Electronics Housing (***item 6***, 9-4-03-34E3501), the tool joint may well 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 any hissing or fluid appearance is noted, the disconnection process should cease **IMMEDIATELY** and the pressure inside the Electronics Housing (***item 6***, 9-4-03-34E3501) 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 is escaping, resume to unscrew **SLOWLY** the joint. When further hissing or signs of fluid escape are evident, cease **IMMEDIATELY** the unscrewing and allow the pressure to dissipate.

5. Repeat these steps until all trapped pressure is released and there is no pressure loading on the tool joint.

5.2 Disassembly

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

CAUTION!

TOOL INTEGRITY

Refer to ***Section 2.6, Tool Integrity***.

Note: **DO NOT** clamp the mandrel cans (***items 2, 4, 8 & 10***) into a vice. Dents to the cans will compromise the sonic function of the RBT003.

Refer to ***Section 7.1.3*** for recommended seal replacement.

5.2.1 SEPARATION OF ELECTRONIC & SONDE SECTIONS

Reference:	General Assembly	***AD-3403501***
	Electronic Assembly	***AD-9-4-03-34E3501***
	Pressure Relieving Feed Thru Assembly	***AD-413380***

1 **CHECK** the Valve Shaft (***item 1***, 413380) is fully seated in the Valve Body (***item 2***, 413380). Refer to ***Section 5.1, Relief of Trapped Pressure - Tool Disassembly***.

2 Support the Sonic Section in suitable stands (for example, V-Blocks).

3 Use a strap wrench on the Electronics Housing (***item 6***, 9-4-03-34E3501) to remove the Electronics Housing from the Sonic Slotted (***item 2***, 3403501).

4 Remove the Electronic Housing (***item 6***, 9-4-03-34E3501) along with the Top Sub SX (***item 4***, 3403501).

5 Referring to ***BD-3403501***, unplug the following connectors from the Electronics Section:

- 2-pin connector to the Power Supply Board (PCB9-4-01-340010A1) at J4.
- 10-pin connector to the Main Analogue Board (PCB9-4-01-340030A1) at J1.
- 4-pin connector to the Transmitter Power Board (PCB9-4-01-340050A1) at J3.

6 Mark the Sonic Section (***item 2***, 3403501) top sub and one of the HS Rail Caps (***item 7***, 9-4-03-34E3501) to make sure of correct orientation upon reassembly.

7 Remove the four Screws (***item 11***, 9-4-03-34E3501) attaching the HS Rail Caps (***item 7***, 9-4-03-34E3501) to the Sonic Section top sub and carefully remove the Electronics Section.

5.2.2 ELECTRONICS SECTION

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

The Electronics Section must first be removed from the Sonde Section as detailed in ***Section 5.2.1***.

Note: ***SN100C*** solder is to be used on the Electronics Section and **MUST NOT** be mixed with the ***HMP*** solder used in the Sonde Section. **Mixing solder types will result in tool failure downhole.**

5.2.2.1 Top Sub

Reference:	Electronic Assembly	***AD-9-4-03-34E3501***
	Top Sub SX Assembly	***AD-9-4-03-0000002***

1 Place the Electronic Housing (***item 6***, 9-4-03-34E3501) in a vice with soft jaws.

2 Loosen the joint between the Electronics Housing and the Top Sub (***item 1***, 9-4-03-0000002) using a spanner on the Top Sub flats. Remove the Top Sub.

3 Remove and discard the two O-Rings (***item 2***, 9-4-03-0000002) and check the four Back-up Rings (***item 3***, 9-4-03-0000002). Replace where damaged.

5.2.2.2 Pressure Relieving Feed Thru

Reference:	Top Sub SX Assembly	***AD-9-4-03-0000002***
	Pressure Relieving Feed Thru Assembly	***AD-413380***

1 Remove the Protective Male Plug (***item 4***, 9-4-03-0000002) from the Top Sub (***item 1***, 9-4-03-0000002).

2 Unscrew the Pressure Shaft (***item 6***, 9-4-03-0000002) from the Pressure Relieving Feed Thru (***item 5***, 9-4-03-0000002) using two box spanners.

3 Remove the Pressure Shaft (***item 6***, 9-4-03-0000002) along with the Multilam Cage, Pressure Washer and Sleeve (***items 9, 8 & 7***, 9-4-03-0000002).

4 To remove the Pressure Relieving Feed Thru (***item 5***, 9-4-03-000002) from the Top Sub (***item 1***, 9-4-03-0000002):

i. Locate a suitable shaft to fit inside and be as long as or longer than the Top Sub.
ii. Place the probe in the bottom of the Top Sub and push the bottom of the Pressure Feed Thru to ease it out of the top of the Top Sub.
iii. The Valve Washer (***item 3***, 413380) will likely separate from the rest of the assembly upon removal.

5 Check the two O-Rings (***item 5***, 413380). Replace where damaged.

6 Remove the Valve Shaft (***item 1***, 413380) from the Valve Body (***item 2***, 413380).

7 Check the O-Ring (***item 4***, 413380). Replace where damaged.

5.2.2.3 Relative Bearing Device

Reference: Electronic Assembly *AD-9-4-03-34E3501*
Wiring Diagram *WD-9-4-03-34E3501*

1 To make sure the Relative Bearing Device is returned to its correct orientation upon reassembly, mark one of the HS Rail Caps (*item 7*) and the Coupling Block (*item 5*).

2 Unsolder (*SN100C*) four wires connecting the Relative Bearing Device (*item 1*) to PCB413884 (*item 20*), refer to *WD-9-4-03-34E3501*.

3 Unplug connector board (*P/N: 9-4-01-34008001*) from the Power Supply PCB (*item 14*).

4 Remove four Screws (*item 11*) securing the top of the HS Rail Caps (*item 7*) to the Coupling Block (*item 5*).

5 Remove the electronics upper assembly containing the Relative Bearing Device (*item 1*), see *Figure 5-1*.

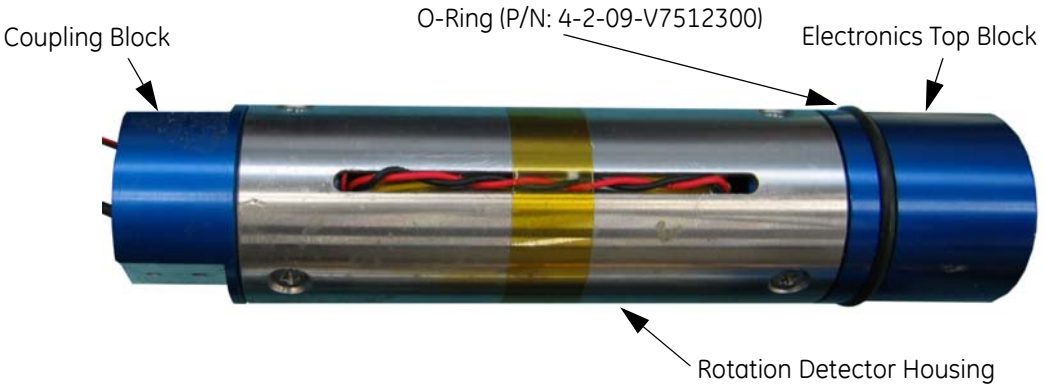


Figure 5-1 Electronics Upper Assembly

6 Check the O-Ring (P/N: 4-2-09-V7512300) on the Electronics Top Block (*item 21*). Replace if damaged.

Note: It is not recommended to disassemble the upper assembly unless faulty. It is recommended that the tool is returned to GE Oil & Gas for repair and re-calibration.

5.2.3 SONDE SECTION

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant.*

IRRITANT!

DOW CORNING® 200® FLUID, 100CST OIL

Refer to *Section 2.5.4, Dow Corning® 200® Fluid, 100CST Oil*

Reference: Sonde Assembly *AD-9-4-03-30S3501*

The Sonde Section contains silicone oil which will drain during disassembly. Therefore, it is advisable that suitable containers and clean rags are obtained before continuing.

Should any part of the Sonde Main Harness (*item 53*) become damaged, it is recommended that the harness is replaced. Note that the Sonde Section top connector (part of the Sonde Main Harness

(*item 53*)) is difficult to remove and will likely become damaged. Therefore, it is recommended that a replacement harness is available before servicing the Sonde Section.

Remove Electronics Section from Sonde Section as detailed in *Section 5.2.1*.

GE Oil & Gas recommended that the servicing of the Sonde Section is started at the bottom and worked through in sections to the top. All other methods of disassembly can damage the Sonde Section.

Note: *HMP* solder is to be used on the Sonde Section and **MUST NOT** be mixed with the *SN100C* solder used in the Electronics Section. **Mixing solder types will result in tool failure downhole.**

5.2.3.1 Bottom Sub

Reference: Sonde Assembly *AD-9-4-03-30S3501*

1 Remove the Bottom End Cap (*item 55*) from the Bottom Sub (*item 15*).

2 Remove and discard the two O-Rings (*item 41*) on the Bottom Sub (*item 15*).

3 Remove the six Cap Head Screws (*item 59*) securing the Housing (*item 20*) to the Bottom Sub (*item 15*).

4 Insert a flathead screwdriver through the Housing slot and into the groove at the base of the RX2 to End Hose (*item 25*), see *Figure 5-2*. Exert pressure when carrying out the next step to maintain the RX2 to End Hose position. The Hose must not be compromised while removing the Bottom Sub.

5 Insert a second large flathead screwdriver between the Housing (*item 20*) and the Bottom Sub (*item 15*) to pry off the Bottom Sub, see *Figure 5-2*.

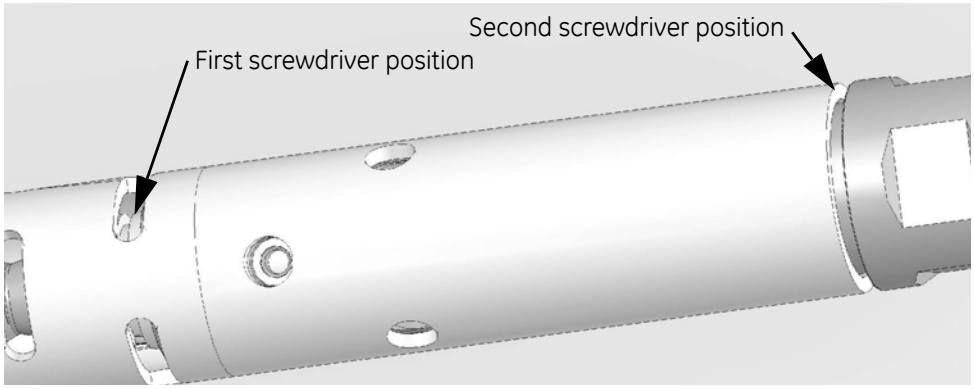


Figure 5-2 Position of Screwdrivers to Remove the Bottom Sub

5.2.3.2 Housing and Internal Sonic Assembly

Reference: Sonde Section Assembly *AD-9-4-03-30S3501*

Note: **DO NOT** clamp the mandrel cans (*items 2, 4, 8 & 10*) into a vice. Dents to the cans will compromise the sonic function of the RBT003.

1 Remove the 12 Cap Head Screws (*item 30*) and round bumpers (*item 12*) securing the two Receivers (Rx1 & Rx2) to the Housing (*item 20*).

2 Remove the six Cap Head Screws (*item 59*) securing the Housing (*item 20*) to the Tx Short and Piston Mandrels (*item 19*).

3 Insert a large flathead screwdriver between the base of the Tx Short and Piston Mandrel (*item 19*) and the top of the Housing (*item 20*). Carefully pry the Tx Short and Piston Mandrel (*item 19*) free.

4 Position the Tx Short and Piston Mandrel (*item 19*) with the oil fill port facing upwards in a soft grip vice on a sufficiently sized workbench.

Note: GE Oil & Gas recommend that the next stage is completed by at least two people.

5 Carefully slide the Housing (*item 20*) away from the Tx Short and Piston Mandrel (*item 19*). Make sure the Receivers are suitably supported on stands or work bench as soon as they are free from the housing, see *Figure 5-3*.

Figure 5-3 Support Sonic Sensors when removed from Housing

5.2.3.3 Bottom Inside B

Reference:	Sonde Assembly	*AD-9-4-03-30S3501*
	Rx2 to End Hose	*AD-4-1-29-1550534A*

1 Extract the Retaining Ring (*item 23*, 9-4-03-30S3501).

2 Remove the outer Recessed Washer (*item 17*, 9-4-03-30S3501).

3 Unscrew and remove the terminal from the pin and nut, see *Figure 5-4*.

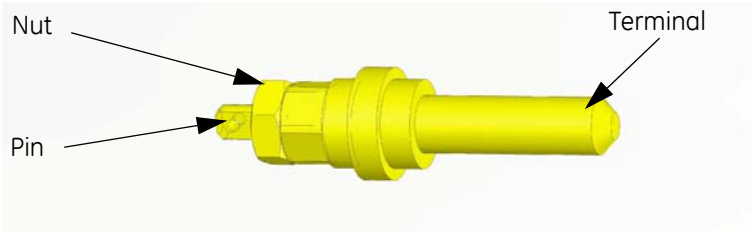


Figure 5-4 Pin Connector Detail

4 Remove the inner Recessed Washer (*item 17*, 9-4-03-30S3501).

5 Gently pull out the pin and leave to one side to allow access to and remove the Screw (*item 61*, 9-4-03-30S3501) securing the ground.

6 Straighten the solder tag on the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501)

7 Unscrew the Bottom Inside B (***item 16***, 9-4-03-30S3501) from the Bottom Inside A (***item 1***, 4-1-29-1550534A).

8 Carefully free the Bottom Inside B (***item 16***, 9-4-03-30S3501) and pull through the Cable Harness (***item 53***, 9-4-03-30S3501).

5.2.3.4 Drain the Oil From the Tool

WARNING! **COMPRESSED AIR!**

Refer to *Section 2.3.3, Compressed Air*.

IRRITANT! **DOW CORNING® 200® FLUID, 100CST OIL**

Refer to *Section 2.5.4, Dow Corning® 200® Fluid, 100CST Oil*.

Reference: Sonde Assembly ***AD-9-4-03-30S3501***

Note: **DO NOT** clamp the mandrel cans (***items 2, 4, 8 & 10***) into a vice. Dents to the cans will compromise the sonic function of the RBT003.

1 Make sure the Internal Sonic Assembly is supported correctly, as shown in ***Figure 5-3***.

2 Remove the bottom Fill Port Seal Screw (***item 28***) located on the RX2 to End Hose (***item 25***) bottom connector and discard the O-Ring (***item 44***).

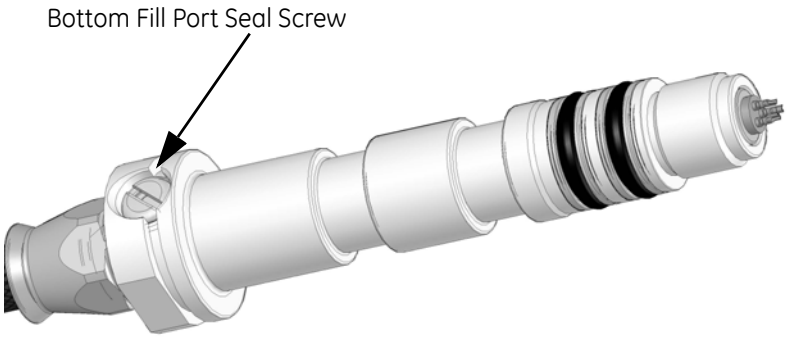


Figure 5-5 Bottom of Tool

3 Drain oil into a container beneath the bottom of the RX2 to End Hose (***item 25***).

4 Remove the top Fill Port Seal Screw (***item 28***) and discard the O-Ring (***item 44***). This is the single Seal Screw located at the top of the tool, ***not*** one of the three locking seal screws securing the transmitter to the piston section.

5 To speed oil drainage:

- Push air through the top Fill Port to speed oil drainage from the tool.
- Periodically elevate the sensors without putting undue strain on the hoses.

5.2.3.5 Sonde Bottom Harness

Reference: Sonde Assembly *AD-9-4-03-30S3501*

1 Carefully pull the connector from the bottom of the RX2 to End Hose (*item 25*). Make sure no further oil is in the tool.

2 Unsolder (*HMP*) the wires connected to the top of the connector (part of the Sonde Harness (*item 53*)) that was fitted inside the RX2 to End Hose (*item 30*). **DO NOT** unsolder the harness (pin and earth solder tag) unless damaged. Replace the whole Sonde Bottom Harness (*item 53*) if damaged.

3 Check the O-Ring (P/N: 4-2-09-V9001500) fitted on the connector (part of the Sonde Bottom Harness (*item 53*). Replace the O-Ring if damaged.

5.2.3.6 Rx2 to End Hose

Reference: Sonde Assembly *AD-9-4-03-30S3501*
RX2 to End Hose Assembly *AD-4-1-29-1550534A*

1 Inspect the Canted Coil (*item 62*, 9-4-03-30S3501) on the Bottom Sub Inside A (*item 1*, 4-1-29-1550534A). Replace where damaged.

2 Remove and discard the two O-Rings (*item 33*, 9-4-03-30S3501). Check the four back-up rings (*item 32*, 9-4-03-30S3501) on the Bottom Sub Inside A (*item 1*, 4-1-29-1550534A). Replace the back-up rings when damaged.

3 Unscrew the Slide Cover (*item 9*, 9-4-03-30S3501) from the Hose End Couple (*item 13*, 9-4-03-30S3501) on Rx2 Receiver Assembly.

4 Loosen the Lower Hose End Termination (*item 4*, 4-1-29-1550534A) from the base of the Rx2 Hose End Couple (*item 13*, 9-4-03-30S3501) without damaging the wires threaded through the tool.

The connection is **NOT** threaded. Loosening the three O-Rings (*item 54*, 9-4-03-30S3501) does not require excessive twisting.

5 Carefully slide the Rx2 to End Hose (*item 25*, 9-4-03-30S3501) off the Rx2 Receiver Assembly and pull through the wires.

6 Remove and discard the three O-Rings (*item 54*, 9-4-03-30S3501) fitted on the Lower Hose End Termination (*item 4*, 4-1-29-1550534A).

7 Pull back the Slide Cover (*item 9*, 9-4-03-30S3501) to check the two O-Rings (*item 39*, 9-4-03-30S3501) and the one O-Ring (*item 40*, 9-4-03-30S3501). Disregard if damaged.

5.2.3.7 Rx2 Receiver

Reference: Sonde Assembly *AD-9-4-03-30S3501*
Sonde Main Harness Wiring Diagram *WD-9-4-03-30SHAR11*

Note: **DO NOT** clamp the mandrel cans (*items 2, 4, 8 & 10*) into a vice. Dents to the cans will compromise the sonic function of the RBT003.

1 Place an absorbent rag beneath the Rx2 Receiver. Oil will spill out when the Rx2 Hose End Couple (*item 13*) is removed.

2 Unscrew the Rx2 Hose End Couple (*item 13*) from the Rx Sub Lower Cap (*item 14*) on the Rx2 Receiver Assembly and pull through the wires.

3 Remove and discard the O-Ring (*item 48*) fitted on the Hose End Couple (*item 13*).

4 Carefully remove the Rx Sub Lower Cap (*item 14*) from the Rx Assembly, held in place with an O-Ring (*item 50*), and pull through the wires.

5 Check the two O-Rings (*item 50*) and the two O-Rings (*item 46*). Replace where damaged.

6 Slide off the Rx Can (*item 10*) from the Receiver Top (*item 11*), held in place by an O-Ring (*item 50*) fitted on the Receiver Top, and pull through the wires.

7 Use a suitable absorbent material to remove residual oil from the Crystals on the Receiver Crystal Assembly (*item 1*).

8 Remove the lacing holding the cables in position around the Crystal Assembly and the Heatshrink covering the solder joints.

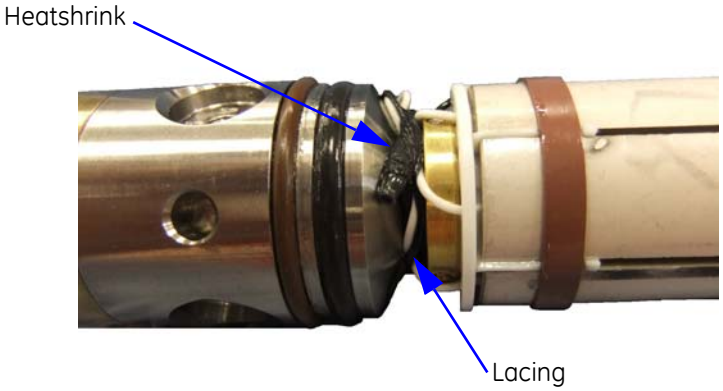


Figure 5-6 Receiver Crystal Assembly Wiring Details

9 Unsolder (*HMP*) the wire connections or cut the cables as close to the soldered joint as possible to allow for re-connection at assembly.

10 Slide the Receiver Crystal Assembly (*item 1*) from the Receiver Top (*item 11*) and pull through the wires. The Crystal Assembly will remain whole as shown in *Figure 5-7*, provided it is not disassembled further.

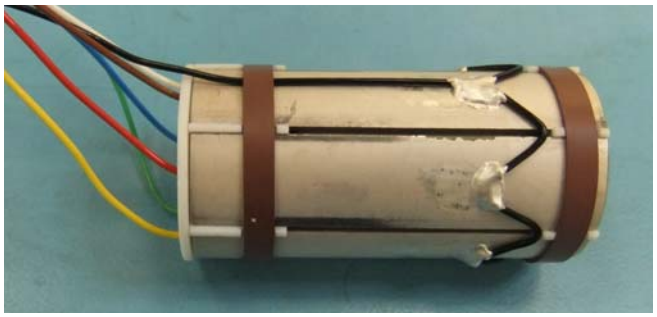


Figure 5-7 Receiver Crystal Assembly

Where the Crystal Assembly is damaged (for example a damaged crystal), *GE Oil & Gas* recommend the Receiver Crystal Assembly (*item 1*) is replaced.

5.2.3.8 Rx1 to Rx2 Hose

Reference:	Sonde Assembly	***AD-9-4-03-30S3501***
	Rx1 to Rx2 Hose Assembly	***AD-4-1-29-1551347A***

1 Unscrew the Slide Cover (***item 9***, 9-4-03-30S3501) from the Rx2 Receiver Top (***item 11***, 9-4-03-30S3501).

2 Loosen the Rx2 Hose End Termination Top (***item 1***, 4-1-29-1551347A) from the Receiver Top (***item 11***, 9-4-03-30S3501) without damaging the wires threaded through the tool and the Receiver Top.

The connection is **NOT** threaded. Loosening the three O-Rings (***item 38***, 9-4-03-30S3501) does not require excessive twisting.

3 Carefully free the Rx2 Hose End Termination Top (***item 1***, 4-1-29-1551347A) from the Rx2 Receiver Top (***item 11***, 9-4-03-30S3501) and pull through the wires.

4 Remove and discard the three O-Rings (***item 38***, 9-4-03-30S3501) fitted on the Rx2 Hose End Termination Top (***item 1***, 4-1-29-1551347A).

5 Pull back the Slide Cover (***item 9***, 9-4-03-30S3501) to inspect two O-Rings (***item 39***, 9-4-03-30S3501) and one O-Ring (***item 40***, 9-4-03-30S3501). Disregard if damaged.

6 Unscrew the Slide Cover (***item 9***, 9-4-03-30S3501) from the Rx1 Hose End Couple (***item 13***, 9-4-03-30S3501).

7 Loosen the Lower Hose End Termination (***item 2***, 4-1-29-1551347A) from the Rx1 Hose End Couple (***item 13***, 9-4-03-30S3501) without damaging the wires threaded through the tool.

The connection is **NOT** threaded. Loosening the three O-Rings (***item 54***, 9-4-03-30S3501) does not require excessive twisting.

8 Carefully free the Rx1 to Rx2 Hose (***item 27***, 9-4-03-30S3501) from the Rx1 Hose End Couple (***item 13***, 9-4-02-30S3501) and pull through the wires.

9 Remove and discard the three O-Rings (***item 54***, 9-4-03-30S3501) fitted on the Lower Hose End Termination (***item 4***, 4-1-29-1550534A).

10 Pull back the Slide Cover (***item 9***, 9-4-03-30S3501) to inspect the two O-Rings (***item 39***, 9-4-03-30S3501) and one O-Ring (***item 40***, 9-4-03-30S3501). Disregard if damaged.

5.2.3.9 Rx1 Receiver

Note: **DO NOT** clamp the mandrel cans (***items 2, 4, 8 & 10***) into a vice. Dents to the cans will compromise the sonic function of the RBT003.

Repeat ***Section 5.2.3.7, Rx2 Receiver***, to disassemble the Rx1 Receiver Assembly. The only difference is seven wires must be detached on Rx1 Receiver (see ***Figure 5-7***), where Rx2 Receiver has only two wires.

Where the Crystal Assembly is damaged (for example a damaged crystal), ***GE Oil & Gas*** recommend the Receiver Crystal Assembly (***item 1***) is replaced.

5.2.3.10 Tx to Rx1 Hose

Reference:		
	Sonde Assembly	*AD-9-4-03-30S3501*
	Tx to Rx1 Hose Assembly	*AD-4-1-29-1550798A*

1 Unscrew the Slide Cover (***item 9***, 9-4-03-30S3501) from the Rx1 Receiver Top (***item 11***, 9-4-03-30S3501).

2 Loosen the Upper Hose End Termination (***item 4***, 4-1-29-1550798A) from the Receiver Top (***item 11***, 9-4-03-30S3501) without damaging the wires threaded through the tool and the Receiver Top.

The connection is **NOT** threaded. Loosening the three O-Rings (***item 51***, 9-4-03-30S3501) does not require excessive twisting.

3 Carefully free the Rx1 Receiver Top (***item 11***, 9-4-03-30S3501) from the Tx to Rx1 Hose (***item 26***, 9-4-03-30S3501) and pull through the wires.

4 Remove and discard the three O-Rings (***item 38***, 9-4-03-30S3501) fitted on the Upper Hose End Termination (***item 1***, 4-1-29-1550798A).

5 Pull back the Slide Cover (***item 9***, 9-4-03-30S3501) to inspect the two O-Rings (***item 39***, 9-4-03-30S3501) and one O-Ring (***item 40***, 9-4-03-30S3501). Disregard if damaged.

6 Unscrew the Slide Cover (***item 9***, 9-4-03-30S3501) from the base of the Piston Shaft (***item 5***, 9-4-03-30S3501).

7 Loosen the Upper Hose End Termination (***item 1***, 4-1-29-1550798A) from the Piston Shaft (***item 5***, 9-4-03-30S3501) without damaging the wires threaded through the tool.

The connection is **NOT** threaded. Loosening the three O-Rings (***item 38***, 9-4-03-30S3501) does not require excessive twisting.

8 Carefully free the Tx to Rx1 Hose (***item 26***, 9-4-03-30S3501) free of the Piston Shaft (***item 5***, 9-4-03-30S3501) and pull through the wires.

9 Remove and discard the three O-Rings (***item 38***, 9-4-03-30S3501) fitted on the Upper Hose End Termination (***item 1***, 4-1-29-1550798A).

10 Pull back the Slide Cover (***item 9***, 9-4-03-30S3501) to inspect two O-Rings (***item 39***, 9-4-03-30S3501) and one O-Ring (***item 40***, 9-4-03-30S3501). Disregard if damaged.

5.2.3.11 Tx Short and Piston Mandrel

WARNING!

COMPRESSED SPRING!

Refer to *Section 2.3.4, Compressed Springs*.

CAUTION!

MAIN HARNESS AND CONNECTOR DAMAGE

Removing the Sonde Main Harnes (***item 52***) top connector free of the pressure nut can only be accomplished by pulling on the wires of the Sonde Main Harness. The removal will irrevocably damaged the Sonde Main Harness and will need replacing. Contact ***GE Oil & Gas Technical Services*** for further information.

It is recommended that a Sonde Main Harness (***item 52***) is acquired before proceeding.

Reference:	Sonde Assembly	*AD-9-4-03-30S3501*
	Sonde Main Harness Wiring Diagram	*WD-9-4-03-30SHAR11*

1 Place absorbent rags beneath the piston sub-assembly.

2 Unscrew the Piston Shaft (***item 5***) from the Tx Short and Piston Mandrel (***item 19***) and remove the Inconel Spring (***item 22***).

3 Remove the Piston Can (***item 4***) and remove any excess oil.

4 Remove and discard the O-Ring (***item 49***) and check the two Back-up Rings (***item 36***) fitted to the inside the lower end of the Piston Can (***item 4***), see ***Figure 5-8***. Replace Back-up Rings when damaged.

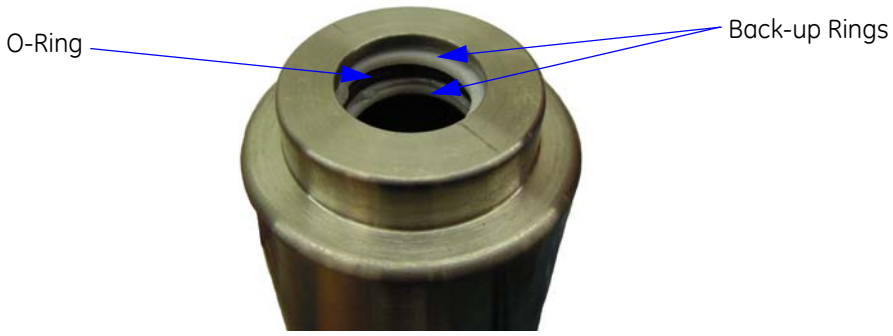


Figure 5-8 Piston Can Inner Seals

5 Remove and discard the O-Ring (***item 42***) and check the two Back-up Rings (***item 37***) fitted on the Tx Short and Piston Mandrel (***item 19***). Replace Back-up Rings when damaged.

6 Detach the Retaining Ring (***item 24***) and remove the two Tx Can Collars (***item 8***).

7 Remove and discard the lower O-Ring (***item 47***) and slide off the Transmitter Can (***item 2***) over the lower end of the Tx Short and Piston Mandrel (***item 19***) held in position with the two O-rIngs (***item 43***).

Note: The Tx Short and Piston Mandrel (***item 19***) consists of three parts, refer to ***Figure 5-9***. The parts will be referred to as 'Top Sub', 'Transmitter' and 'Piston' for the remainder of this section.

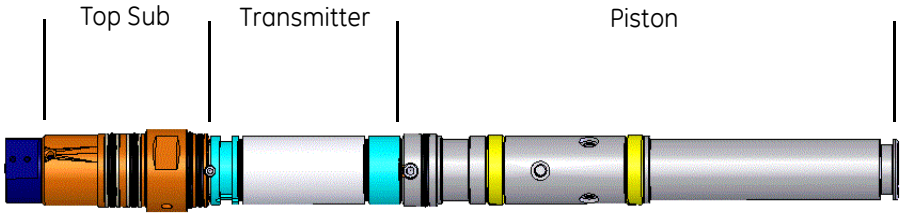


Figure 5-9 Tx Short and Piston Mandrel Parts

8 Remove three Cap Head Screws (***item 58***) securing the 'Transmitter' and 'Piston' parts of the Tx Short and Piston Mandrel (***item 19***).

9 Loosen the joint between the 'Piston' and 'Transmitter' parts on the Tx Short and Piston Mandrel (***item 19***) without damaging the through wires. Use a spanner on the 'Top Sub' and a C-Spanner on the 'Piston'.

10 Carefully unscrew the 'Piston' from the 'Transmitter' by hand and pull through the wires. Remove excessive oil.

11 Remove and discard the two O-Rings (***item 43***) and O-Ring (***item 47***).

12 Remove and discard the two O-Rings (***item 35***) on the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***).

Note: Further disassembly should only be carried out when access is required to:

- The Tx Crystal (***item 51***).
- The three O-Rings (***item 46***) and two O-Rings (***item 45***) fitted around the Transmitter Crystal (***item 51***).
- The Sonde Main Harness (***item 53***) top connector.

13 Disconnect the crystal wiring. Remove any lacing cord securing the wiring and the Heatshrink covering the wire connections. See ***Figure 5-13***.

14 Unsolder (***HMP***) the wire connections or cut each wire as close as possible to the solder joint.

15 Carefully remove the items from the 'Transmitter' part of the Tx Short and Piston Mandrel (***item 19***) without damaging the wires in the following order:

i. O-Ring (***item 46***)
ii. Tx Crystal Filler (***item 7***)
iii. Two O-Rings (***items 46 & 45***)
iv. Tx Crystal (***item 51***)
v. Two O-Rings (***items 45 & 46***)
vi. Tx Crystal Hanger (***item 6***)

16 Check and discard a cracked Tx Crystal (***item 51***), O-Rings and/or any other damaged component(s). Where a wire has become free of the Tx Crystal, remove all the old bonding before attaching.

17 To remove the Sonde Main Harness (***item 52***) top connector:

i. Remove the three Screws (***item 57***) securing the 'Top Sub' part to the 'Transmitter' part of the Tx Short and Piston Mandrel (***item 19***).
ii. Unscrew the 'Transmitter' part from the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***) without damaging the Tx Wires and through wires.
iii. Remove the Set Screw (***item 31***) securing the Sonde Main Harness (***item 52***) pressure nut to the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***).
iv. Unscrew the Sonde Main Harness (***item 52***) pressure nut from the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***).
v. The Sonde Main Harness (***item 52***) top connector can now be removed. Make sure the 'Top Sub' is cleaned of swarf before reattaching.
vi. Replace the two O-Rings (***P/N: 99016***) on the 19-pin connector (***P/N: 8-1-00-BULK19PI***).
vii. If the 19-pin connector is damaged, it is recommended the whole Sonde Main Harness (***item 52***) is replaced.

5.3 Reassembly

CAUTION!

TOOL INTEGRITY

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

5.3.1 SONDE SECTION

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

IRRITANT!

DOW CORNING® 200® FLUID, 100CST OIL

Refer to *Section 2.5.4, Dow Corning® 200® Fluid, 100CST Oil*.

IRRITANT!

DURALCO™ 120 EPOXY

Refer to *Section 2.5.5, Duralco™ 120 Epoxy*.

The order of reassembly is from top to bottom of the Sonde Section.

Note: *HMP* solder is to be used on the Sonde Section and **MUST NOT** be mixed with the *SN100C* solder used in the Electronics Section. **Mixing solder types will result in tool failure downhole.**

5.3.1.1 Tx Short and Piston Mandrel

WARNING!

SHOCK HAZARD!

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

Reference: Sonde Assembly *AD-9-4-03-30S3501*

Note: The Tx Short and Piston Mandrel (***item 19***) consists of three parts, refer to ***Figure 5-9***. The parts will be referred to as 'Top Sub', 'Transmitter' and 'Piston' for the remainder of this section.

1 To assemble the Sonde Main Harness (***item 52***) top connector:

i. Check the condition of the Sonde Main Harness (***item 52***). In particular the 19-pin connector (***P/N: 8-1-00-BULK19PI***).
ii. Check and grease the two O-Rings (***P/N: 99016***) located on the 19-pin connector (***P/N: 8-1-00-BULK19PI***).
iii. Thread the Sonde Main Harness (***item 52***) through the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***).
iv. Fit the Sonde Main Harness (***item 52***) top connector into the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***).
v. Carefully thread the Sonde Main Harness (***item 52***) pressure nut into the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***) without damaging the Sonde Main Harness wires.
vi. Fit the Set Screw (***item 31***) to hold the Sonde Main Harness (***item 52***) pressure nut in position.
vii. Screw together the 'Top Sub' and 'Transmitter' parts of the Tx Short and Piston Mandrel (***item 19***).
viii. Fit the three Screws (***item 57***) to hold the 'Top Sub' and 'Transmitter' together.

ix. Separate the Tx wires in the Main Harness (***item 52***) and thread through the hole in the 'Transmitter' part of the Tx Short and Piston Mandrel (***item 19***), see ***Figure 5-10***.

Figure 5-10 Tx Wiring through 'Transmitter' part of the Tx Short and Piston Mandrel

2 Replace and grease (***P/N: LOR101***) the two O-Rings (***item 35***), four Back-up Rings (***item 34***), O-Ring (***item 47***) and O-Ring (***item 43***) on the 'Top Sub' part of the Tx Short and Mandrel (***item 19***).

3 Fit and grease (***P/N: LOR101***) the O-Ring (***item 44***) on the Screw (***item 28***). Fit the Screw (***item 28***) into the 'Top Sub' part of the Tx Short and Piston Mandrel (***item 19***).

4 Tightly wrap the Teflon sheet (***item 56***) around the 'Transmitter' part of the Tx Short and Piston Mandrel (***item 19***).

5 Slide the Tx Crystal Hanger (***item 6***) over the Teflon Sheet (***item 56***) to the end of the 'Transmitter' part of the TX Short and Piston Mandrel (***item 19***), making sure that the wire channel is toward the 'Top Sub' part of the Tx Short and Piston Mandrel and aligned with the Screw (***item 57***) heads.

6 Fit and grease (***P/N: LOR101***) the O-Ring (***item 46***) and O-Ring (***item 45***), by sliding onto the 'Transmitter' part of the Tx Short and Piston Mandrel (***item 19***) until snug up against the Tx Crystal Hanger (***item 6***).

7 The Tx Crystal (***item 51***) is supplied with the wires already bonded into position.

Where the wires have been broken and require urgent repair:

i. Cut two 6" (approximately) lengths of 24 AWG: one white and one black. Strip 0.25" of insulation off each wire.
ii. Using Duralco™ 120 Epoxy (***P/N: 414666***), attach the white wire to the middle of the interior wall of the Tx Crystal (***item 51***) and the black wire directly opposite on the exterior wall, see ***Figure 5-11***.

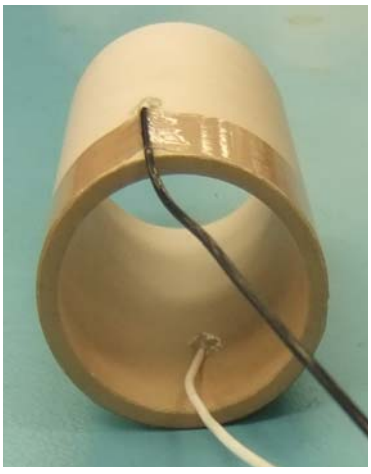


Figure 5-11 Tx Crystal Bonded Wire positions

8 Slide the Tx Crystal (***item 51***) onto the 'Transmitter' part of the Tx Short and Piston Mandrel (***item 19***) up to the Tx Crystal Hanger (***item 6***) making sure the wires are facing *toward* the Tx Crystal Hanger.

9 Install and grease (***P/N: LOR101***) the O-Ring (***item 45***) just under the Tx Crystal (***item 51***).

10 Install and grease (***P/N: LOR101***) the O-Ring (***item 46***) up against the Tx Crystal (***item 51***).

11 Slide on the Tx Crystal Filler (***item 7***) and push up against the O-Ring (***item 46***). Orientate the Tx Crystal (***item 51***) on the Tx Short and Piston Mandrel (***item 19***) so that the white wire is aligned with the fill plug, see ***Figure 5-12***.

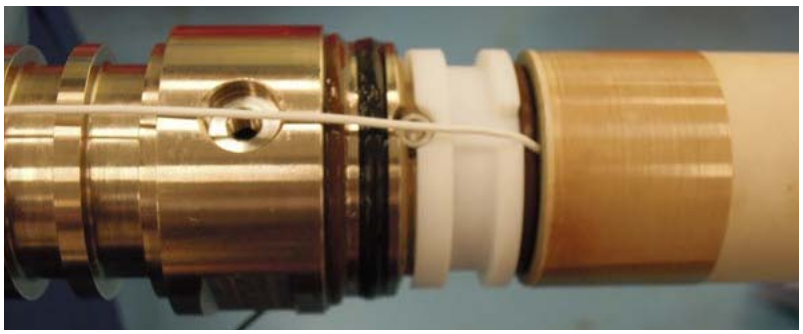


Figure 5-12 Tx Crystal Alignment on Tx Short and Piston Mandrel

12 Install and grease (***P/N: LOR101***) the O-Ring (***item 47***) up against the Tx Crystal Filler (***item 7***).

13 Position heatshrink over the Tx Crystal wires. Solder (***HMP***) the Tx Crystal wires to the Sonde Main Harness (***item 52***) wires. Clean thoroughly. Install the Heatshrink over the joints using a suitable Heat Gun.

14 Tuck and tie the wires neatly into the wire channel of the Tx Crystal Hanger (***item 6***) with suitable nylon string. Make sure the wires are flush to the lip of the filler or wires may shear when the Tx Can (***item 2***) is installed, see ***Figure 5-13***. Remove the tape around the Tx Crystal when wiring is complete to prevent the Tx Can catching on the tape on installation.

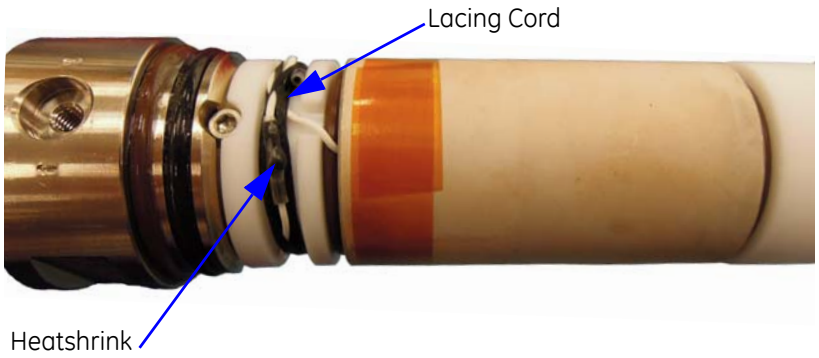


Figure 5-13 Transmitter Crystal Wiring Details

15 Replace two Teflon Rings (***item 3***) on the bottom part of the Tx Short and Piston Mandrel (***item 19***).

16 Install and grease (***P/N: LOR101***) the O-Ring (***item 43***), O-Ring (***item 42***) and Back-up Rings (***item 37***) onto the 'Piston' part of the Tx Short and Piston Mandrel (***item 19***).

17 Feed the harness wiring through the 'Piston' part of the Tx Short and Piston Mandrel (***item 19***).

18 Carefully screw together the 'Transmitter' and 'Piston' parts of the Tx Short and Piston Mandrel (*item 19*). Tighten using a with a soft grip vice and C-spanner.

19 Secure in place with the three Cap Head Screws (*item 58*).

20 Grease (*P/N: LOR101*) the interior lip of the Tx Can (*item 2*).

21 Feed the Sonde Main Harness (*item 52*) wiring through the Tx Can (*item 2*).

22 Slide the Tx Can (*item 2*) over the 'Piston' and 'Transmitter' parts until it is up against the O-Ring (*item 47*) fitted on the 'Top Sub' part of the Tx Short and Piston Mandrel (*item 19*).

23 Install and grease (*P/N: LOR101*) the O-Ring (*item 47*) under the lower lip of the Tx Can (*item 2*).

24 Position the two Tx Can Collars (*item 8*) and hold in place with the Retaining Ring (*item 24*).

25 Install and grease (*P/N: LOR101*) the O-Ring (*item 49*) and Back-up Rings (*item 36*) in the neck of the Piston Can (*item 4*).

26 Grease (*P/N: LOR101*) the neck of the Piston Can (*item 4*) and fit the can onto the Tx Short and Piston Mandrel (*item 19*).

27 Slide the Inconel Spring (*item 22*) over the Piston Shaft (*item 5*).

28 Thread the Piston Shaft (*item 5*) onto the Tx Short and Piston Mandrel (*item 19*). Tighten with two C-spanners.

29 Install and grease (*P/N: LOR101*) a Teflon® ring (*item 3*) on the base of the Piston Shaft (*item 5*).

30 Place the Tx Short and Piston Mandrel (*item 19*) in a soft grip vice with the No 1 alignment stamp (or fill port) facing upwards.

5.3.1.2 Tx to Rx1 Hose

Reference:	Sonde Section Assembly	*AD-9-4-03-30S3501*
	Tx to Rx1 Hose Assembly	*AD-4-1-29-1550798A*

1 Install and grease (*P/N: LOR101*) the six O-Rings (*item 38*, 9-4-03-30S3501) on the two Upper Hose End Terminations (*item 1*, 4-1-29-1550798A).

2 To replace the O-Rings (*item 39 & 40*, 9-4-03-30S3501) on both the Hose Nut Adaptors (*item 21*, 9-4-03-30S3501), carry out the following steps:

i. Remove the two Set Screws (*item 29*, 9-4-03-30S3501).
ii. Unscrew the Hose Nut Adaptors (*item 21*, 9-4-03-30S3501) from the Upper Hose End Terminations (*item 1*, 4-1-29-1550798A).
iii. Replace and grease (*P/N: LOR101*) the two O-Rings (*item 40*, 9-4-03--30S3501) and four O-Rings (*item 39*, 9-4-03-30S3501).
iv. Refit the Hose Nut Adaptors (*item 21*, 9-4-03-30S3501) onto the Upper Hose End Terminations (*item 1*, 4-1-29-1550798A).
v. Fit the Set Screws (*item 29*, 9-4-03-30S3501).

3 Feed the Sonde Main Harness (*item 52*, 9-4-03-30S3501) wiring through the Tx to Rx1 Hose (*item 26*, 9-4-03-30S3501).

4 Push the Upper Hose End Termination (*item 1*, 4-1-29-1550798A) into the Piston Shaft (*item 5*, 9-4-03-30S3501).

5 Screw the Slide Cover (***item 9***, 9-4-03-30S3501) onto the Piston Shaft (***item 5***, 9-4-03-30S3501). Tighten with two C-spanners.

5.3.1.3 Rx1 Receiver

WARNING!

SHOCK HAZARD!

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

Reference:

Sonde Section Assembly	***AD-9-4-03-30S3501***
Sonde Main Harness Wiring Diagram	***WD-9-4-03-30SHAR11***

1 Install and grease (***P/N: LOR101***) the O-Rings (***items 46 & 50***) on the Receiver Top (***item 11***).

2 Feed the harness wiring through the Receiver Top (***item 11***). Thread the Rx1 wires coming from the Sonde Main Harness (***item 52***), up and out through the wiring borehole, see ***Figure 5-14***.

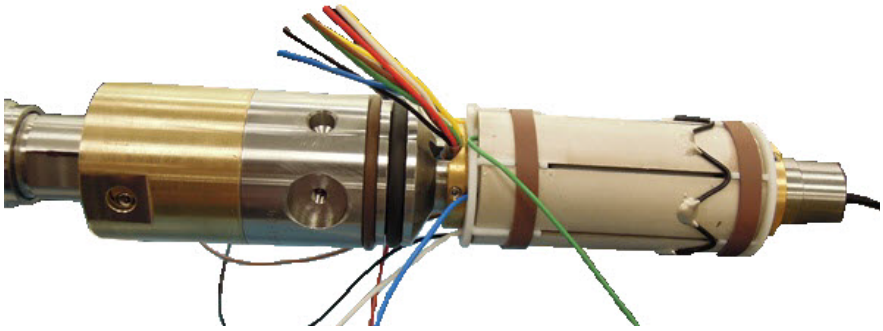


Figure 5-14 Rx Wiring Through Receiver Top

3 Push the Tx to Rx1 Hose (***item 26***) into the Receiver Top (***item 11***). Orientate the Receiver Top so that the No 1 Alignment stamp is facing upwards.

4 Screw the Slide Cover (***item 9***) onto the Receiver Top (***item 11***). Tighten with two C-spanners.

5 Check the Crystal Receiver Assembly (***item 1***) is not damaged. Contact ***GE Oil & Gas Technical Services*** where a replacement is required.

6 Slide the Crystal Receiver Assembly (***item 1***) onto the Receiver Top (***item 11***).

7 Check the correct orientation of the Crystal Receiver Assembly (***item 1***) on the Receiver Top (***item 11***) - the cutout should be aligned with the wires that exit the Receiver Top.

Note: It is very important to align the Crystal Receiver Assembly (***item 1***) segment No 1 with the **brown wire** to the screw hole on the Receiver Top (***item 11***), see ***Figure 5-15***.

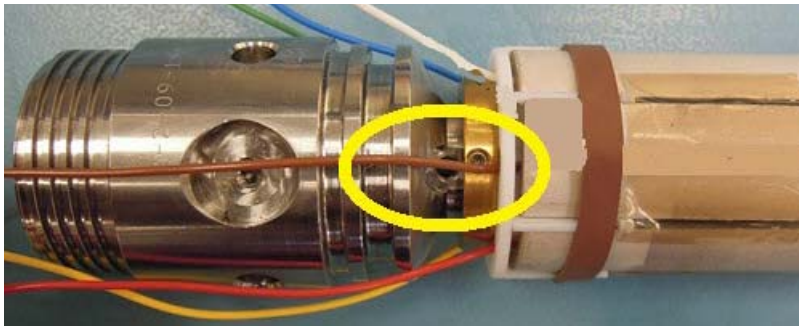


Figure 5-15 Rx Crystal Alignment

8 Position Heatshrink on the Crystal wires. Referring to ***WD-9-4-03-30HAR11***, solder (***HMP***) the wires from each Crystal to its Sonde Main Harness (***item 52***) mate. Clean each solder joint thoroughly. Install Heatshrink over each joint using a suitable Heat Gun.

9 Fit a Cap Head Screw (***item 60***) into the Receiver Top (***item 11***).

10 Wrap the wires in the channel at the Top of the Crystal Receiver Assembly (***item 1***). Secure with suitable nylon lacing string, see ***Figure 5-6***. Make sure the wires are flush to the crystal, or wires can be damaged during installation of the Rx Can (***item 10***).

11 Grease (***P/N: LOR101***) the interior lip of the Rx Can (***item 10***).

12 Install and grease (***P/N: LOR101***) the O-Rings (***items 50 and 40***) on the Rx Sub Lower Cap (***item 14***).

13 Fit and grease (***P/N: LOR101***) the O-Ring (***item 48***) on the Hose End Couple (***item 13***).

14 Feed the Sonde Main Harness (***item 52***) wiring through the Rx Can (***item 10***).

15 Carefully slide the Rx Can (***item 10***) over the crystal until it is against the Receiver Top (***item 11***).

16 Place the Hose End Couple (***item 13***) into the Rx Sub Lower Cap (***item 14***) and feed the Sonde Main Harness (***item 52***) wiring through both parts.

17 Screw the Hose End Couple (***item 13***) onto the base of the Receiver Top (***item 11***).

18 Tighten with two C-spanners.

5.3.1.4 Rx1 to Rx2 Hose

Reference:	Sonde Section Assembly	***AD-9-4-03-30S3501***
	Rx1 to Rx2 Hose Assembly	***AD-4-1-29-1551347A***

1 To replace the O-Rings (***item 39 & 40***, 9-4-03-30S3501) on both the Hose Nut Adaptors (***item 21***, 9-4-03-30S3501), carry out the following steps:

i. Remove the two Set Screws (***item 29***, 9-4-03-30S3501).
ii. Unscrew the Hose Nut Adaptors (***item 21***, 9-4-03-30S3501) from the Hose End Terminations (***items 1 & 2***, 4-1-29-1551347A).
iii. Replace and grease (***P/N: LOR101***) the two O-Rings (***item 40***, 9-4-03--30S3501) and four O-Rings (***item 39***, 9-4-03-30S3501).
iv. Refit the Hose Nut Adaptors (***item 21***, 9-4-03-30S3501) onto the Hose End Terminations (***items 1 & 2***, 4-1-29-1551347A).
v. Replace the Set Screws (***item 29***, 9-4-03-30S3501).

2 Install and grease (***P/N: LOR101***) the three O-Rings (***item 54***, 9-4-03-30S3501) on the Lower Hose End Termination (***item 2***, 4-1-29-1551347A).

3 Install and grease (***P/N: LOR101***) the three O-Rings (***item 38***, 9-4-03-30S3501) on the Top Rx2 Hose End Termination (***item 1***, 4-1-29-1551347A).

4 Feed the Sonde Main Harness (***item 52,*** 9-4-03-20S3501) wiring through the Rx1 to Rx2 Hose (***item 27***, 9-4-03-30S3501).

5 Push the Lower Hose End Termination (***item 2***, 4-1-29-1551347A) into the lower end of the Crystal Receiver Assembly (***item 1***).

6 Screw the Slide Cover (*item 9*, 9-4-03-30S3501) onto the Hose End Couple (*item 13*, 9-4-03-30S3501). Tighten with two C-spanners.

5.3.1.5 Rx2 Receiver

WARNING!

SHOCK HAZARD!

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

Reference:		
	Sonde Section Assembly	*AD-9-4-03-30S3501*
	Sonde Main Harness Wiring Diagram	*WD-9-4-03-30SHAR11*

Repeat *Section 5.3.1.3, Rx1 Receiver*, to reassemble the Rx2 Receiver with the difference that all the individual wires (not the black wire) which are connected to the six segments from the Crystal Receiver Assembly (*item 1*) along with the white wire from the Sonde Main Harness (*item 52*) should be soldered (*HMP*) together, see *Figure 5-7*. The remaining black wire from the Crystal Receiver Assembly and the black wire from the Sonde Main Harness should also be soldered (*HMP*) together. Refer to *WD-9-4-03-30SHAR11*.

5.3.1.6 Rx2 to End Hose

Reference:		
	Sonde Section Assembly	*AD-9-4-03-30S3501*
	Rx2 to End Hose Assembly	*AD-4-1-29-1550534A*

1 To replace the O-Rings (*item 39 & 40*, 9-4-03-30S3501) on the Hose Nut Adaptors (*item 21*, 9-4-03-30S3501), carry out the following steps:

i. Remove the two Set Screws (*item 29*, 9-4-03-30S3501).
ii. Unscrew the Hose Nut Adaptor (*item 21*, 9-4-03-30S3501) from the Lower Hose End Termination (*item 4*, 4-1-29-1550534A).
iii. Replace and grease (*P/N: LOR101*) the O-Ring (*item 40*, 9-4-03--30S3501) and two O-Rings (*item 39*, 9-4-03-30S3501).
iv. Refit the Hose Nut Adaptor (*item 21*, 9-4-03-30S3501) onto the Lower Hose End Termination (*items 4*, 4-1-29-1550534A).
v. Replace the Set Screw (*item 29*, 9-4-03-30S3501).

2 Install and grease (*P/N: LOR101*) the three O-Rings (*item 54*, 9-4-03-30S3501) on the Lower Hose End Termination (*item 4*, 4-1-29-1550534A).

3 Install and grease (*P/N: LOR101*) the two O-Rings (*item 33*, 9-4-03-30S3501) and the four Back-up Rings (*item 33*, 9-4-03-30S3501) on the Bottom Sub Inside A (*item 1*, 4-1-29-1550534A).

4 Feed the Sonde Main Harness (*item 52*, 9-4-03-30S3501) wiring through the Rx1 to Rx2 Hose (*item 27*, 9-4-03-30S3501).

5 Push the Lower Hose End Termination (*item 2*, 4-1-29-1551347A) into the lower end of the Rx2 Assembly.

6 Screw the Slide Cover (*item 9*, 9-4-03-30S3501) onto the Hose End Couple (*item 13*, 9-4-03-30S3501). Tighten with two C-spanners.

5.3.1.7 Bottom Inside B

Reference:		
	Sonde Section Assembly	AD-9-4-03-30S3501
	Rx2 to End Hose Assembly	AD-4-1-29-1550534A
	Sonde Main Harness Wiring Diagram	WD-9-4-03-30SHAR11
	Sonde Bottom Harness Wiring Diagram	WD-9-4-03-40SHAR21

1 Check the Spring Coil (*item 62*, 9-4-03-30S3501). Replace when damaged.

2 Fit and grease (*P/N: LOR101*) the O-Ring (*item 44*, 9-4-03-30S3501) onto the Screw (*item 28*, 9-4-03-30S3501). Fit the Screw (*item 28*, 9-4-03-30S3501) into the Bottom Inside A (*item 1*, 4-1-29-1550534A).

3 Position heatshrink over each wire from the Sonde Main Harness (*item 52*, 9-4-03-30S3501).

4 Check the condition of the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501). Replace where damaged.

5 Check and grease (*P/N: LOR101*) the O-Ring (P/N: 4-2-09-V9001500) on the 3-pin connector part of the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501). Replace if damaged.

6 Referring to wiring diagrams (*WD-9-4-03-30SHAR11* & *WD-9-4-03-40SHAR21*), solder (*HMP*) the two wires on the Sonde Main Harness (*item 52*, 9-4-03-30S3501) onto the 3-pin connector (part of the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501)).

7 Clean all solder points thoroughly. Install the Heatshrink over the solder joints using a suitable Heat Gun.

8 Fit the 3-pin connector part of the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501) into the Bottom Sub Inside A (*item 1*, 4-1-29-1550534A).

9 Feed the pin and solder tag parts of the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501) through the Bottom Inside B (*item 16*, 9-4-03-30S3501).

10 Screw the Bottom Inside B (*item 16*, 9-4-03-30S3501) onto Bottom Sub Inside A (*item 1*, 4-1-29-1550534A). Tighten using a spanner.

11 Bend the solder tag part of the Bottom Harness (*item 53*, 9-4-03-30S3501) to enable it to fit inside of the Bottom Inside B (*item 16*, 9-4-03-30S3501).

12 Reassemble the nut and contact onto the pin as shown in *Figure 5-4*.

13 Feed the solder tag and pin parts of the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501) through the Recessed Washer (*item 17*, 9-4-03-30S3501) with the recess facing outward and fit into the Bottom Inside B (*item 16*, 9-4-03-30S3501).

14 Insert the pin part of the Sonde Bottom Harness (*item 53*, 9-4-03-30S3501) into the Contact (*item 18*, 9-4-03-30S3501).

15 Insert the Contact (*item 18*, 9-4-03-30S3501) into the neck of Bottom Inside B (*item 16*, 9-4-03-30S3501). Push down into position.

16 Install the second Recessed Washer (*item 17*, 9-4-03-30S3501) with the recessed facing inwards.

17 Fit the Retaining Ring (*item 23*, 9-4-03-30S3501) to secure the Contact (*item 18*, 9-4-03-30S3501) into position.

5.3.1.8 Sonic Housing

Reference: Sonde Section Assembly *AD-9-4-03-30S3501*

1 Orientate the Sonic Housing (***item 20***) with the engraved *"No. 1"* stamp facing *up* and clamp the Sonic Housing loosely with a vice near the centre.

2 Find the corresponding engraved *"No. 1"* stamp on the Tx Short and Piston Mandrel (***item 19***). Orientate the sonic section with the marking, and the transmitter fill port, facing *up*.

3 Slide the Sonic's section into the Sonic Housing (***item 20***). Guide and support the sensors into position with a flat blade screwdriver, or similar implement. Align the *No. 1* markings.

4 Fit the six Screws (***item 59***) securing the Sonic Housing (***item 20***) with the Tx Short and Piston Mandrel (***item 19***).

5 Fit the six Round Bumpers (***item 12***) and Screws (***item 30***) securing the Sonic Housing (***item 20***) with the Crystal Receiver Rx1 Assembly (***item 1***).

6 Fit the six Round Bumpers (***item 12***) and Screws (***item 30***) securing the Sonic Housing (***item 20***) with the Crystal Receiver Rx2 Assembly (***item 1***).

5.3.1.9 Fill The Sonics Section With Oil

WARNING!

COMPRESSED AIR!

Refer to *Section 2.3.3, Compressed Air*.

IRRITANT!

DOW CORNING® 200® FLUID, 100CST OIL!

Refer to *Section 2.5.4, Dow Corning® 200® Fluid, 100CST Oil*.

Reference: Sonde Section Assembly *AD-9-4-03-30S3501*

The RBT requires filling with oil to protect the tool from the effects of temperature and pressure. It is important to remove all the air within the tool to prevent inaccurate results and/or damage to the tool.

These instructions are for single port filling. However the RBT tool is suitable for dual port filling, contact ***GE Oil & Gas Technical Services*** for more information.

Note: This section requires a rubber mallet to tap the tool to assist with evacuating the air from the tool. However to avoid damage to the tool, **DO NOT** tap in the areas of Receiver Assemblies Rx1 or Rx2.

A vacuum pump providing a vacuum of 24" Hg is required to evacuate the air from the tool. A pressure of at least 90psi is required to fill the tool with oil, either a airline or suitable pump can be used.

1 Remove Screw (***item 28***) along with the O-Ring (***item 44***).

2 Prepare the RBT, vacuum set up and ancillary equipment as shown in ***Figure 5-16***.

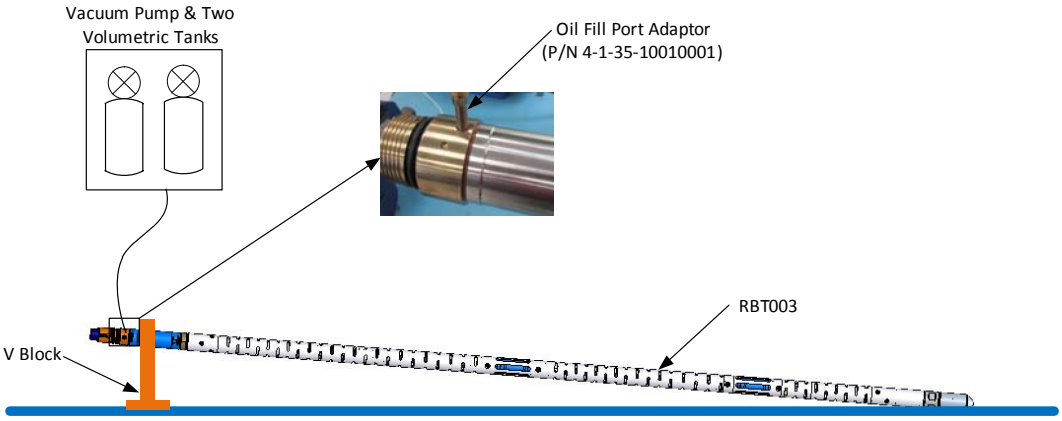


Figure 5-16 Vacuum/Oil Filling Set Up

3 Fill the volumetric tank with one litre of Dow Corning 200® 100CST Oil (***P/N: 415574***).

4 Evacuate the air from the tool, this will take a minimum of 4 - 12 hours. To evacuate the air from the tool:

i. Make sure the upper end of the Sonde Section is raised as shown in ***Figure 5-16***. This will encourage the air to evacuate from the tool.
ii. Connect the vacuum set up to the fill port via the Oil Fill Port Adaptor (***P/N: 4-1-35-10010001***), see ***Figure 5-16***.
iii. Open the valve to evacuate the air from the tool.
iv. Tap the tool with a rubber mallet.
v. Keep tapping the tool with a rubber mallet until no further air bubbles appear in the holding tank.
vi. Increase the height of the upper end of the Sonde Section (ideally vertical).
vii. Gently tap the tool with a rubber mallet.
viii. Return the tool to the V-block and repeat step ***iv*** onwards until no air bubbles appear in the holding tank.

5 While maintaining the vacuum within the tool, open the valve to the tank holding the new Silicone Oil to transfer oil into the tool. When the flow stops, mark the position of the oil on the tank.

6 Add pressure to the oil tank. The Piston Can (***item 4***) will slowly move into its fully extended position and the Spring (***item 22***) will fully compress.

7 Remove the pressure and check the Piston Can (***item 4***) returns to its retracted position. It may be necessary to carefully use a screwdriver to lever the Piston Can back into position, see ***Figure 5-17***.

Figure 5-17 Retracting Piston Can

8 Once the Piston Can (***item 4***) is returned to its retracted position, check that the oil level returns to the marked position on the oil tank. Variation in the oil levels will indicate that there is air pockets still in the tool. Where there is a difference it is recommended to remove the oil and repeat the oil filling process.

9 Repeat step ***6*** above.

10 Place a C-Spanner (width 4mm) in the second slot from the lower sub, see ***Figure 5-18***.

11 Remove the pressure from the oil tank.

12 The Piston Can (***item 4***) will endeavour to return to its retracted position and will rest against the C-Spanner, see ***Figure 5-18***.

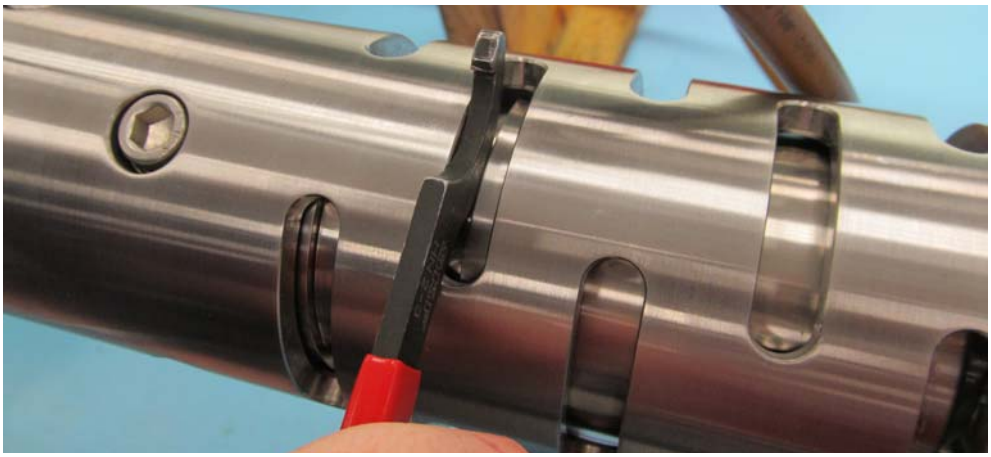


Figure 5-18 Piston Can Positioning

13 Remove the vacuum pipes and Oil Fill Port Adaptor (***P/N: 4-1-35-10010001***).

14 Fit the Plug (***item 28***) along with the O-Ring (***item 44***) into the fill port.

15 Remove the C-Spanner from the second slot.

5.3.1.10 Bottom Sub

Reference:		
	General Assembly	AD-3403501
	Sonde Section Assembly	AD-9-4-03-30S3501
	Connect Hyper Bottom SX	AD-9-4-03-HBTMSXC1

1 Install and grease (**P/N: LOR101**) the two O-Rings (**item 41**, 9-4-03-30S3501) and three Teflon® Rings (**item 3**, 9-4-03-30S3501) on the Bottom Sub (**item 15**, 9-4-03-30S3501).

2 Check the Connect Hyper Bottom SX (**item 3**, 3403501). Where the Connect Hyper Bottom SX is damaged, access can be gained by:

i. Remove the Retaining Ring (**item 6**, 9-4-03-HBTMSXC1) to allow the UW Small Washer, SX Brass Socket, Spring, Pin Adaptor and Insulator Go Pin (**items 2, 1, 5, 3 & 4**, 9-4-03 HBTMSXC1) to be removed.
ii. Replace damaged parts.
iii. Fit the Insulator GO Pin (**item 4**, 9-4-03-HBTMSXC1), bevelled edge facing inwards, into the neck of the Bottom Sub (**item 15**, 9-4-03-30S3501).
iv. Fit the Pin Adaptor (**item 3**, 9-4-03-HBTMSXC1) into one end of the Spring (**item 5**, 9-4-03-HBTMSXC1).
v. Fit the SX Brass Socket (**item 1**, 9-4-03-HBTMSXC1) into the other end of the Spring (**item 5**, 9-4-03-HBTMSXC1).
vi. Install the Spring along with the SX Brass Socket and Pin Adaptor into the Insulator GO Pin (**item 4**, 9-4-03-HBTMSXC1). Make sure the SX Brass Socket (**item 1**, 9-4-03-HBTMSXC1) is facing outwards.
vii. Install the Washer (**item 2**, 9-4-03-HBTMSXC1) in the neck of the Bottom Sub (**item 15**, 9-4-03-30S3501).
viii. Use a screw driver to push against the UW Small Washer to compress the Spring and install the Retaining Ring (**item 6**, 9-4-03-HBTMSXC1). Carefully ease off the pressure and remove the screw driver.

3 Insert a screwdriver into a slot in the housing and support the Rx2 to End Hose (**item 25**, 9-4-03-30S3501) as shown in **Figure 5-2**.

4 Push the Bottom Sub (**item 15**, 9-4-03-30S3501) over the Rx2 to End Hose (**item 25**, 9-4-03-30S3501) and inside the Sonic Housing (**item 20**, 9-4-02-30S3501) until the Bottom Sub is positioned against the Rx2 to End Hose bottom connector.

5 Install the six Screws (**item 59**, 9-4-03-30S3501) securing the Sonic Housing (**item 20**, 9-4-03-30S3501) to the Bottom Sub (**item 15**, 9-4-03-30S3501).

6 Fit the Bottom End Cap (**item 55**, 9-4-03-30S3501) onto the Bottom Sub (**item 15**, 9-4-03-30S3501).

5.3.2 ELECTRONICS SECTION

5.3.2.1 Relative Bearing Device

Reference:		
	Electronic Assembly	AD-9-4-03-34E3501
	Electronic Section Wiring Diagram	WD-9-4-03-34E3501

1 Orientate the electronics upper assembly, as shown in **Figure 5-1**, so that the marks made on disassembly are matched to the HS Rail Cap (**item 7**).

2 Feed the wires through the Relative Bearing Device (**item 1**).

3 Referring to **WD-9-4-03-34E3501**, connect the PCB9-4-03-34008001 to PCB9-4-01-340010A1.

4 Solder (*SN100C*) the four wires from the Relative Bearing Device (*item 1*) to the PCB413884, refer to *WD-9-4-03-34E3501*. Clean any flux from the board.

5 Thread four Screws (*item 11*) to secure the top of the HS Rail Caps (*item 7*) to the Coupling Block (*item 5*).

6 Check and grease (*P/N: LOR101*) the O-Ring (P/N: 4-2-09-V7512300) on the Electronics Top Block (*item 21*). Replace if damaged. See *Figure 5-1*.

5.3.2.2 Pressure Relieving Feed Thru

Reference:		
	Top Sub SX Assembly	*AD-9-4-03-0000002*
	Pressure Relieving Feed Thru Assembly	*AD-413380*

1 Check and grease (*P/N: LOR101*) the O-Ring (*item 4*, 413380).

2 Fit the Valve Shaft (*item 1*, 413380) into the Valve Body (*item 2*, 413380).

3 Check and grease (*P/N: LOR101*) the two O-Rings (*item 5*, 413380).

4 Place the Valve Washer (*item 3*, 413380) into position and push into the Top Sub (*item 1*, 9-4-03-0000002).

5 Push in the remaining Pressure Relieving Feed Thru (*item 5*, 423380).

6 Fit the Washer (*item 8*, 9-4-03-0000002) and the Sleeve (*item 7*, 9-4-03-0000002) onto the Pressure Shaft (*item 6*, 9-4-03-0000002).

7 Thread the Pressure Shaft (*item 6*, 9-4-03-0000002) through the bottom of the Top Sub (*item 1*, 9-03-0000002) into the Pressure Relieving Feed Thru (*item 5*, 423380).

8 Replace the Protective Male Plug (*item 4*, 9-4-03-0000002) onto the Top Sub (*item 1*, 9-4-03-0000002).

5.3.2.3 Top Sub

Reference:		
	Electronic Assembly	*AD-9-4-03-34E3501*
	Top Sub SX Assembly	*AD-9-4-03-0000002*

1 Check and grease (*P/N: LOR101*) the two O-Rings (*item 2*, 9-4-03-0000002) and the four Back-up Rings (*item 4*, 9-4-03-0000002).

2 Place the Electronic Housing (*item 6*, 9-4-34E3501) in a vice with soft jaws.

3 Screw the Top Sub (*item 1*, 9-4-03-34E3501) into the top of the Electronic Housing. Tighten using a spanner on the Top Sub (*item 1*, 9-4-03-0000002).

5.3.3 RBT SECTIONS

Reference:		
	General Assembly	*AD-3403501*
	Electronic Assembly	*AD-9-4-03-34E3501*
	RBT003 Block Diagram	*BD-3403501*

1 Support the Sonic Section in suitable stands (for example, V-blocks), see *Figure 5-3*.

2 Orientate the internal electronics assembly to the Sonic Section (*item 2*, 3403501) so that the marks made during disassembly are matched.

3 Support the internal electronics assembly whilst installing the Screws (***item 11***, 9-4-03-34E3501) connecting the HS Rail Caps (***item 7***, 9-4-03-34E3501) to the Sonic Section top sub.

4 While referencing to the wiring diagram (***BD-3403501***), plug-in the wiring emerging from the Sonic Section to the internal electronics assembly as follows:

- 2-pin connector to the Power Supply Board (PCB9-4-01-34001001) at J4.
- 10-pin connector to the Main Analogue (PCB9-4-01-34003001) at J1.
- 4-pin connector to the Transmitter Power (PCB9-4-01-34005001) at J3.

5 Place the Electronics Housing (***item 6***, 9-4-03-34E3501) along with the Top Sub (***item 4***, 3403501) over the internal electronics assembly and thread onto the Sonic Section (***item 2***, 3403501).

6 Use a strap wrench on the Electronic Housing (***item 6***, 9-4-03-34E3501) to tighten onto the Sonde Section (***item 2***, 3403501).

6 ELECTRICAL DESCRIPTION

Reference:	RBT003 Functional Block Diagram	*BD-3403501*
	RBT Electronic Assembly Wiring Diagram	*WD-9-4-03-34E3501*

Note: The signal descriptions used to describe the RBT003 receiver operation in this section are detailed in *Table 1-1 Receiver Descriptions*.

6.1 Power Supply Board

Reference: Circuit Diagram *CD-9-4-01-340010A1*

The RBT003 power supply is a switching mode type that provides the tool with +3.3 VDC and -3.3 VDC from 18 VDC line voltage (or battery). The Ultrawire™ Controller (PCB413884) plugs on the back of the power supply. Control and data signals from and to the Ultrawire™ Controller are routed via the power supply to the rest of the tool.

For simplicity, the +3.3 VDC supply is explained and the corresponding components for the -3.3 VDC are shown in brackets.

U1 (U3) is a DC-DC converter controller IC. The pulse-width modulated output from U1 (U3) drives a MOSFET power switch, Q10 (Q30). The MOSFET with associated components, L10 (L30) and D10 (D30) perform the voltage step-down operation. C15 (C35) is a filter capacitor to smooth the output voltage. Voltage reference U4 (U5) provides external reference to the controller IC.

Fine adjustment to the +3.3 VDC can be done by changing R3. Similarly, -3.3 VDC supply can be adjusted with R5.

Zener diode D1 protects against reverse or over voltage. U6 and U7 buffer the Ultrawire™ control signals. P3 routes the Ultrawire™ bus to the bottom of the tool for connection to other Ultrawire™ tools.

6.2 Main Digital Board

Reference: Circuit Diagram *CD-9-4-01-340020A1*

The Main Digital board performs the following tasks:

- Digitise the Sonic waveforms.
- Stores the digitised waveforms in memory to be read later by the Ultrawire™ controller.
- Responds to the Ultrawire™ controller commands and transfers the digitised sonic data to it.
- Sends the firing pulse to the Transmitter circuit.

Upon receiving a “XMIT” pulse from the Ultrawire™ controller, U30 controls a set of eight ADCs to convert the Sonic signals to digital format. A handshake signal, “MEM_BUSY”, is asserted during the conversion process. U33, a static RAM memory, stores the digital data output from the ADCs. The Ultrawire™ controller sends a read pulse “MEM_START” followed by a series of clock pulses “MEM_CLK” to read the data from memory for later reconstruction at surface.

Q3, U7 and associated components form a +2.5 VDC power supply to provide U30 with power. U31 resets the circuit when power is first applied. X1 and U32 form a 20MHz clock circuit for timing purposes. U35 buffer the serial data to the Ultrawire™ controller. U34 carries the Fire and Charge control pulses to the Transmitter board.

6.3 Main Analogue Board

Reference: Circuit Diagram *CD-9-4-01-340030A1*

The Main Analogue board receives and conditions the sonic signal from the radial and far receivers. It then routes it to the Main Digital board for digitization.

The Main Analogue board has eight analogue channels: six identical channels for radial signals plus a channel for the far signal and a channel for the near signal. It is possible to adjust the gain of each channel independently with a single, selectable resistor. Gain adjustment is usually done as part of the harware setup, refer to ***Section 7.2.1***. The locations of gain setting resistors are shown in the attached PCB layout diagram.

Radial and Far sonic signals (see ***Table 1-1***) are fed to the board via J1. For simplicity, radial channel #1 is described and the same operation principal applies to the rest.

U10 is an adjustable-gain instrumentation amplifier. The gain is set with selectable resistor R10. U11 is configured as a level-shifting driving stage, which drives the Analogue-to-Digital converter on the Main Digital board (PCB9-4-01-340020A1). R17 and C17 form a simple RC anti-aliasing filter.

U80A is a summing amplifier that sums all the Radial signals to produce the Near signal.

6.4 Transmitter Control & Power Boards

Reference: Circuit Diagram *CD-9-4-01-340040A1*
Circuit Diagram *CD-9-4-01-340050A1*

Note: **DO NOT** fire the transmitter circuitry when the Electronics Section is separated from the Transmitter in the Sonde Section.

The RBT003 Transmitter consists of two boards stacked together, a Control board and a Power board. Both boards are explained here as a unit.

Q1 with associated components, D2, D3 and L2 charge a capacitor bank C30, C31 and C32 to ~ 130VDC. U15A compares the capacitor bank voltage with a constant reference and feeds the result to a microprocessor, U16, on the control board. U16 issues charge pulses as needed to maintain the capacitor charge. A firing pulse from the Main Digital board switches Q2 on and consequently fires the transmitter crystal. Q3 with U3 generate a +5V reference voltage for U15. U19 is a gate drive IC to drive Q1 and Q2. X1 and U18 generate an 8MHz clock for the microprocessor. The crystal firing voltage can be adjusted with the selectable resistor R112.

6.5 Digital Board

Reference: Digital Board (PCB413884) *CD-82333*

The Digital Board contains three main functional blocks. These are the Switched Mode Power Supplies (SMPS), the Ultrawire™ bus interface and the system control electronics. The SMPS takes DC power from the Ultrawire™ tool bus and generates 3.3V rail that powers all the analogue and digital circuitry on the Ultrawire™ PCB. A nominally, unfiltered, 1.6V rail is also generated, for use in some tools (refer to wiring diagram). The SMPS is isolated from the Ultrawire™ toolbus by an active choke consisting of Q5 and associated circuitry. The filter formed by this active choke, together with capacitor C6, prevents switching currents, generated by the SMPS, from appearing on the Ultrawire™ bus, where they would cause data corruption and ensures that the tool takes a steady DC current. The tool is protected against over voltage and reverse connection by the fuse (F1) and the Zener diode (D1).

The SMPS is controlled by the SMPS controller (U1). The MOSFET (Q4) and the transformer (L1) form the core of the power supply. U8 provides a 2.048V reference for the supply and the inductor (L2) and the capacitor (C7) form an output filter on the 3.3V output.

The SMPS operating frequency is variable and increases with increased demand on the output rails. This design of power supply is inherently protected against a short circuit on either output rail, making it extremely robust.

System control is performed by the microprocessor (U7), which (in addition to communicating with the Ultrawire™ bus via PLD U5), controls the acquisition of data from the various sensors within the sensing section.

Control lines D3, D4, TX, RX and CLK communicate with the Analogue Board, using SPI protocol.

U3 is a voltage monitor and system reset generator that only allows the tool to operate when the 3.3V power rail is stable.

X1 is a crystal oscillator, generating the system clock for the sensing section. Under normal operation this is an 8MHz clock signal, but may be switched down to 64kHz by the microprocessor (via PLD U5 CPU_CLK_SPD line) to save power while the tool is idle. Op-amp U6 and the associated components condition the signal from the temperature probe, but this is currently unused. The output of this op-amp is connected to the microprocessor (U7) where it is converted into a digital quantity by the processor's internal analogue to digital converter.

7 EXTENDED CHECKS

7.1 Preventative Maintenance

IRRITANT!

LIQUID-O-RING® TYPE 101 LUBRICANT

Refer to *Section 2.5.1, Liquid-O-Ring® type 101 Lubricant*.

CAUTION!

SEAL INTEGRITY!

Refer to ***Section 2.6, Tool Integrity***.

Reference: General Assembly ***AD-3403501***

Note: **DO NOT** fire the transmitter circuitry when the Electronics Section (***item 1***) is separated from the Transmitter in the Sonde Section (***item 2***).

7.1.1 MECHANICAL

1 Remove dirt and old grease from pressure housing threads and the seals.

2 Inspect the seals for damage or ageing/hardening and replace where required. Apply fresh grease to the threads and seals as required.

3 Check for:

- Damaged wires.
- Wires that are loose or likely to be damaged during reassembly.
- Damaged components.
- Electrical components shorting to chassis.
- Heat or chemical damage (discoloured components).
- Incorrect thread grease or excessive quantity, refer to ***Section 2.6***.
- Cleanliness of connectors and loose/bent pins before replacing.
- Loose screws/nuts/components/connectors.

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

4 Check all fixings for tightness.

7.1.2 ELECTRICAL

WARNING!

ELECTRICAL HAZARD!

Refer to *Section 2.2, Electrical Hazard*.

1 Check through line resistance with a multimeter. The reading should be <0.5Ω.

2 The RBT003 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 or Dummy Logging Cable (DLC). Make sure a bottom end flowmeter or suitable Bullnose (BUL) with Ultrawire™ termination is fitted to the bottom of the toolstring.

3 Measure the tool current at 18VDC. The reading should be between 35mA and 60mA.

4 Perform a visual inspection of the electronics for debris, damaged components and wires.

7.1.3 SEAL REPLACEMENT RECOMMENDATIONS

Reference:	Top Sub Assembly	*AD-9-4-03-0000002*
	RBT Electronic Assembly	*AD-9-4-03-34E3501*
	RBT Sonde Assembly	*AD-9-4-03-30S3501*
	Pressure Relieving Feed Thru Assembly	*AD-413380*

Refer also: ***Section 4.4, Post-Logging Checks***.

GE Oil & Gas recommend that all the primary seals are replaced after every run or six months when the tool is not in use.

Secondary seals should be replaced under these situations:

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

Anti-Extrusion Rings (Back-up Rings) should 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*** for the correct fitting of the Anti-Extrusion Rings.

Primary Seals:

Table 7-1 Primary Seals

Qty	Type	Item No	Drawing No
2	O-Rings	2	*AD-9-4-03-0000002*
2	O-Rings	33	*AD-9-4-03-30S3501*
2	O-Rings	35	*AD-9-4-03-30S3501*
2	O-Rings	41	*AD-9-4-03-30S3501*

Secondary Seals and Anti-Extrusion Rings (Back-up Rings):

Table 7-2 Secondary Seals and Anti-Extrusion Rings (Back-up Rings)

Qty	Type	Item No	Drawing No
4	Back-up rings	3	*AD-9-4-03-0000002*
4	Back-up rings	32	*AD-9-4-03-30S3501*
4	Back-up rings	34	*AD-9-4-03-30S3501*
2	Back-up rings	36	*AD-9-4-03-30S3501*
2	Back-up rings	37	*AD-9-4-03-30S3501*
9	O-Rings	38	*AD-9-4-03-30S3501*
10	O-Rings	39	*AD-9-4-03-30S3501*
5	O-Rings	40	*AD-9-4-03-30S3501*
1	O-Rings	42	*AD-9-4-03-30S3501*
2	O-Rings	43	*AD-9-4-03-30S3501*
2	O-Rings	44	*AD-9-4-03-30S3501*
2	O-Rings	45	*AD-9-4-03-30S3501*
7	O-Rings	46	*AD-9-4-03-30S3501*
2	O-Rings	47	*AD-9-4-03-30S3501*
2	O-Rings	48	*AD-9-4-03-30S3501*

Table 7-2 Secondary Seals and Anti-Extrusion Rings (Back-up Rings) *(continued)*

Qty	Type	Item No	Drawing No
1	O-Rings	49	*AD-9-4-03-30S3501*
4	O-Rings	50	*AD-9-4-03-30S3501*
6	O-Ring	54	*AD-9-4-03-30S3501*
1	O-Ring	4	*AD-413380*
2	O-Ring	5	*AD-413380*
1	O-Ring	P/N: 4-2-09-V7512300	Fitted on Electronics Top Block (item 21, *AD-9-4-03-34E3501*)
2	O-Rings	P/N: 99016	Fitted on 19-pin connector (part of item 52, *AD-9-4-03-30S3501*)
1	O-Ring	P/N: 4-2-09-V9001500	Fitted on 3-pin connector (part of item 53, *AD-9-4-03-30S3501*)

7.1.4 Ageing of Electronics

At 150°C (302°F), significant electronic ageing failures are expected after 4000hrs typical use, hence PCB replacement should be considered at this point. Every additional 10°C (18°F) halves the time. Ageing of the electronics is also accelerated by vibration and corrosive gas inside the chassis. Visual inspection and logging previous history is recommended, but is unlikely to predict premature failure. Tools that may be suspected of reliability problems due to age or unusual log response may 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.

DO NOT USE METAL HAMMERS.

7.1.5 Heat Testing Above 120°C (248°F)

Generally this is not recommended since it shortens tool life expectancy. Heat testing may be required for contractual reasons, tool out of use for a long period, or job with unusually high well temperature. The test should be carried out slightly above expected well temperature only and the tool should not be kept at temperature for more than 1 hour. Do not exceed the maximum rated temperature for the tool.

7.1.6 Software Calibration

WARNING! **ELECTRICAL HAZARD!**

Refer to *Section 2.2, Electrical Hazard*.

Reference: General Assembly *AD-3403501*

Note: **DO NOT** fire the transmitter circuitry when the Electronics Section (***item 1***) is separated from the Transmitter in the Sonde Section (***item 2***).

It is recommended that software calibration is carried out every 5 runs or more frequently where possible.

7.1.6.1 Equipment Requirements

- RCT001 - RBT Calibration Tool (refer to ***MN-RCT001***).
- BUL006 - Bullnose with Ultrawire™ Termination (refer to ***MN-BUL***).
- XTU002 - Ultralink™/Ultrawire™ Crossover Tool (refer to ***MN-XTU002***).
- DLC007 - Dummy Logging Cable (refer to ***MN-DLC007***).
- ULP002 - Ultralink™ Logging Panel (refer to ***MN-ULP002***).
- PC with Warrior Software installed (refer to ***MN-WARRIOR***).
- RBT003 Calibration Kit (***P/N: 3400006***).
- Various connection cables.

7.1.6.2 Connection & Calibration Details

Reference:	General Assembly	***AD-3403501***
	Top Sub Assembly	***AD-9-4-03-0000002***
	Sonde Assembly	***AD-9-4-03-30S3501***
	Hyper Software Cal Adaptor	***AD-9-5-03-000200A1***

1 Check the RCT001 and items in the RBT003 Calibration Kit (***P/N: 3400006***) are operating correctly and have been maintained. Refer to ***MN-RCT001*** and ***Appendix D, RBT003 Calibration Kit***.

2 Remove the Lower Thread Protector (***item 55***, 9-4-03-30S3501) and fit a Bullnose with Ultrawire™ Termination (BUL006) onto the bottom of the RBT003 to be tested.

3 Fit the four Sonic Clam Shells (***P/N: 9-5-03-000215A2***) onto the RBT003. The Clam Shells should be located equidistantly and roughly in the following positions:

- Bottom of tool.
- Between Rx1 and Rx2.
- Between Tx and Rx1.
- Top of tool.

Note: **DO NOT** place the Clam Shells over the Transmitter or Receiver Cans.

4 Make sure the Connect Hyper Bottom SX (***item 13***, 9-5-03-000200A1) is fitted in Hyper Software Cal Adaptor (***P/N: 9-5-03-000200A1***).

5 Remove the upper Protective Male Plug (***item 4***, 9-4-03-0000002) and attach the Hyper Software Cal Adapter (***P/N: 9-5-03-000200A1***) on to the Top Sub (***item 4***, 3403501) of the RBT003.

6 Carefully locate the RBT003 into the RBT Calibration Tank (RCT001). Refer to RCT001 manual (***MN-RCT001***) for instructions.

7 Make sure the Hyper Software Cal Adaptor is secure and sealed at the top of the RCT001, refer to ***MN-RCT001***.

8 Connect the remaining equipment as shown in ***Figure 7-1***. Refer to the relevant manuals for individual equipment information. Make sure the Tool Safety Clamp (***P/N: KITB-UW-Earth Clip***) is fitted to the XTU002 before applying power to the setup.

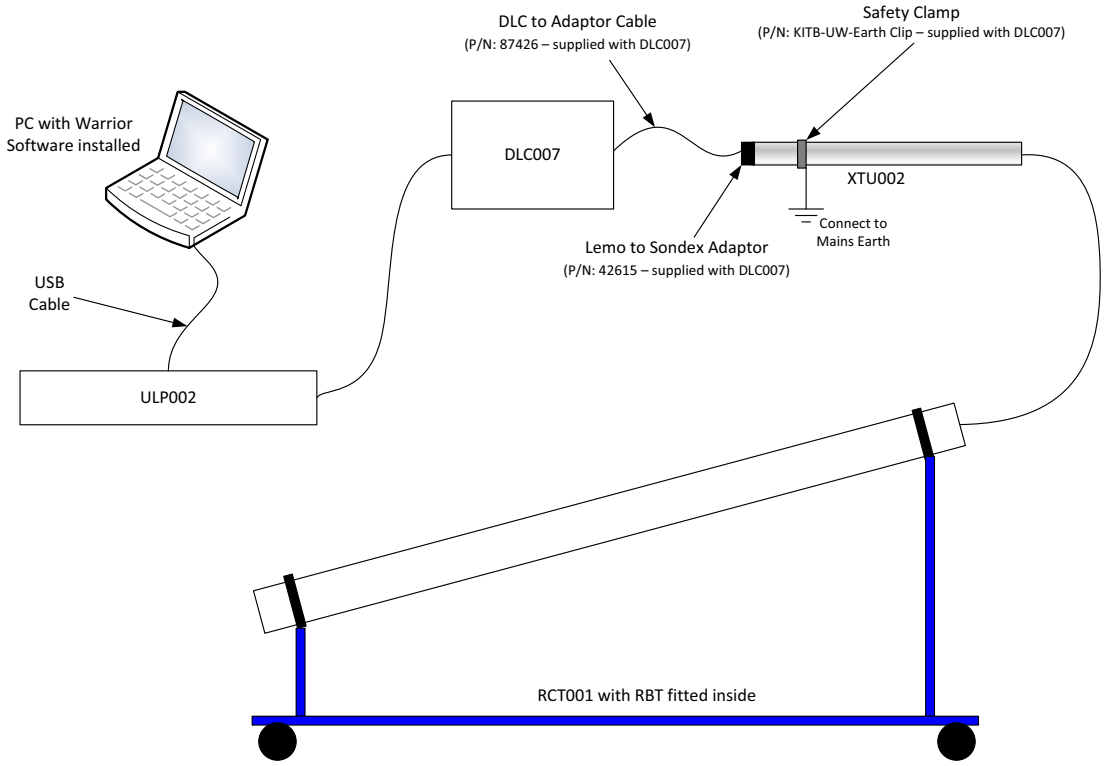


Figure 7-1 RBT Software Calibration Setup

9 Follow the RBT calibration procedure in the Warrior software. Refer to the Warrior manual (***MN-WARRIOR***) for further information.

7.1.6.3 Disconnecting Calibration Equipment

Reference:		
	General Assembly	***AD-3403501***
	Top Sub Assembly	***AD-9-4-03-0000002***
	Sonde Assembly	***AD-9-4-03-30S3501***
	Hyper Software Cal Adaptor	***AD-9-5-03-000200A1***

1 Turn the power off to the equipment and unplug the cables. Refer to relevant manuals for individual equipment instructions.

2 Drain the RBT Calibration Tank (RCT001) as detailed in the RCT001 manual (***MN-RCT001***).

3 Carefully remove the RBT003 from the RCT001 and dry the RBT003 thoroughly. Refer to the RCT001 manual (***MN-RCT001***).

4 Unscrew the Hyper Software Cal Adaptor (***P/N: 9-5-03-000200A1***) from the Top Sub (***item 4***, 3403501) of the RBT003.

5 Replace the upper Protective Male Plug (***item 4***, 9-4-03-0000002) onto the Top Sub (***item 4***, 3403501) of the RBT003.

6 Remove the four Sonic Clam Shells (***P/N: 9-5-03-000215A2***) from the RBT003.

7 Unscrew the Bullnose from the bottom of the RBT003 and fit the Lower Thread Protector (***item 55***, 9-4-03-30S3501).

7.2 Extraordinary Maintenance

7.2.1 HARDWARE SETUP

WARNING! **ELECTRICAL HAZARD!**

Refer to *Section 2.2, Electrical Hazard*.

Reference: General Assembly ***AD-3403501***

Note: **DO NOT** fire the transmitter circuitry when the Electronics Section (***item 1***) is separated from the Transmitter in the Sonde Section (***item 2***).

The RBT003 requires a hardware setup when any of the following parts are replaced or modified:

- Receiver Crystals.
- Transmitter Crystals.
- Analogue Board in the Electronics Section.

This section explains how to adjust the amplitude of the amplifiers on the Analogue Board so that the signal strength is 1.0V ±0.02V.

To setup the hardware the RBT003 must be connected to enable adjustment of the resistors on the Analogue Board.

The setting up of Receiver Rx1 is a calculated sum and the integrity of its value depends upon proper calibration of Radial R1 through to Radial R6. Therefore the setup sequence detailed must be followed.

7.2.1.1 Equipment Requirements

Refer to ***Section 7.1.6.1, Equipment Requirements***.

7.2.1.2 Connection and Hardware Setup Details

Reference:		
	General Assembly	***AD-3403501***
	Top Sub Assembly	***AD-9-4-03-0000002***
	Electronics Assembly	***AD-9-4-03-34E3501***
	Sonde Assembly	***AD-9-4-03-30S3501***

1 Check the RCT001 and the items in the RBT003 Calibration Kit (***P/N: 3400006***) are operating correctly and have been maintained. Refer to ***MN-RCT001*** and ***Appendix D, RBT003 Calibration Kit***.

2 Separate the RBT Electronics section from the Sonde section, refer to ***Section 5.2.1, Separation of Electronic & Sonde Sections***.

3 Remove the Lower Thread Protector (***item 55***, 9-4-03-30S3501) and fit a Bullnose with Ultrawire™ Termination (BUL006) onto the bottom of the Sonde section to be tested.

4 Slide three Sonic Clam Shells (***P/N: 9-5-03-000215A2***) onto the Sonde section. The Clam Shells should be located equidistantly and roughly in the following positions:

- Bottom of Sonde section.
- Between Rx1 and Rx2.
- Top of Sonde section.

Note: **DO NOT** place the Clam Shells over the Transmitter or Receiver Cans.

5 Attach connectors J1 (10-pin) and J2 (4-pin) on the Calibration Harness (***P/N: 414193***) to the appropriate flying leads from the Sonde section. Make sure the shorter cable supplied in the RBT003 Calibration Kit (***P/N: 3400006***) is used. Using the wrong cable will affect the results.

6 Fit the remaining Sonic Clam Shells (***P/N: 9-5-03-000215A2***) onto the Cal Adapter (***P/N: 9-5-03-000301A1***).

7 Slide the Calibration Harness through the Cal Adapter (***P/N: 9-5-03-000301A1***) and carefully screw the Cal Adapter to the Sonde section.

8 Carefully locate the Sonde section into the RBT Calibration Tank (RCT001). Refer to RCT001 manual (***MN-RCT001***) for instructions.

9 Make sure the Cal Adapter is secure and sealed at the top of the RCT001, refer to ***MN-RCT001***.

10 Remove the Top Sub (***item 4***, 3403501) from the Electronics Housing (***item 6***, 9-4-03-34E3501) and carefully slide the internal Electronics Chassis from the Electronics Housing (to gain access to the Main Analogue Board (***PCB9-4-01-340020A1***) - particularly the Selectable Resistors shown in ***Figure 7-3***. Refer to ***Section 5.2.2.1, Top Sub***.

11 Referring to the RBT003 Functional Block Diagram (***BD-3403501***) attach the Calibration Harness (***P/N: 414193***) connectors:

i. P1 to the 10-pin connector on the Main Analogue Board (***PCB9-4-01-340030A1***) at J1.
ii. P2 to the 4-pin connector on the Transmitter Power Board (***PCB9-4-01-340050A1***) at J3.

12 Connect the remaining equipment as shown in ***Figure 7-2***. Refer to the relevant manuals for individual equipment information. Make sure the Tool Safety Clamp (***P/N: KITB-UW-Earth Clip***) is fitted to the XTU002 before applying power to the setup.

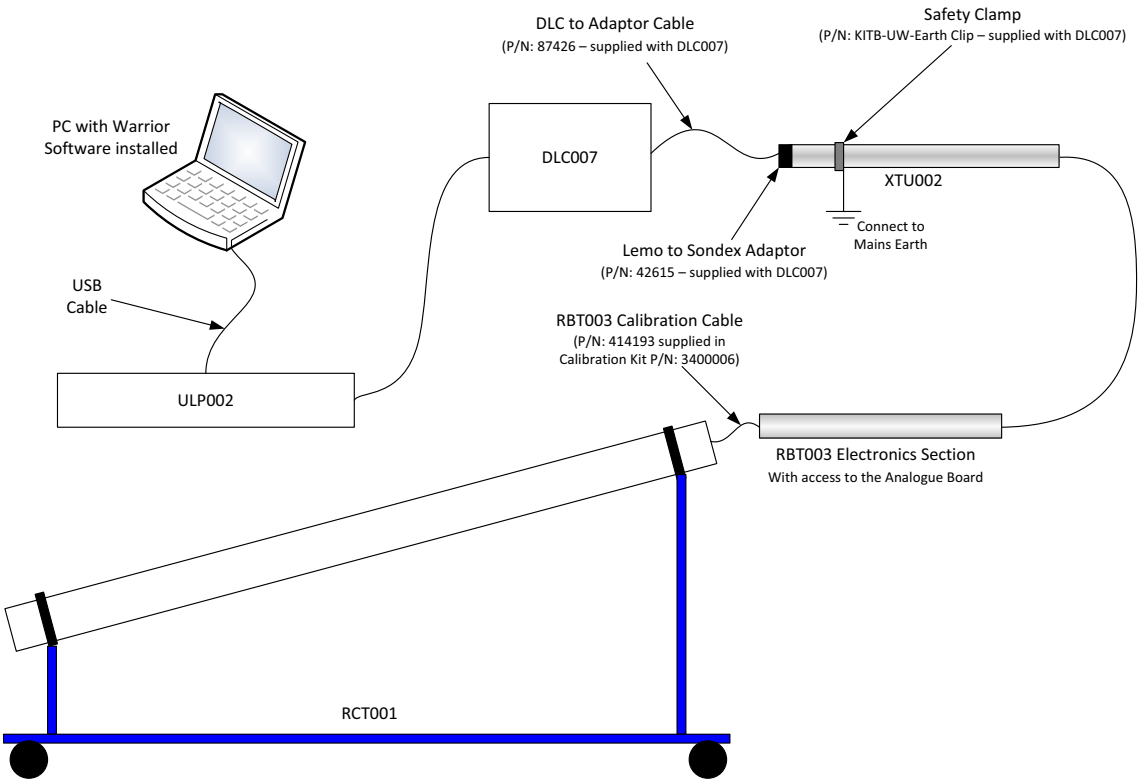


Figure 7-2 RBT Hardware Setup

7.2.1.3 Selectable Resistor Details

The resistor values listed below are suggested values and may vary.

Table 7-1 Typical Resistor Values

Sensor	Resistor Value	Install Location on the Main Analogue Board
Radials R1 - R6	~3.3kΩ	R10 through R60
Receiver Rx2	~470Ω	R70
Receiver Rx1	~75kΩ	R80

Note: *SN100C* solder is to be used on the Electronics Section and **MUST NOT** be mixed with the *HMP* solder used in the Sonde Section. **Mixing solder types will result in tool failure downhole.**

Make sure the Analogue Board is accessible for resistor adjustments. The selectable resistor locations are shown in *Figure 7-3*.

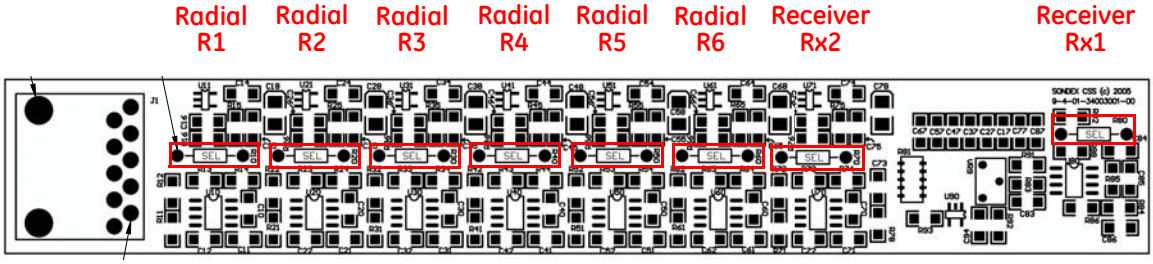


Figure 7-3 Selectable Resistor Locations on the Analogue Board

7.2.1.4 Procedure for Selecting Resistor Values

1 Open the screen shown in *Figure 7-4* which is available within the Warrior software. Refer to the Warrior manual (*MN-WARRIOR*) for further details.

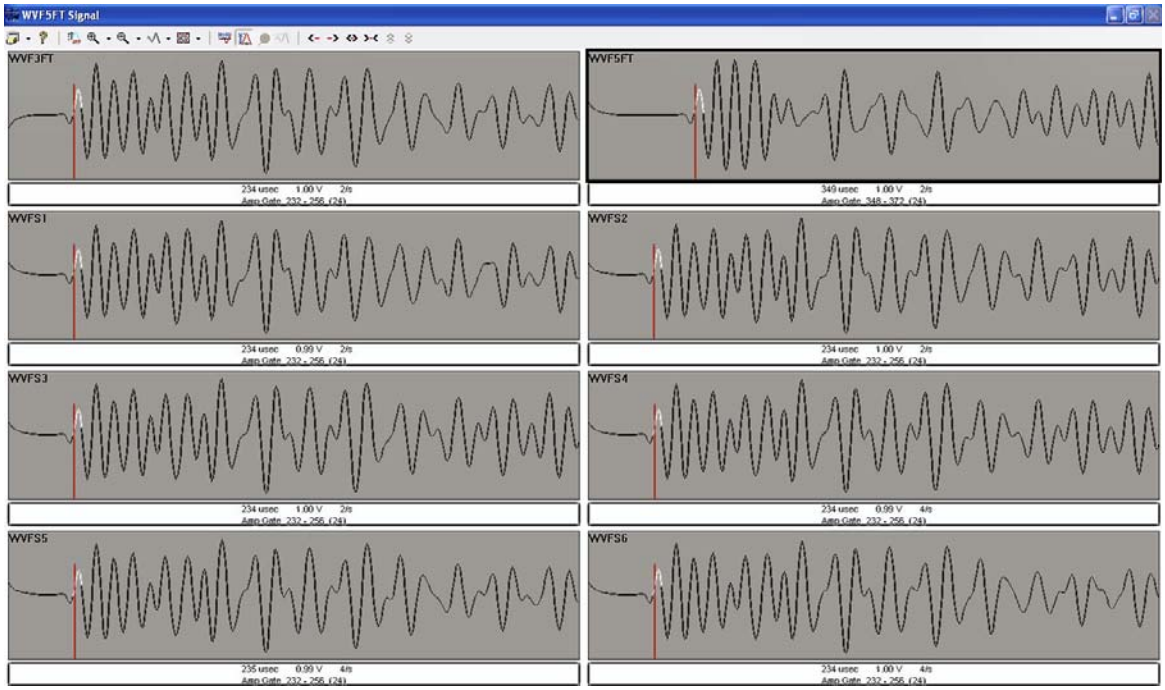


Figure 7-4 Warrior Screen Required

Note: ***SN100C*** solder is to be used on the Electronics Section and **MUST NOT** be mixed with the ***HMP*** solder used in the Sonde Section. **Mixing solder types will result in tool failure downhole.**

2 Adjust the resistor values so that the signal response is 1.0V (±0.02V) when the amplitude gate is set to the maximum peak of E1. Make sure ***SN100C*** is used. The resistors **MUST** be adjusted in the following order:

i. Radial R1.
ii. Radial R2.
iii. Radial R3.
iv. Radial R4.
v. Radial R5.
vi. Radial R6.
vii. Receiver Rx2.
viii. Receiver Rx1.

3 Complete the software calibration detailed in the Warrior manual (***MN-WARRIOR***).

4 Clean any flux residue around solder joints before reassembling the Electronics section.

7.2.1.5 Disconnecting Hardware Setup Equipment

Reference:		
	General Assembly	***AD-3403501***
	Top Sub Assembly	***AD-9-4-03-0000002***
	Electronics Assembly	***AD-9-4-03-34E3501***
	Sonde Assembly	***AD-9-4-03-30S3501***

1 Turn the power off to the equipment and unplug the cables. Refer to relevant manuals for individual equipment instructions.

2 Carefully slide the Electronic Housing (***item 6***, 9-4-03-34E3501) over the Electronics Chassis and fit the Top Sub (***item 4***, 3403501) on to the Electronic Housing. Refer to ***Section 5.3.2.3, Top Sub***.

3 Drain the RBT Calibration Tank (RCT001). Refer to ***MN-RCT001***.

4 Carefully remove the Sonde section and Cal Adaptor (***P/N: 9-5-03-000301A1***) from the RCT001 and dry the Sonde section thoroughly. Refer to ***MN-RCT001***.

5 Remove the four Sonic Clam Shells (***P/N: 9-5-03-000215A2***) from the Sonde section and Cal Adaptor (***P/N: 9-5-03-000301A1***).

6 Unscrew the Bullnose from the bottom of the Sonde Section and fit the Lower Thread Protector (***item 55***, 9-4-03-30S3501).

7 Reassemble the Electronics Section onto the Sonde Section. Refer to ***Section 5.3.3, RBT Sections***.

8 Perform a Software Calibration. Refer to ***Section 7.1.6***.

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
Initial inspection	Check for: • Damaged wires. • Damaged components. • Electrical components shorting to chassis. • Heat or chemical damage (discoloured components). • Incorrect thread grease or excessive quantity, see ***Section 2.6***. Also check that all fixings are tight.	
Tool does not respond	Check fuse on Digital Board. Make sure that the Digital Board is properly programmed. Check +3.3VDC power, J2 of Power Supply Board.	***PCB413884*** ***PCB9-4-01-340010A1***
Transmitter not firing	Check function of U6 and U7 on the Power Supply Board. Check oscillator pin 4 of U32 on Main Digital Board. Check signals on J1 pins 3 and 4 of Transmitter Controller Board. Check oscillator pin 4 of U18 on Transmitter Controller Board. Check high voltage (130V) present on R112 of Transmitter Power Board.	***PCB9-4-01-340010A1*** ***PCB9-4-01-340020A1*** ***PCB9-4-01-340040A1*** ***PCB9-4-01-340050A1***
Received signal strength is low	Make sure calibration tank is full and pressured to 500PSI. Make sure tool is properly centralized in calibration tank. Make sure R10, R20, R30, R40, R50, R60, R70, R80 are properly inserted on the Main Analogue Board. Check high voltage (130V) present on R112 of Transmitter Power Board. Make sure tool is properly filled with Oil.	***PCB9-4-01-340030A1*** ***PCB9-4-01-340050A1***
Signal on one radial channel is significantly lower than the other channels.	Make sure R10, R20, R30, R40, R50, R60 are properly inserted on the Main Analogue Board. Remove J1 connector from the Main Analogue Board and check capacitance between RC (pin 1) and each radial receiver R1-6. Values should be approximately 5.5nF, Where very different, radial receiver is cracked or damaged, tool must be torn down for inspection.	***PCB9-4-01-340030A1***.

Table 7-1 Troubleshooting checklist *(continued)*

Symptom	Possible Fault	Assembly
Tool exhibits significant noise on receiver channels	Check that electrical shield in harness in sonde is connected to tool ground on the Main Analogue Board. Make sure zero metal to metal contact between hoses and receiver sections in the sonde. Use electrical meter to measure resistance between sections, should be >1MΩ.	*PCB9-4-01-340030A1*

APPENDIX A EQUIPMENT & SPARES

A.1 Main Equipment

Part No	Description	Qty	Remarks
RBT003	Radial Bond Tool	1	$1^{11}/_{16}$", Ultrawire™

A.2 Ancillary Equipment

Part No	Description	Qty	Remarks
RCT001	RBT Calibration Tank	1	Required for calibrating the RBT.

A.3 Maintenance Equipment

A.3.1 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
T006-03140	Dow Corning® 3140 RTV	1	90ml tube
T006-03145	Dow Corning® 3145 RTV	1	90ml tube
415574	Dow Corning 200® 100CST Silicone Oil	1	1L bottle
T004-00092	Kapton Tape (25mm Width)	1	Roll (length 33m)
414666	Duralco™ 120 Epoxy	1	2oz kit
N/A	SN100C Flux Cored Solder Wire	N/A	Not available from GE Oil & Gas
N/A	HMP Flux Cored Solder Wire	N/A	Not available from GE Oil & Gas

A.3.2 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***)
3400006	Calibration Kit	1	Refer to ***Appendix D*** for maintenance requirements.
4-1-35-10010001	Oil Fill Port Adaptor	1	Size $^{7}/_{16}$"

A.4 Recommended Spares

Part No	Description	Qty	Remarks
KITB-RBT003	Basic Spares Kit	1	For After Each Run
KITR-RBT003	Recommended Spares Kit	1	For Every 25 Runs
KITO-RBT003	O-Ring Spares Kit	1	

A.5 Kit Details

PARTS LISTING

Part	*Issue*
91050	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	EA	
0002	91019	Spanner C 50mm 35mm	2	EA	
0003	10038	Spanner Box 3/8 x 5/16 Modified	2	EA	
0004	91028	Spanner O/E 3/8x5/16	1	EA	
0005	93876	Spanner Single Open End 18mm	1	EA	
0006	91029	Key, Hex Metric (Set)	1	EA	
0007	91030	Punch Pin Parallel set	1	EA	
0008	00615	Assy Spanner PKJ	1	EA	
0009	91293	Screwdriver Parallel tip (3 0 x 75)	1	EA	
0010	91105	Toolroll With SX Badge Large Black	1	EA	
0011	91104	Screwdriver Parallel tip (5 5 x 200)	1	EA	
0012	91103	Pliers Circlip 812 Chrome/Van	1	EA	
0013	91102	Pliers Mini Flat Nose 5 Inch	1	EA	
0014	10037	Bar Tommy	2	EA	
0015	10051	Kemlon tool Sondex - 4BA Hex Socket	1	EA	
0016	91280	Hammer, 4oz ball pein	1	EA	
0017	91130	Pin C Spanner 35-50mm	1	EA	
0018	91822	Medium Flat Blade Screwdriver, 5mm	1	EA	
0019	91255	T15 Torx driver, Sandvik Belzer 8915	2	EA	

PARTS LISTING

Part	*Issue*
3400006	02

Description

KIT - 1 11/16 HYPER CALIBRATION

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	9-4-03-30SHAR31	1 11/16 TEST HARNESS	1	EA	
0002	9-5-03-000215A2	ASSY SONIC CLAM SHELL 1 11/16	4	EA	
0003	9-5-03-000301A1	1 11/16 CAL ADAPTER	1	EA	
0004	414193	RBT003 1 11/16" Calibration Cable	1	EA	
0005	9-5-03-000200A1	ADAPTER HYPER SOFTWARE CAL	1	EA	

PARTS LISTING

Part	*Issue*
KITB-RBT003	04

Description

KIT - SPARES, BASIC, RBT003

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	KITO-RBT003	Kit, spares, o-rings, RBT003	1	EA	
0002	4-2-03-044014PS	SCREW PAN PHIL SS 4-40 X 1/4	2	EA	
0003	4-2-03-044051FS	SCREW FLAT PHIL SS 4-40 5/16	6	EA	
0004	4-2-03-25631600	SCREW PAN PHIL SS 2-56 X 3/16	6	EA	
0005	94075	Cage,Multilam,4mm,AUd (LAIIIS/4/0.15AU)	4	EA	
0006	2-2-09-15521081	1 11/16 HS RING TEFLON	2	EA	
0007	2-2-09-15531101	1 11/16 HS ROUND BUMPER	4	EA	
0008	3-1-01-WS150INX	RETAINING RING EXT SPIRAL INC 1.5	1	EA	
0009	4-2-03-01032FBT	SCREW SLOTTED SEALING 1/4 10-32	2	EA	
0010	4-2-03-142814SS	SCREW HEX SOCK CAP SS 1/4-28 X 1/4	4	EA	
0011	4-2-03-SHS31618	SCREW SLOT SHLDR SS 3/16 X 1/8"	4	EA	
0012	4-2-03-SPSS2032	SCREW SET HEX SCK CUP SS 10-32 3/16	1	EA	
0013	93900	SPRING CANTED COIL 12.5MM ID	1	EA	
0014	9-4-03-HBTMSXC	SASM CONNECT HYPER BOTTOM SX	1	EA	
0015	413953	ADAPTER 10-32 FILL PORT TO HOSETAIL	2	EA	

PARTS LISTING

Part	*Issue*
KITR-RBT003	04

Description

KIT - SPARES, 25 RUN, RBT003

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	KITB-RBT003	KIT - SPARES, BASIC, RBT003	1	EA	
0002	KITO-RBT003	Kit, spares, o-rings, RBT003	4	EA	
0003	2-2-09-15521031	1 11/16 HS TRANSMITTER CAN	1	EA	
0004	2-2-09-15531031	1 11/16 HS RX CAN	2	EA	
0005	4-1-29-1550534A	HOSE RX2 TO END 1 11/16	1	EA	
0006	4-1-29-1550798A	HOSE TX TO RX1 TO END 1 11/16	1	EA	
0007	4-1-29-1551347A	HOSE RX1 TO RX2 TO END 1 11/16	1	EA	
0008	2-2-09-15521081	1 11/16 HS RING TEFLON	4	EA	
0009	2-2-09-15531101	1 11/16 HS ROUND BUMPER	8	EA	
0010	3-1-01-WH56S021	RETAINING RING INT SPIRAL 2T SS9/16	1	EA	
0011	4-2-03-06320250	SCREW HEX SOCK CAP SS 6-32 X1/4"	3	EA	
0012	4-2-03-142814SS	SCREW HEX SOCK CAP SS 1/4-28 X 1/4	8	EA	
0013	4-2-03-1032025S	SCREW HEX SOCK CAP SS 10-32 X0.25	3	EA	
0014	4-2-03-044051FS	SCREW FLAT PHIL SS 4-40 5/16	6	EA	
0015	4-2-09-TFE81121	BACKUP RING SPLIT TEFLON 112	2	EA	
0016	4-2-09-TFE82141	BACKUP RING SPLIT TEFLON 214	2	EA	
0017	4-2-09-V01290SL	O-RING VITON 90 012	9	EA	
0019	4-2-09-V117OHTS	O-RING VITON 75 117	10	EA	
0020	4-2-09-V119OHTS	O-RING VITON 75 119	5	EA	
0021	4-2-09-V214OHTS	O-RING VITON 75 214	1	EA	
0022	4-2-09-V2189000	O-RING VITON 90 218	2	EA	
0023	4-2-09-V7502300	O-RING VITON 75 023	2	EA	
0024	4-2-06-332X316SP	3/32" DIA X 3/16" LENGTH SPRING PIN	4	EA	
0025	4-2-09-V7512100	O-RING VITON 75 121	7	EA	
0026	4-2-09-V7512400	O-RING VITON 75 124	2	EA	
0027	4-2-09-V9001400	O-RING VITON 90 014	2	EA	
0028	4-2-09-V9001500	O-RING VITON 90 010	7	EA	
0030	4-2-09-V9011300	O-RING VITON 90 113	1	EA	
0031	4-2-09-V9021500	O-RING VITON 90 215	4	EA	
0032	4-2-06-116X14SP	1/16" DIA X 1/4" LENGTH SPRING PIN	8	EA	
0033	4-2-03-440X18SS	SET SCREW 4-40 X 1/8", SS	4	EA	
0034	99016	O-ring 016 Viton 90	2	EA	

PARTS LISTING

Part	*Issue*
KITO-RBT003	B

Description

Kit, spares, o-rings, RBT003

PARTS LIST

Item	*Part No*	*Description*	*Qty*	*Units*	*Remarks*
0001	4-2-09-V21190SL	O-RING VITON 90 211	10	EA	
0002	4-2-09-GT218SEA	SEAL GT 218 V90	4	EA	
0003	4-2-09-GT218BAC	BACKUP GT 218	8	EA	
0004	99211	O-RING 211 VITON 90	2	EA	
0005	99012	O-ring 012 Viton 90	1	EA	
0006	4-2-09-V7512300	O-RING VITON 75 123	1	EA	
0007	414006	O-RING VITON 90 4MM X 1.5MM	2	EA	
0008	4-2-09-GT113BAC	BACKUP GT 113M2	4	EA	
0009	4-2-09-GT113SEA	SEAL GT 113 V90	2	EA	

APPENDIX B DRAWINGS & PARTS LISTS

B.1 Mechanical Drawings

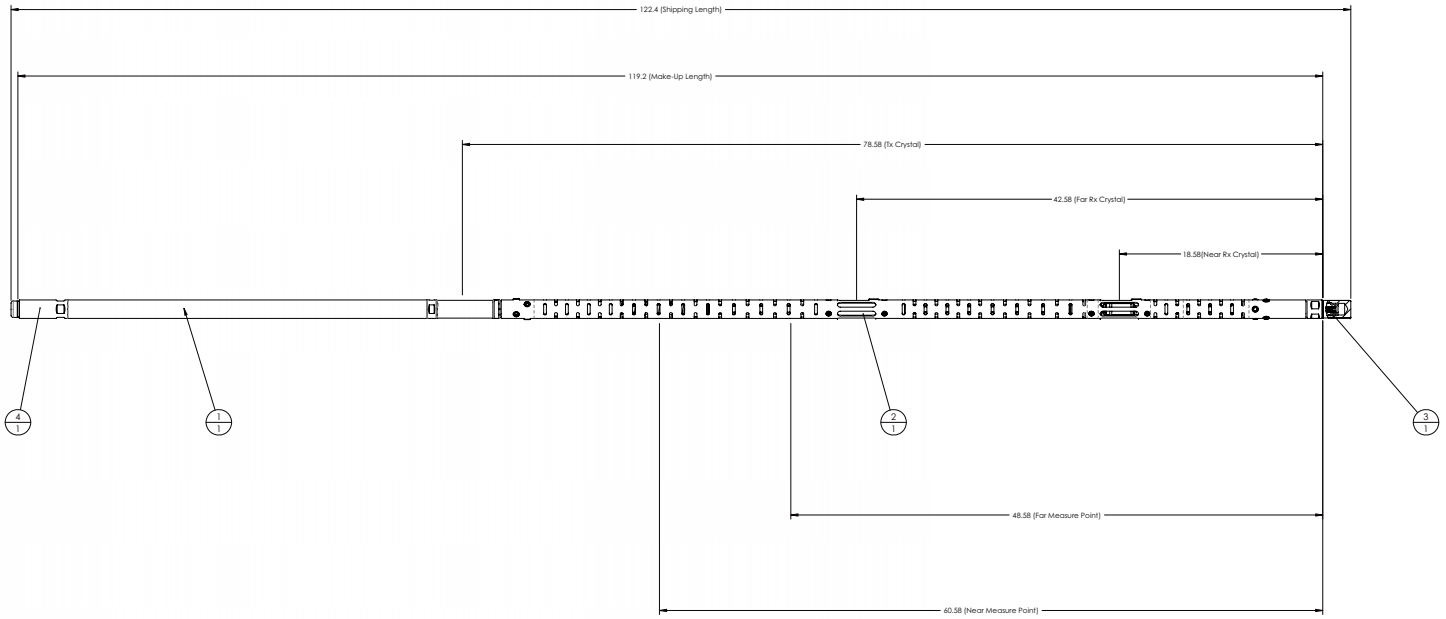
Description	Drawing	Parts List
RBT003 General Assembly	AD-3403501-03	See drawing
Top Sub Assembly	AD-9-4-03-0000002-02	See drawing
Feed Thru Pressure Relieving Assembly	AD-413380-A	See drawing
RBT Electronic Assembly (2 sheets)	AD-9-4-03-34E3501-03	See drawing
Relative Bearing Device	AD-11517-H	See drawing
RBT Sonde Assembly (5 sheets)	AD-9-4-03-30S3501-08	See drawing
RBT Hose Tx to Rx1 Assembly	AD-4-1-29-1550798A-01	See drawing
RBT Hose Rx1 to Rx2 Assembly	AD-4-1-29-1551347A-01	See drawing
RBT Hose Rx2 to End Assembly	AD-4-1-29-1550534A-01	See drawing
Hyper Bottom SX Connector Assembly	AD-9-4-03-HBTMSXC1-01	See drawing

B.2 Electrical Drawings

Description	Type	Drawing
RBT003 Functional Block Diagram	Block Diagram	BD-3403501-00
RBT003 Electronic Assembly	Wiring Diagram	WD-9-4-03-34E3501-B
Power Supply Board	Circuit Diagram	CD-9-4-01-340010A1-06
Main Digital Board	Circuit Diagram	CD-9-4-01-340020A1-01
Main Analogue Board	Circuit Diagram	CD-9-4-01-340030A1-03
Transmitter Control Board	Circuit Diagram	CD-9-4-01-340040A1-02
Transmitter Power Board	Circuit Diagram	CD-9-4-01-340050A1-02
Digital Board MIT2 (PCB413884) (2 sheets)	Circuit Diagram	CD-82333-Kx
Sonde Main Harness	Wiring Diagram	WD-9-4-03-30SHAR11-05
Sonde Bottom Harness	Wiring Diagram	WD-9-4-03-40SHAR21-01

DO NOT SCALE

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	9-4-03-34E3501	SASM ELECT ASSY URB - 1 11/16"
2	1	9-4-03-30S3501	SASM SONDE 1 11/16" SLOTTED
3	1	9-4-03-HBTMSXC1	SASM Connect Hyper Bottom SX
4	1	9-4-03-0000002	SASM 1 11/16 TOP SUB SX



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
07	19/12/2012	JMS	ECR 5-02150
02	15/12/11	TG	ECR 5-88323
01			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.

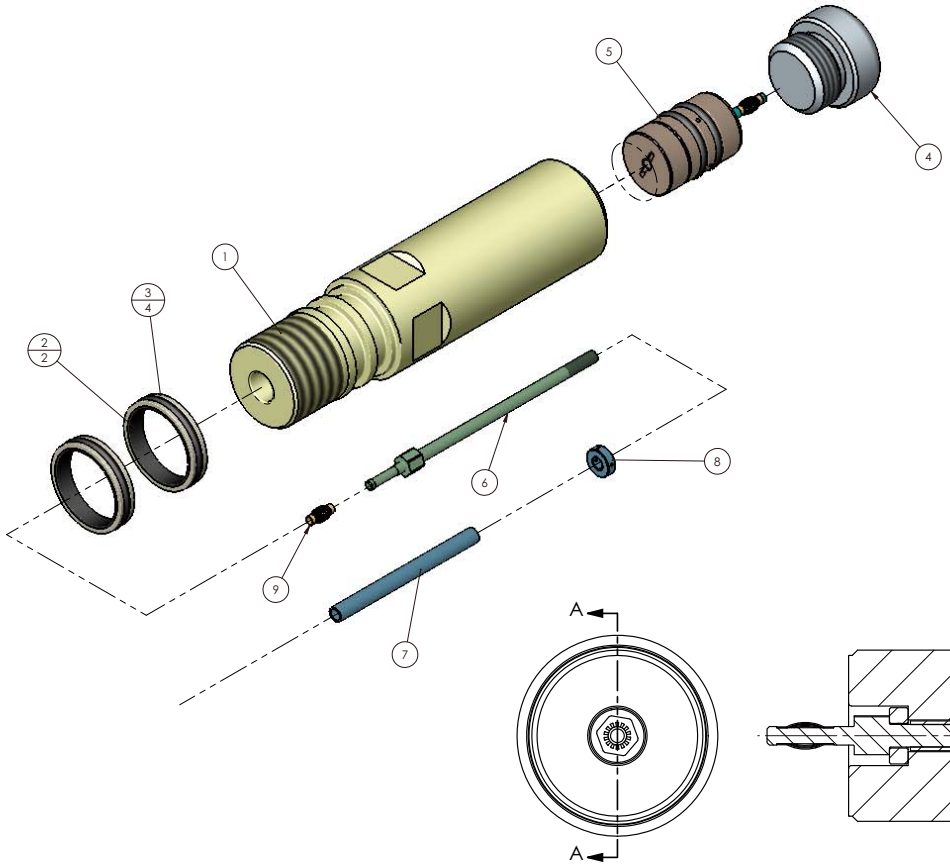
THIRD ANGLE PROJECTION
ALL DIMENSIONS IN INCHES
USED ON: RBT
MASS: kg

MODELLED	DRAWN	CHECKED	APPROVED
CB	CB	DP	
22/10/04	22/10/04	08/11/04	

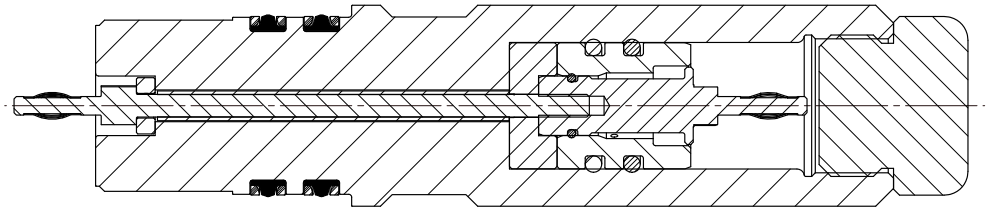
MATERIAL: SEE PART DRAWINGS
HEAT TREATMENT

TITLE: ASSY RBT UW 1 11/16"
SCALE: 1:5
DRAWING No.: AD-3403501
REVISION: 03
SHEET: 1 OF 1
A1

DO NOT SCALE



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2-2-05-16010021	1 11/16 CNL Top Sub	1
2	4-2-09-GT218SEA	SEAL GT 218 V90	2
3	4-2-09-GT218BAC	BACK UP GT 218	4
4	3-3-00-1316MVMS	PLUG, PROTECTIVE MALE	1
5	413380	ASSY FEED THRU PRESSURE RELIEVING	1
6	413364	SHAFT PRESSURE	1
7	413381	SLEEVE	1
8	413363	WASHER PRESSURE	1
9	94075	Cage, Multilam, 4mm, Gold Plated (LAIIIS/4/0.15AU)	1



SECTION A-A
SCALE 1:1

DRAWN: DP	CHECKED: CB	APP'D: -
DATE: 01/10/05	DATE: 01/10/05	DATE: -
DIM IN: INCHES	MATERIAL: SEE PARTS LIST	
SCALE: 1:1	SIZE: B	HEAT TREATMENT/CONDITION:

ISS	DESCRIPTION	APPD	DATE
-02	REF ECR 5-84141	JP	28/06/11
-01	Inital Release		

Apegga Permit No. P08402

Sondex CSS

Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

USED ON

MACHINE FINISH 63

GEN TOL
0.X 0.020"
0.XX 0.010"
0.XXX 0.005"
ANGLE ±0.5°

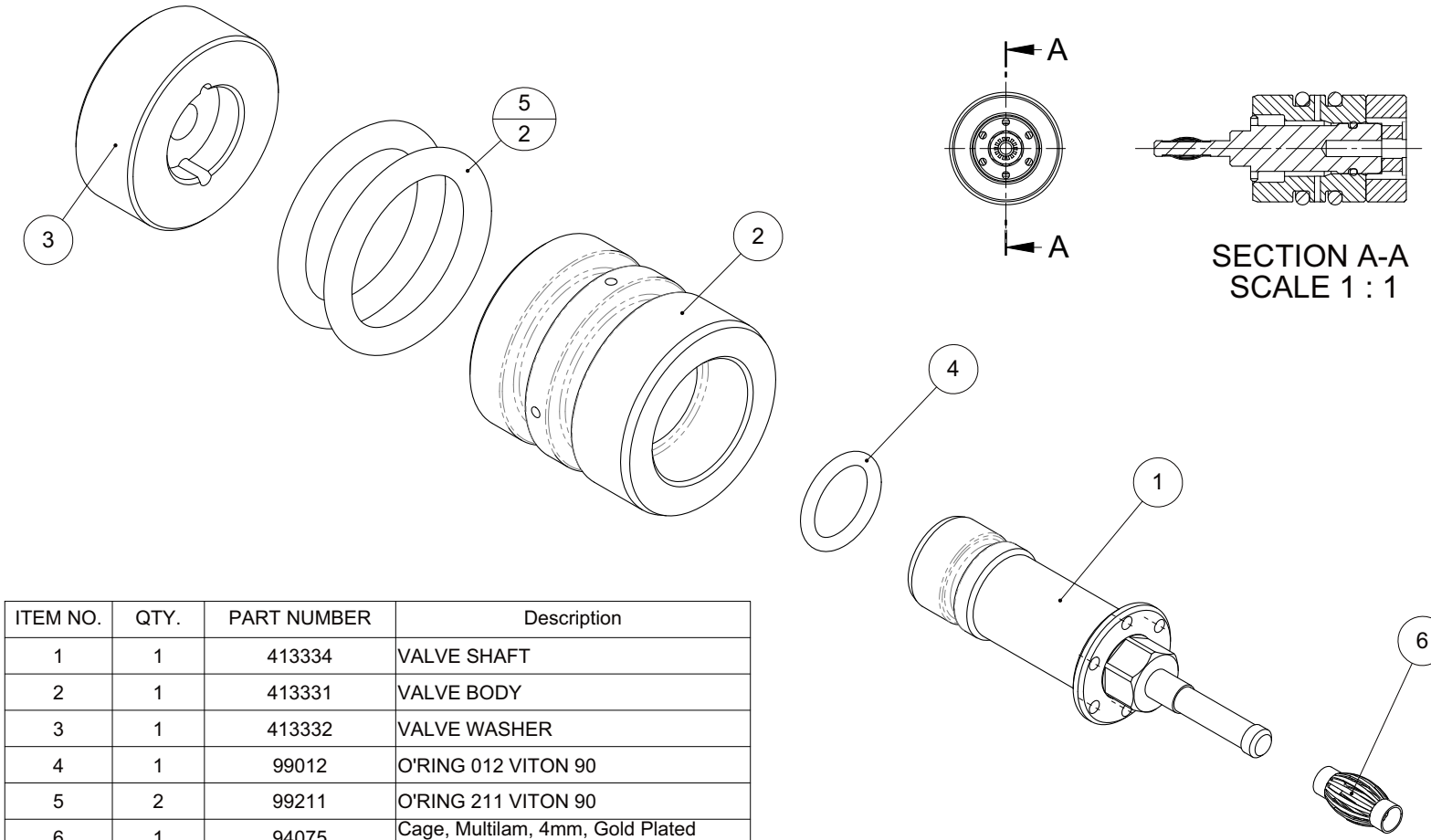
TITLE: SASM 1 11/16 TOP SUB SX

SHEET	DRAWING No.	ISSUE
1/1	9-4-03-0000002	-02

09 September 2011 14:47:21 105043152

M:\9-4-03 ASSY\9-4-03-000\9-4-03-0000002\OLD REVS\9-4-03-0000002

DO NOT SCALE



ITEM NO.	QTY.	PART NUMBER	Description
1	1	413334	VALVE SHAFT
2	1	413331	VALVE BODY
3	1	413332	VALVE WASHER
4	1	99012	O'RING 012 VITON 90
5	2	99211	O'RING 211 VITON 90
6	1	94075	Cage, Multilam, 4mm, Gold Plated (LAIIIS/4/0.15AU)

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: COMMON

MASS: 0.15 kg

	MODELLED	DRAWN	CHECKED	APPR'D
	JP	JP	DVH	JP
	24/06/11	27/06/11	27/06/11	27/06/11

MATERIAL: SEE PARTS LIST

HEAT TREATMENT: N/A

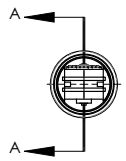
TITLE: ASSY FEED THRU PRESSURE RELIEVING

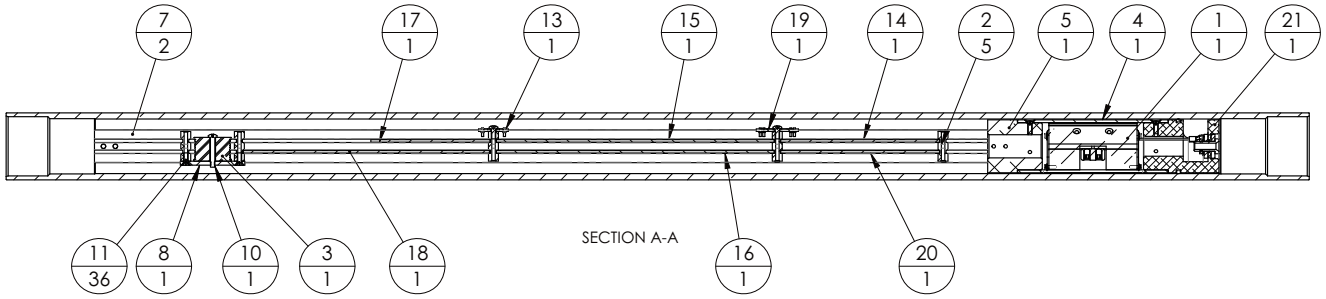
ISS	DESCRIPTION	APPR'D	DATE
A	INITIAL RELEASE	JP	27/06/11

SCALE: 2:1 | DRAWING No.: AD-413380 | ISSUE: A | SHEET: 1 OF 1 | A3

DO NOT SCALE

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	11517	Assy Relative$Bearing Device
2	5	2-2-01-15021352	Slimline Rail Block
3	1	7-5-10-81557510	Slim Transformer Bobin
4	1	2-2-09-15520041	HOUSING ROTATION DETECTOR
5	1	2-2-09-15520051	COUPLING BLOCK
6	1	2-2-09-15520111	Electronics Housing
7	2	2-2-09-15521171	HS Rail Caps
8	1	2-2-09-15561081	TRANSFOMER MOUNT
9	2	4-2-03-044014PS	Screw,Pan Head SS #4-40 X 1/4"
10	1	4-2-03-044034SS	Screw,Pan Head SS #4-40 X 3/4"
11	36	4-2-03-044051FS	Screw Flat Head SS 4-40x5/16"
12	4	4-2-03-FPSSM3X6	Screw,Flat Phil SS M3 X 6MM
13	1	9-4-01-150380A1	EBRD SLIM 8-PIN JUMPER SHORT
14	1	9-4-01-340010A1	EBRD URB 1 11/16 POWER SUPPLY
15	1	9-4-01-340020A1	EBRD URB UW 1 11/16 MAIN DIGITAL
16	1	9-4-01-340030A1	EBRD URB 1 11/16 MAIN ANALOG
17	1	9-4-01-340040A1	EBRD URB1 11/16 TRANSMITTER CONTROLLER
18	1	9-4-01-340050A1	EBRD URB UW 1 11/16 TRANSMITTER POWER
19	1	9-4-01-340070A1	EBRD URB 1 11/16 INTERPCB 10PIN CON
20	1	413884	Assy RBT003 82333 Programmed
21	1	9-4-03-340TOPA1	SASM BLOCK ELECTRONICS TOP





SECTION A-A

NOTE:

NOT ALL ELEMENTS ARE SHOWN

DRAWN: CB	CHECKED: DP	APP'D: -
DATE: 20/10/09	DATE: 08/11/04	DATE: -
DIM IN: INCHES	MATERIAL: N/A	
SCALE: 1:3	SIZE: B	HEAT TREATMENT/CONDITION: -

ISS	DESCRIPTION	APPD	DATE
03	ECR 5-91586 REFERS	TG	27/02/12
02	REF. ECR 5-88321	NPB	28/11/11
01	INITIAL RELEASE	-	-

Apegga Permit No. P08402

Sondex CSS

Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

USED ON

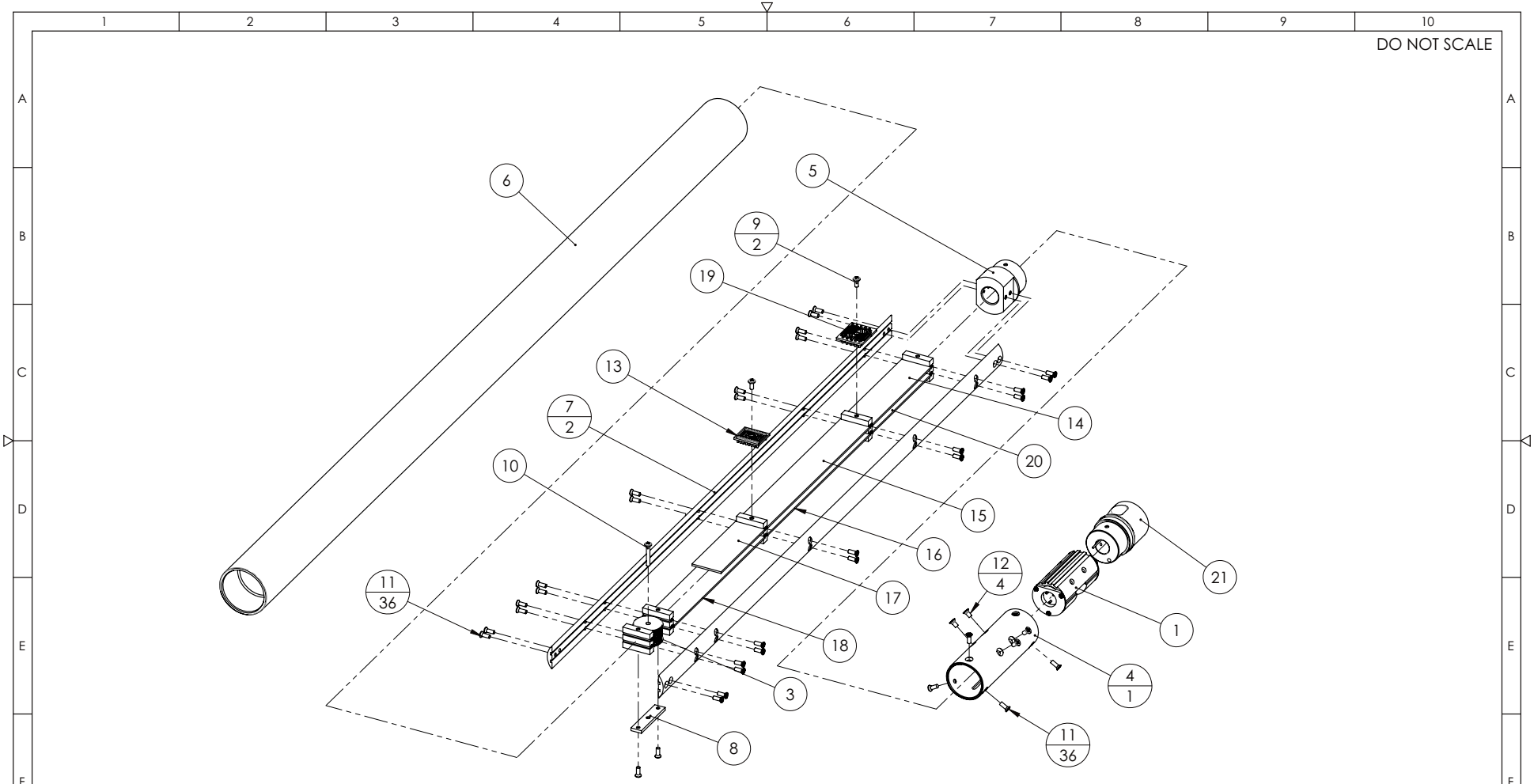
MACHINE FINISH 63

GEN TOL
0.X 0.020"
0.XX 0.010"
0.XXX 0.005"
ANGLE ±0.5°

TITLE: SASM ELECT ASSY URB - 1 11/16"

SHEET 1/2 | DRAWING No. 9-4-03-34E3501 | ISSUE 03 | S W

28 February 2012 15:12:12 501978873 M:_ENTERPRISE RE-ORGANISATION\RBT003\9-4-03-34E3501



DRAWN: CB	CHECKED: DP	APP'D: -	ISS	DESCRIPTION	APPD	DATE	**Sondex CSS**
DATE: 20/10/09	DATE: 08/11/04	DATE: -	03	ECR 5-91586 REFERS	TG	27/02/12	Tel. 1 403 235 6533
DIM IN: INCHES	MATERIAL: N/A		02	REF. ECR 5-88321	NPB	28/11/11	THIS DRAWING IS THE PROPERTY OF Sondex AND SHALL NOT BE COPIED OR USED WITHOUT PRIOR PERMISSION
SCALE: 1:3	SIZE: B	HEAT TREATMENT/CONDITION: -	01	INITIAL RELEASE	-	-	THIRD ANGLE PROJECTION
				Apegga Permit No. P08402			

USED ON

MACHINE FINISH: 63

GEN TOL: 0.X 0.020" / 0.XX 0.010" / 0.XXX 0.005" / ANGLE ±0.5°

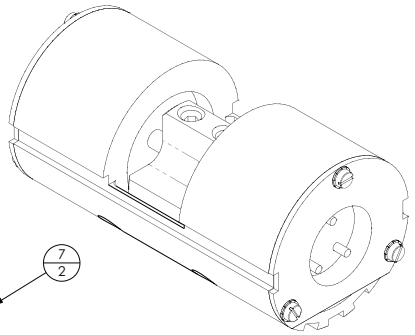
TITLE: SASM ELECT ASSY URB - 1 11/16"

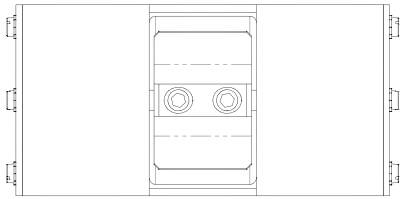
SHEET: 2/2 | DRAWING No.: 9-4-03-34E3501 | ISSUE: 03 | S W

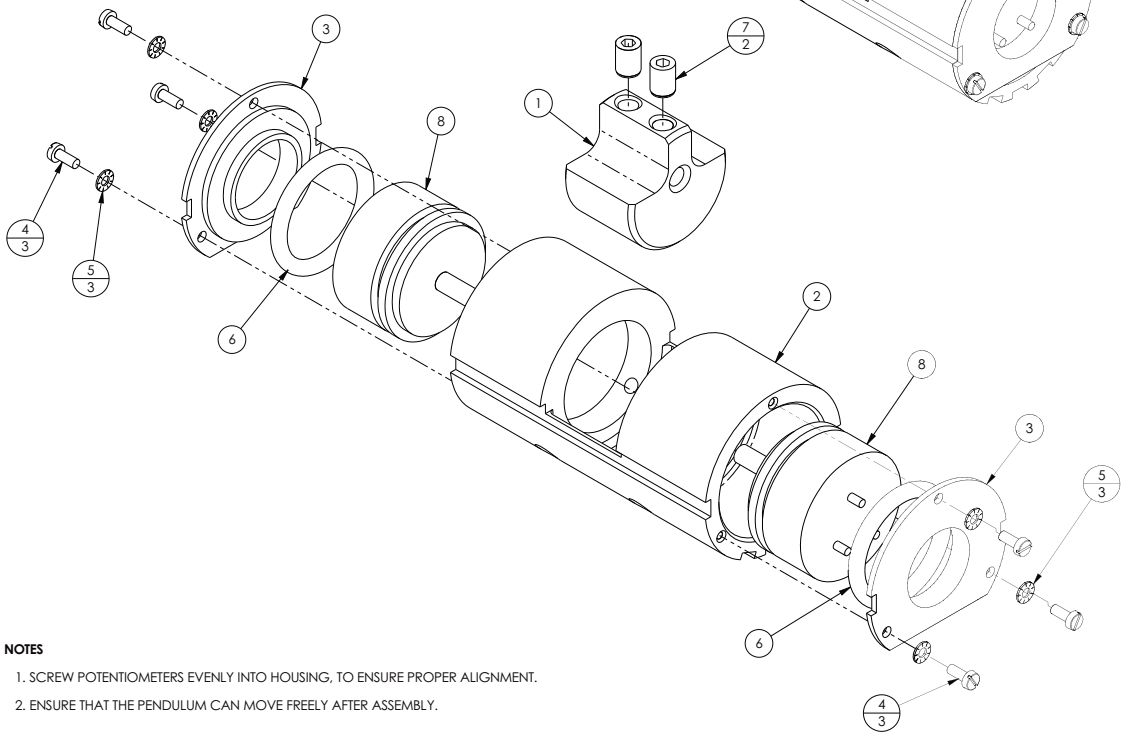
28 February 2012 15:12:12 501978873 M:_ENTERPRISE RE-ORGANISATION\RBT003\9-4-03-34E3501

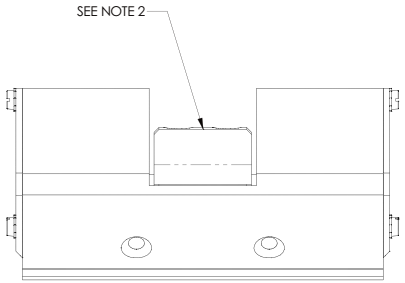
DO NOT SCALE

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	08715	Pendulum
2	1	08717	Housing Potentiometer
3	2	08718	Clamp Potentiometer
4	6	93829	SCREW CHEESE HEAD SLOTTED M1.6 X 04mm LG SS
5	6	91217	WASHER LOCK SERRATED EXTERNAL M1.6 SS (DIN6798A)
6	2	95114	O Ring Viton 75 Type 114
7	2	93363	BALL END THRUST SCREW
8	2	R019-0020K	POTENTIOMETER 20K









NOTES

1. SCREW POTENTIOMETERS EVENLY INTO HOUSING, TO ENSURE PROPER ALIGNMENT.
2. ENSURE THAT THE PENDULUM CAN MOVE FREELY AFTER ASSEMBLY.

DRAWN: JC	CHECKED: NGH	APP'D: NGH	
DATE: 07/10/05	DATE: 29/10/04	DATE: 29/10/04	
DIM IN: INCHES	MATL: SEE DETAIL DRAWINGS		
SCALE: 2:1	A2	HEAT TREATMENT/CONDITION: N/A	

SONDEX F/M No: F0022

ISS	DESCRIPTION	APP'D	DATE
H	ECR 5-87278 REFERS	NPB	18/06/12
G	ECR 4593 REFERS-ITEM 9 ADDED	TG	02/05/12
F	ECR 5106 APPLIED	NPB	01/07/08
E	REF ECR 3963	NPB	01/07/08
D	REF ECR 3048	NPB	07/10/05
C	BRING INTO LINE WITH EFACS	PML	29/10/04

Sondex
Tel. 0118 932 6755

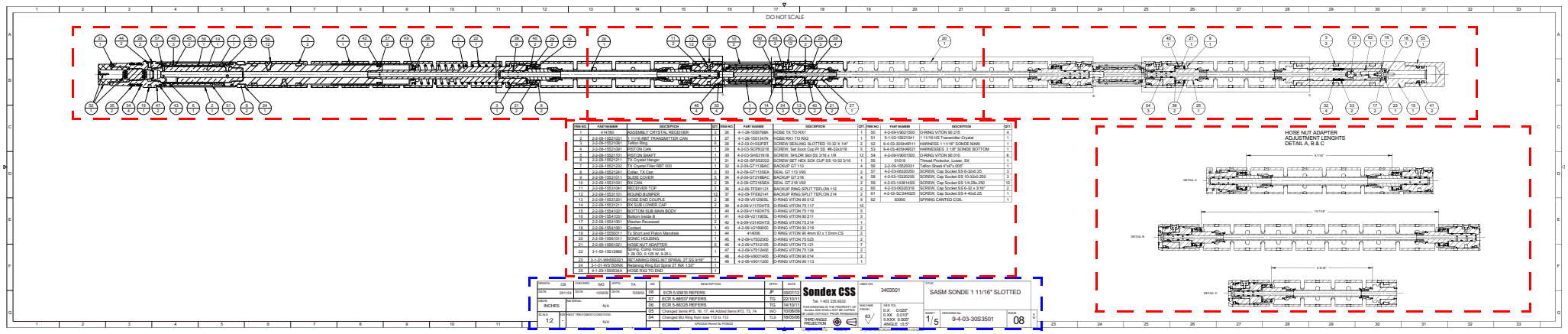
THIRD ANGLE PROJECTION

MACHINE FINISH 64 | USED ON COM

GEN TOL
0.X 0.020"
0.XX 0.010"
0.XXX 0.005"
ANGLE ±0.5°

TITLE: ASSY RELATIVE BEARING DEVICE

SHEET 1/1 | DRAWING No. AD 11517 | ISSUE H | S/W



Click on the red box to see the area highlighted enlarged.

Exploded views can be seen on:

- ***Sheet 2*** for Tx and Piston.
- ***Sheet 3*** for Receivers.
- ***Sheet 4*** for Rx2 to End Hose & Bottom Sub.
- ***Sheet 5*** for Tx to Rx1 Hose & Rx1 to Rx2 Hose.

DRAWN:	CHECKED:	APP'D:
CB	WO	TA
DATE: 08/11/04	DATE: 10/08/09	DATE: 10/08/09

DIM IN	MATERIAL:
INCHES	N/A

SCALE	SIZE	HEAT TREATMENT/CONDITION:
1:2	-	N/A

ISS	DESCRIPTION	APPD	DATE
08	ECR 5-93816 REFERS	JP	09/07/12
07	ECR 5-88537 REFERS	TG	22/10/11
06	ECR 5-86325 REFERS	TG	14/10/11
05	Changed items #15, 16, 17, 44 Added items #72, 73, 74	WO	10/08/09
04	Changed BU Ring from sixe 113 to 112	TLS	18/05/06
	APEGGA Permit No PO8402		

Sondex CSS
Tel. 1 403 235 6533
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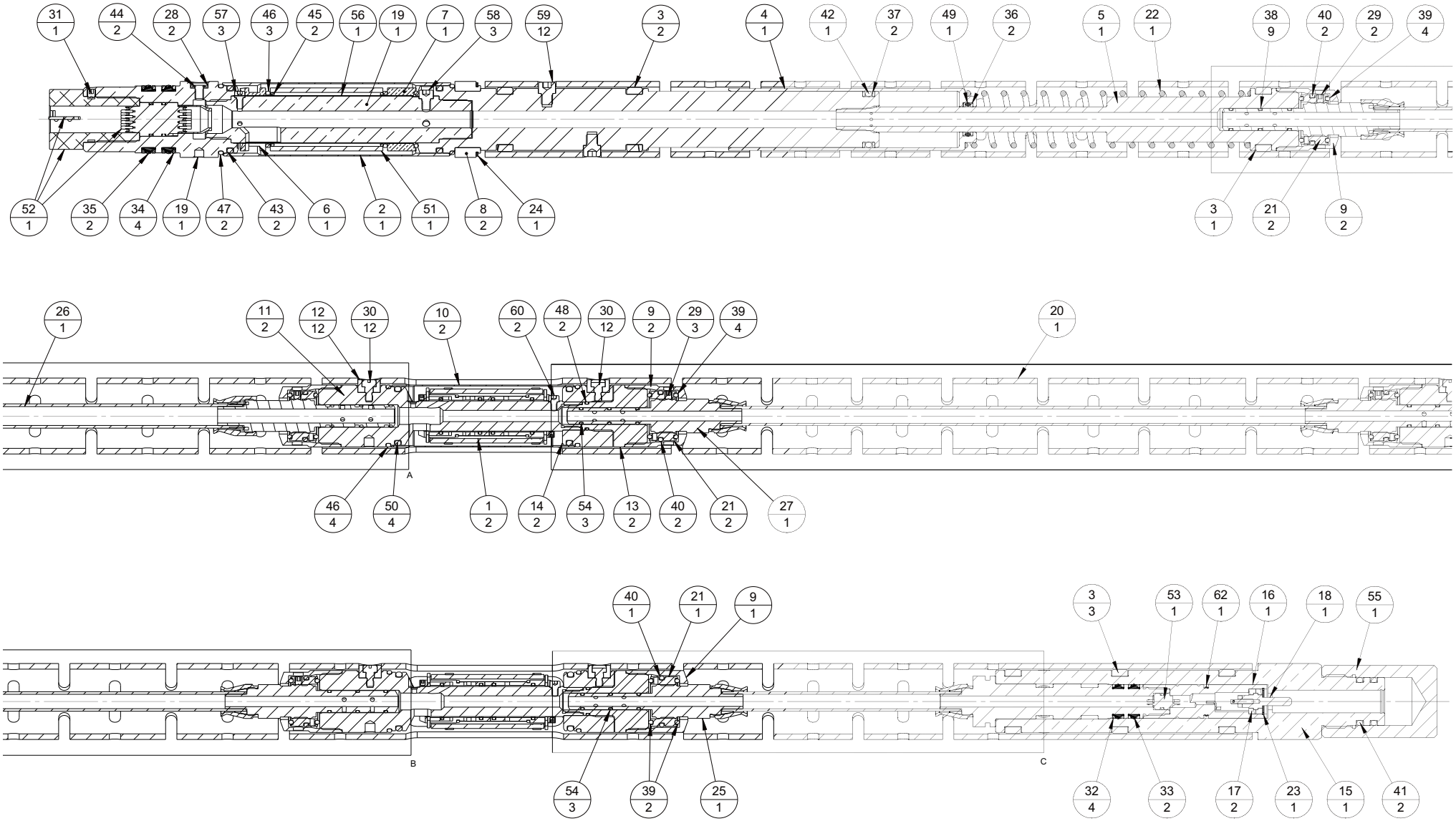
THIRD ANGLE PROJECTION
15 August 2012 16:07:16 105043140

USED ON	TITLE
3403501	SASM SONDE 1 11/16" SLOTTED

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

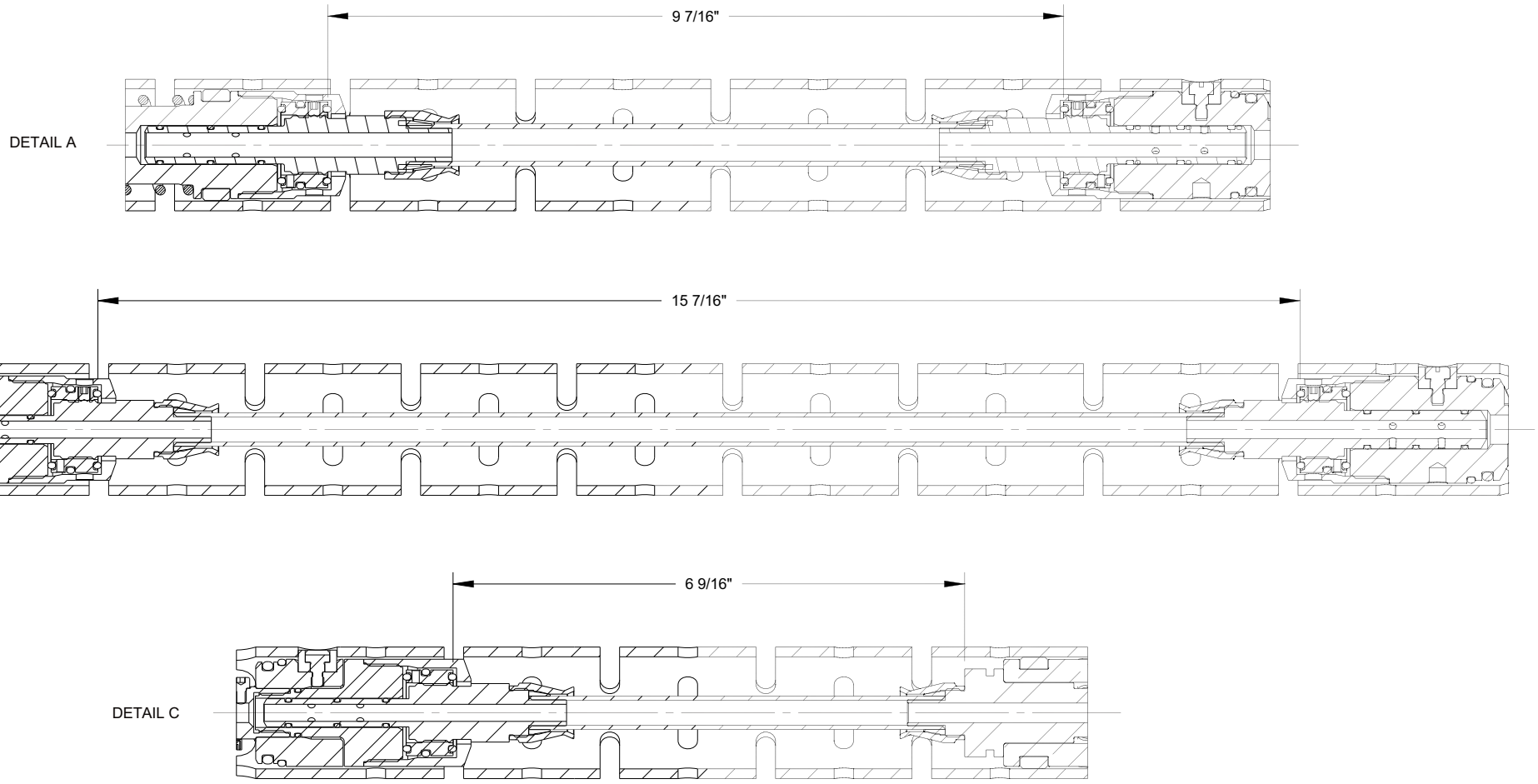
SHEET	DRAWING No.	ISSUE	
1/5	9-4-03-30S3501	08	S W

M:_ENTERPRISE RE-ORGANISATION\RBT003\9-4-03-30S3501

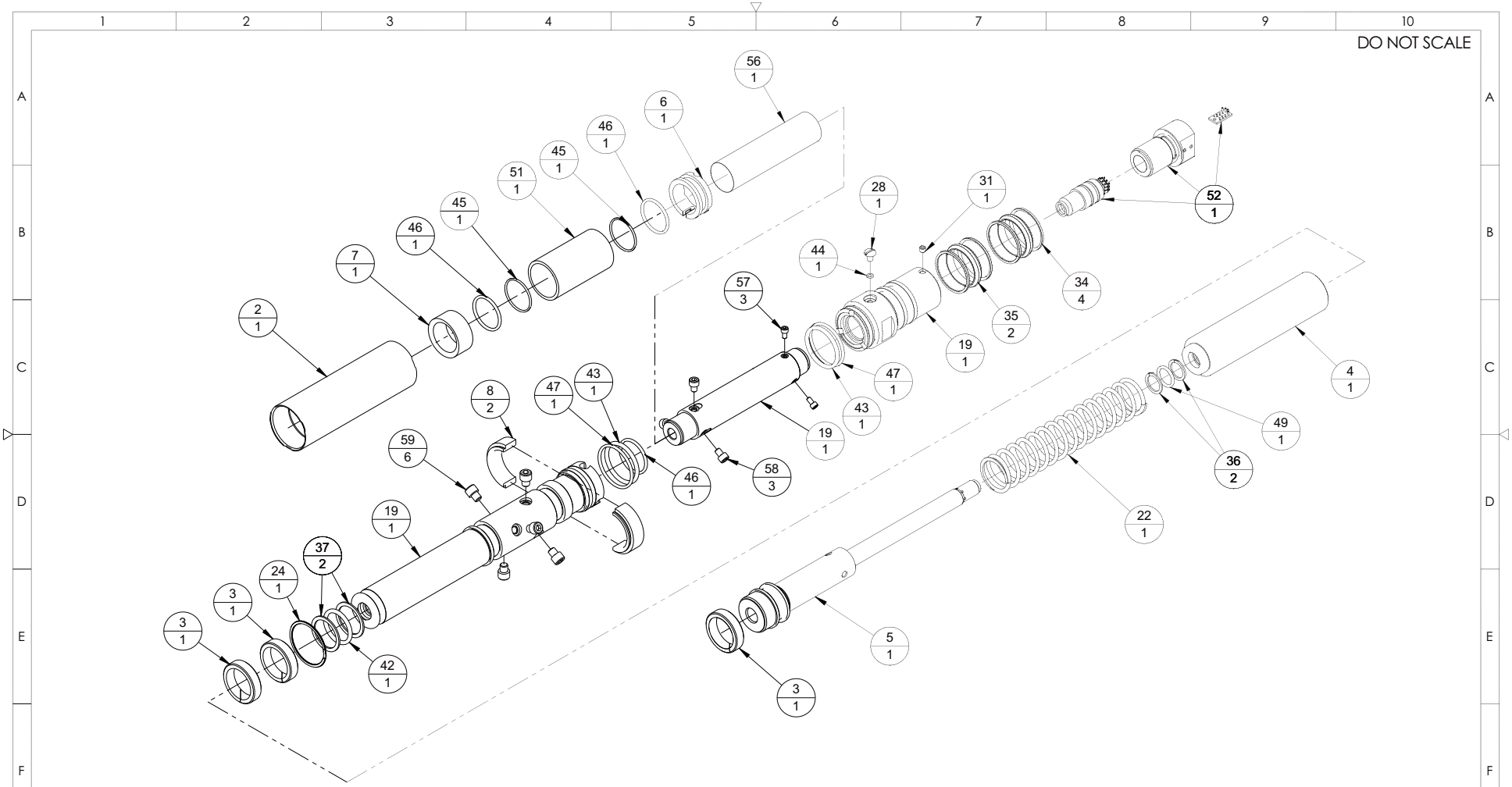


Radial Bond Tool *RBT003*

HOSE NUT ADAPTER
ADJUSTMENT LENGHTS
DETAIL A, B & C



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	414780	ASSEMBLY CRYSTAL RECEIVER	2
2	2-2-09-15521031	1 11/16 RBT TRANSMITTER CAN	1
3	2-2-09-15521081	Teflon Ring	6
4	2-2-09-15521091	PISTON CAN	1
5	2-2-09-15521101	PISTON SHAFT	1
6	2-2-09-15521211	TX Crystal Hanger	1
7	2-2-09-15521232	TX Crystal Filler RBT 003	1
8	2-2-09-15521241	Collar, TX Can	2
9	2-2-09-15531011	SLIDE COVER	5
10	2-2-09-15531031	RX CAN	2
11	2-2-09-15531041	RECEIVER TOP	2
12	2-2-09-15531101	ROUND BUMPER	12
13	2-2-09-15531201	HOSE END COUPLE	2
14	2-2-09-15531211	RX SUB LOWER CAP	2
15	2-2-09-15541021	BOTTOM SUB MAIN BODY	1
16	2-2-09-15541031	Bottom Inside B	1
17	2-2-09-15541051	Washer Recessed	2
18	2-2-09-15541061	Contact	1
19	2-2-09-15550011	Tx Short and Piston Mandrels	1
20	2-2-09-15561011	SONIC HOUSING	1
21	2-2-09-15561021	HOSE NUT ADAPTER	5
22	3-1-00-15512885	Spring, Comp Inconel, 1.28 OD, 0.125 W, 9.25 L	1
23	3-1-01-WH56S021	RETAINING RING INT SPIRAL 2T SS 9/16"	1
24	3-1-01-WS150INX	Retaining Ring Ext Spiral 2T INX 1.50"	1
25	4-1-29-1550534A	HOSE RX2 TO END	1
26	4-1-29-1550798A	HOSE TX TO RX1	1
27	4-1-29-1551347A	HOSE RX1 TO RX2	1
28	4-2-03-01032FBT	SCREW SEALING SLOTTED 10-32 X 1/4"	2
29	4-2-03-SCP83218	SCREW, Set Sock Cup Pt SS #8-32x3/16	5
30	4-2-03-SHS31618	SCREW, SHLDR Slot SS 3/16 x 1/8	12
31	4-2-03-SPSS2032	SCREW SET HEX SCK CUP SS 10-32 3/16	1
32	4-2-09-GT113BAC	BACKUP GT 113	4
33	4-2-09-GT113SEA	SEAL GT 113 V90	2
34	4-2-09-GT218BAC	BACKUP GT 218	4
35	4-2-09-GT218SEA	SEAL GT 218 V90	2
36	4-2-09-TFE81121	BACKUP RING SPLIT TEFLON 112	2
37	4-2-09-TFE82141	BACKUP RING SPLIT TEFLON 214	2
38	4-2-09-V01290SL	O-RING VITON 90 012	9
39	4-2-09-V117OHTS	O-RING VITON 75 117	10
40	4-2-09-V119OHTS	O-RING VITON 75 119	5
41	4-2-09-V21190SL	O-RING VITON 90 211	2
42	4-2-09-V214OHTS	O-RING VITON 75 214	1
43	4-2-09-V2189000	O-RING VITON 90 218	2
44	414006	O RING VITON 90 4mm ID x 1.5mm CS	2
45	4-2-09-V7502300	O-RING VITON 75 023	2
46	4-2-09-V7512100	O-RING VITON 75 121	7
47	4-2-09-V7512400	O-RING VITON 75 124	2
48	4-2-09-V9001400	O-RING VITON 90 014	2
49	4-2-09-V9011300	O-RING VITON 90 113	1
50	4-2-09-V9021500	O-RING VITON 90 215	4
51	5-1-02-15521041	1 11/16 HS Transmitter Crystal	1
52	9-4-03-30SHAR11	HARNESS 1 11/16" SONDE MAIN	1
53	9-4-03-40SHAR21	HARNESSES 3 1/8" SONDE BOTTOM	1
54	4-2-09-V9001500	O-RING VITON 90 010	6
55	01019	Thread Protector, Lower, SX	1
56	2-2-09-15520031	Teflon Sheet 4"x6"x.005"	1
57	4-2-03-06320250	SCREW, Cap Socket SS 6-32x0.25	3
58	4-2-03-1032025S	SCREW, Cap Socket SS 10-32x0.250	3
59	4-2-03-142814SS	SCREW, Cap Socket SS 1/4-28x.250	12
60	4-2-03-06320316	SCREW, Cap Socket SS 6-32 x 3/16"	2
61	4-2-03-SCS44025	SCREW, Cap Socket SS 4-40x0.25	1
62	93900	SPRING CANTED COIL	1



DRAWN: CB	CHECKED: WO	APP'D: TA
DATE: 08/11/04	DATE: 10/08/09	DATE: 10/08/09
DIM IN: INCHES	MATERIAL: N/A	
SCALE: 1:3	SIZE: B	HEAT TREATMENT/CONDITION: N/A

ISS	DESCRIPTION	APPD	DATE
08	ECR 5-93816 REFERS	JP	09/07/12
07	ECR 5-88537 REFERS	TG	22/10/11
06	ECR 5-86325 REFERS	TG	14/10/11
05	Changed items #15, 16, 17, 44 Added items #72, 73, 74	WO	10/08/09
04	Changed BU Ring from sixe 113 to 112	TLS	18/05/06
	APEGGA PermitNo P08402		

△ 15 August 2012 16:07:16

Sondex Canada Inc.
Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

USED ON: 3403501

MACHINE FINISH: 63

GEN TOL
0.X 0.020"
0.XX 0.010"
0.XXX 0.005"
ANGLE ±0.5°

TITLE: SASM SONDE 1 11/16" SLOTTED

SHEET: 2/5

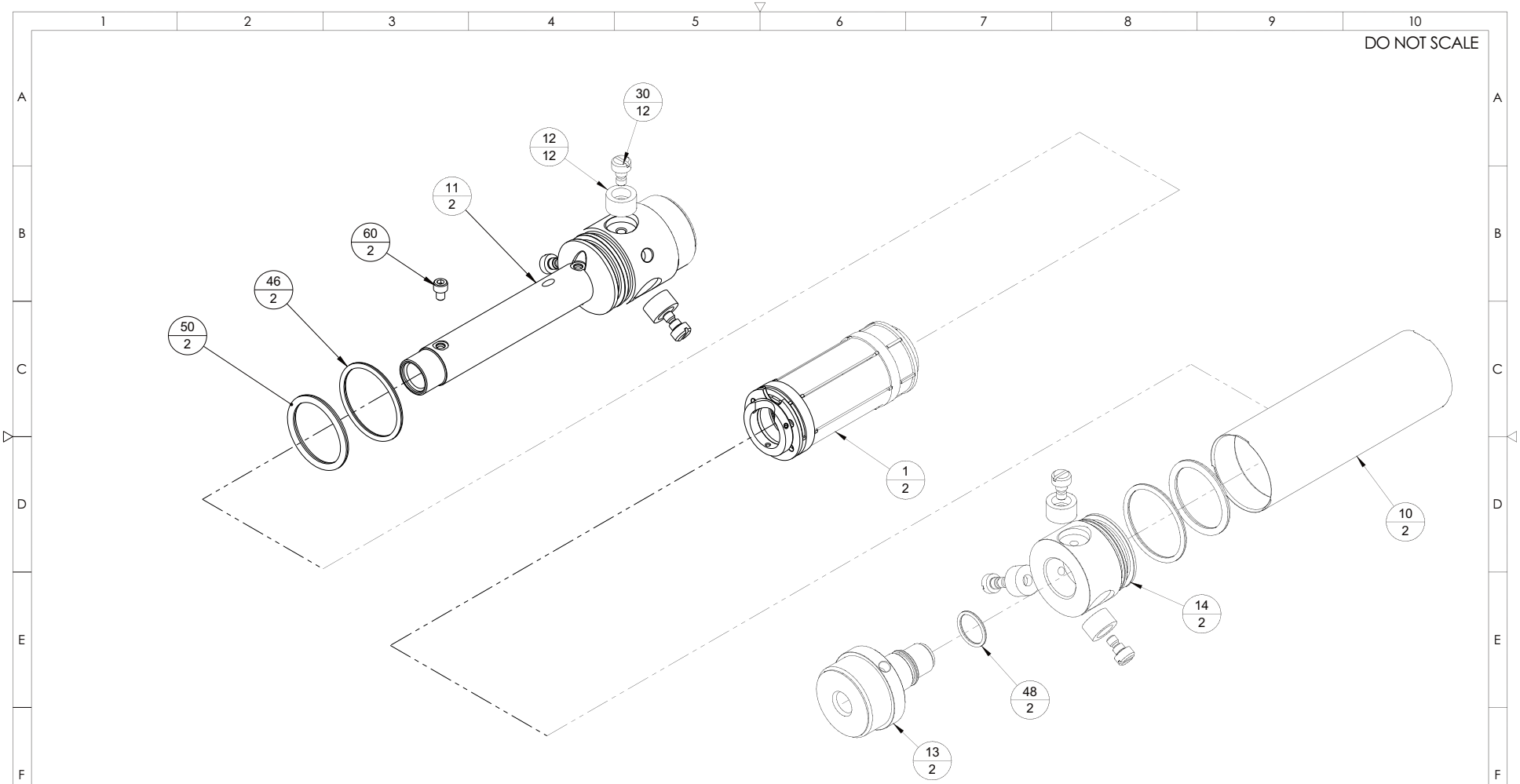
DRAWING No.: 9-4-03-30S3501

ISSUE: 08

S W

10504314O

M:_ENTERPRISE RE-ORGANISATION\RBT003\9-4-03-3053501



DRAWN: CB	CHECKED: WO	APP'D: TA
DATE: 08/11/04	DATE: 10/08/09	DATE: 10/08/09
DIM IN: INCHES	MATERIAL: N/A	
SCALE: 1:2	SIZE: B	HEAT TREATMENT/CONDITION: N/A

ISS	DESCRIPTION	APPD	DATE
08	ECR 5-93816 REFERS	JP	09/07/12
07	ECR 5-88537 REFERS	TG	22/10/11
06	ECR 5-86325 REFERS	TG	14/10/11
05	Changed items #15, 16, 17, 44 Added items #72, 73, 74	WO	10/08/09
04	Changed BU Ring from sixe 113 to 112	TLS	18/05/06
	APEGGA PermitNo P08402		

105043140

Sondex Canada Inc.
Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

15 August 2012 16:07:16

USED ON: 3403501

MACHINE FINISH: 63

GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

M:_ENTERPRISE RE-ORGANISATION\RBT003\9-4-03-30S3501

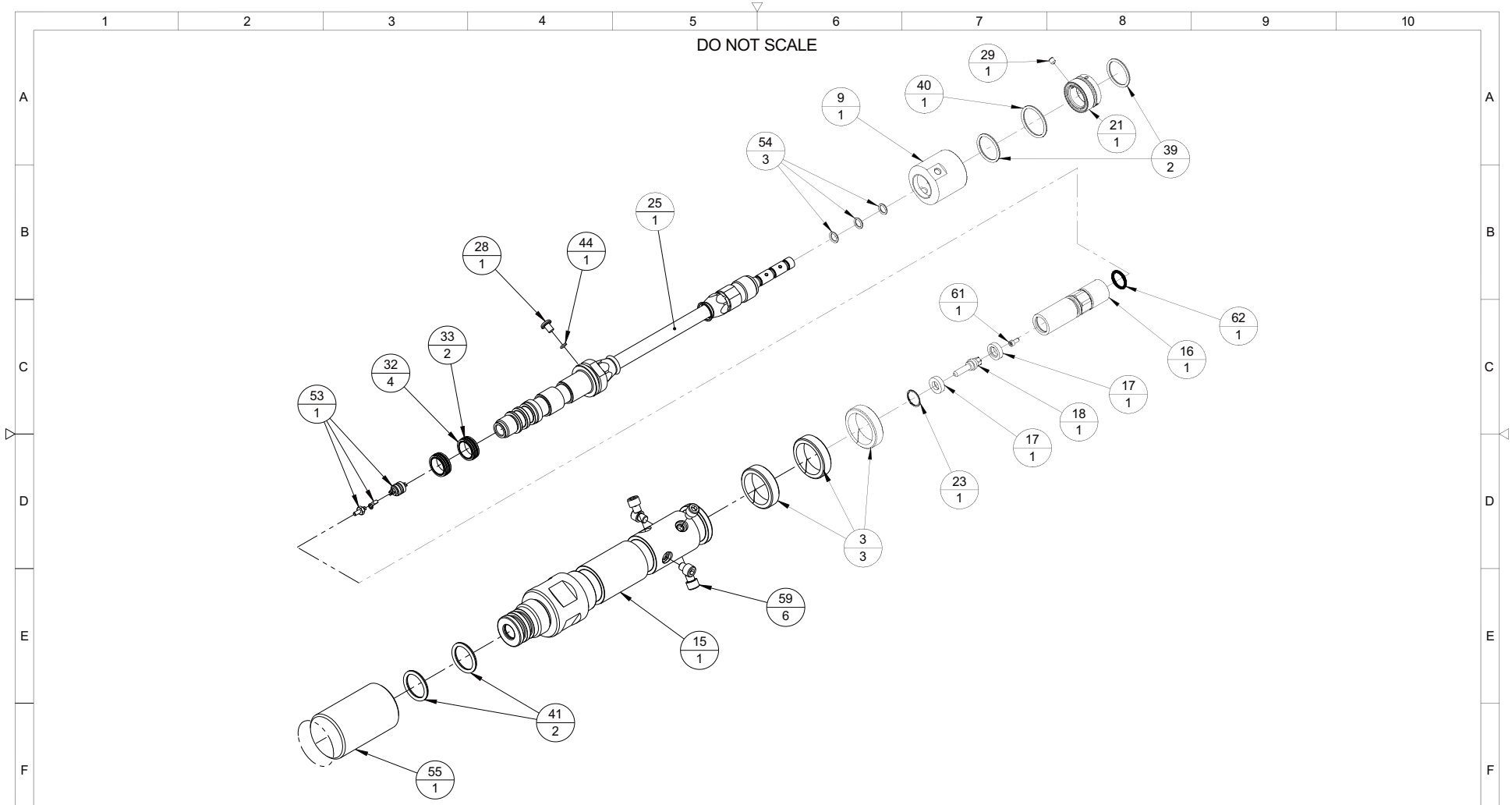
TITLE: SASM SONDE 1 11/16" SLOTTED

SHEET: 3/5

DRAWING No.: 9-4-03-30S3501

ISSUE: 08

S W



DRAWN: CB	CHECKED: WO	APP'D: TA	ISS	DESCRIPTION	APPD	DATE	**Sondex Canada Inc.**
DATE: 08/11/04	DATE: 10/08/09	DATE: 10/08/09	08	ECR 5-93816 REFERS	JP	09/07/12	Tel. 1 403 235 6533
DIM IN: INCHES	MATERIAL: N/A		07	ECR 5-88537 REFERS	TG	22/10/11	THIS DRAWING IS THE PROPERTY OF Sondex AND SHALL NOT BE COPIED OR USED WITHOUT PRIOR PERMISSION
SCALE: 1:3	SIZE: B	HEAT TREATMENT/CONDITION: N/A	06	ECR 5-86325 REFERS	TG	14/10/11	THIRD ANGLE PROJECTION
			05	Changed items #15, 16, 17, 44 Added items #72, 73, 74	WO	10/08/09	
			04	Changed BU Ring from sixe 113 to 112	TLS	18/05/06	
			APEGGA Permit No. PO8402				

USED ON: 3403501

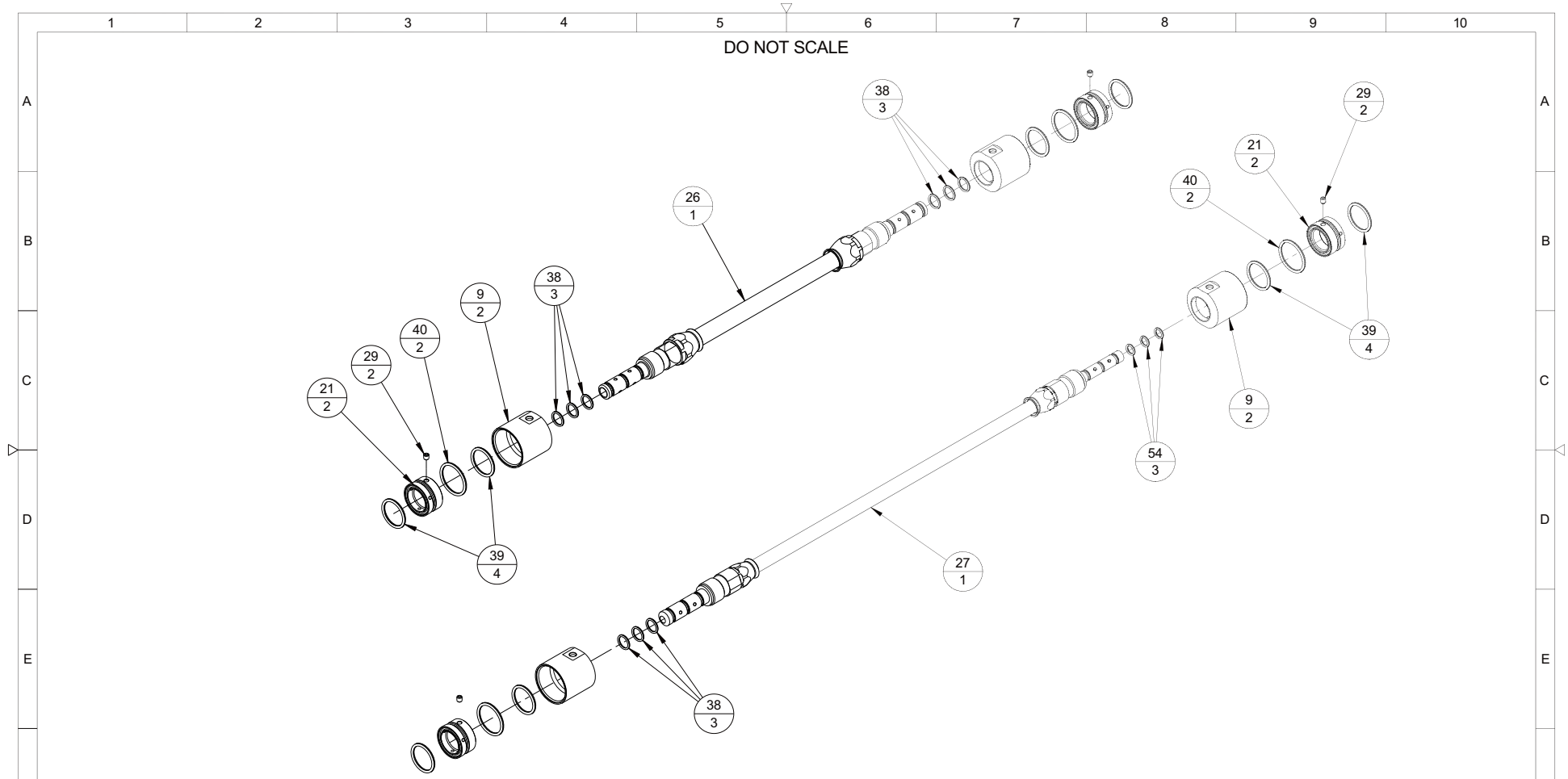
MACHINE FINISH: 63

GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

TITLE: SASM SONDE 1 11/16" SLOTTED

SHEET: 4/5 | DRAWING No.: 9-4-03-30S3501 | ISSUE: 08 S W

M:_ENTERPRISE RE-ORGANISATION\RBT003\9-4-03-3053501 — 10503140 — 15 August 2012 16:07:16



DRAWN: CB	CHECKED: WO	APP'D: TA	ISS	DESCRIPTION	APPD	DATE	Sondex Canada Inc.
DATE: 08/11/04	DATE: 10/08/09	DATE: 10/08/09	08	ECR 5-93816 REFERS	JP	09/07/12	Tel. 1 403 235 6533
DIM IN: INCHES	MATERIAL: N/A		07	ECR 5-88537 REFERS	TG	22/10/11	THIS DRAWING IS THE PROPERTY OF Sondex AND SHALL NOT BE COPIED OR USED WITHOUT PRIOR PERMISSION
SCALE: 1:3	SIZE: B	HEAT TREATMENT/CONDITION: N/A	06	ECR 5-86325 REFERS	TG	14/10/11	THIRD ANGLE PROJECTION
			05	Changed items #15, 16, 17, 44 Added items #72, 73, 74	WO	10/08/09	
			04	Changed BU Ring from sixe 113 to 112	TLS	18/05/06	
			APEGGA Permit No. PO8402				

USED ON: 3403501

MACHINE FINISH: 63

GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

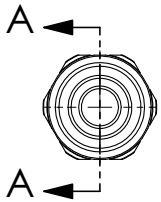
TITLE: SASM SONDE 1 11/16" SLOTTED

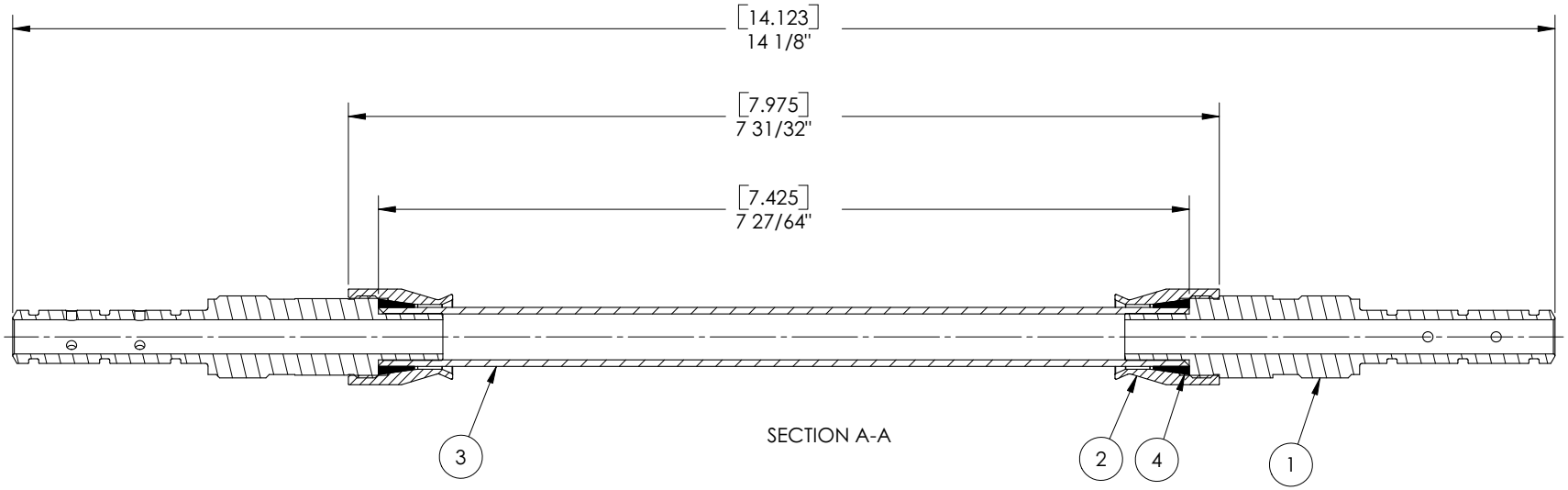
SHEET: 5/5 | DRAWING No.: 9-4-03-30S3501 | ISSUE: 08 S W

M:_ENTERPRISE RE-ORGANISATION\RBT003\9-4-03-30S3501 — 10504314O — 15 August 2012 16:07:16

DO NOT SCALE

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL	QTY.
1	2-2-09-15561031	UPPER HOSE END TERMINATION	STAINLESS STEEL 303	2
2	1206-8C	Collar	Stainless Steel	2
3	2807-8	HOSE	PTFE HOSE W/ SS BRAID	1
4	900568-8C	Ferrule	Stainless Steel	2





SECTION A-A

DRAWN: CB	CHECKED: DP	APP'D:	ISS	DESCRIPTION	APPD	DATE	Sondex CSS
DATE: 14/01/05	DATE: 14/01/05	DATE: -	-01	INITIAL RELEASE	-	-	Tel. 1 403 235 6533
DIM IN: INCHES	MATERIAL: -						THIS DRAWING IS THE PROPERTY OF Sondex AND SHALL NOT BE COPIED OR USED WITHOUT PRIOR PERMISSION
SCALE: 1:1	SIZE: B	HEAT TREATMENT/CONDITION: -					THIRD ANGLE PROJECTION

Apegga Permit No. P08402

USED ON: 2-2-09-15573041

MACHINE FINISH: 63

GEN TOL: 0.X 0.020" / 0.XX 0.010" / 0.XXX 0.005" / ANGLE ±0.5°

TITLE: 1 11/16 BOND PLATFORM HOSE TX TO RX1

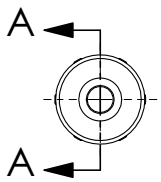
SHEET: 1/1 | DRAWING No.: 4-1-29-1550798A | ISSUE: -01 | S W

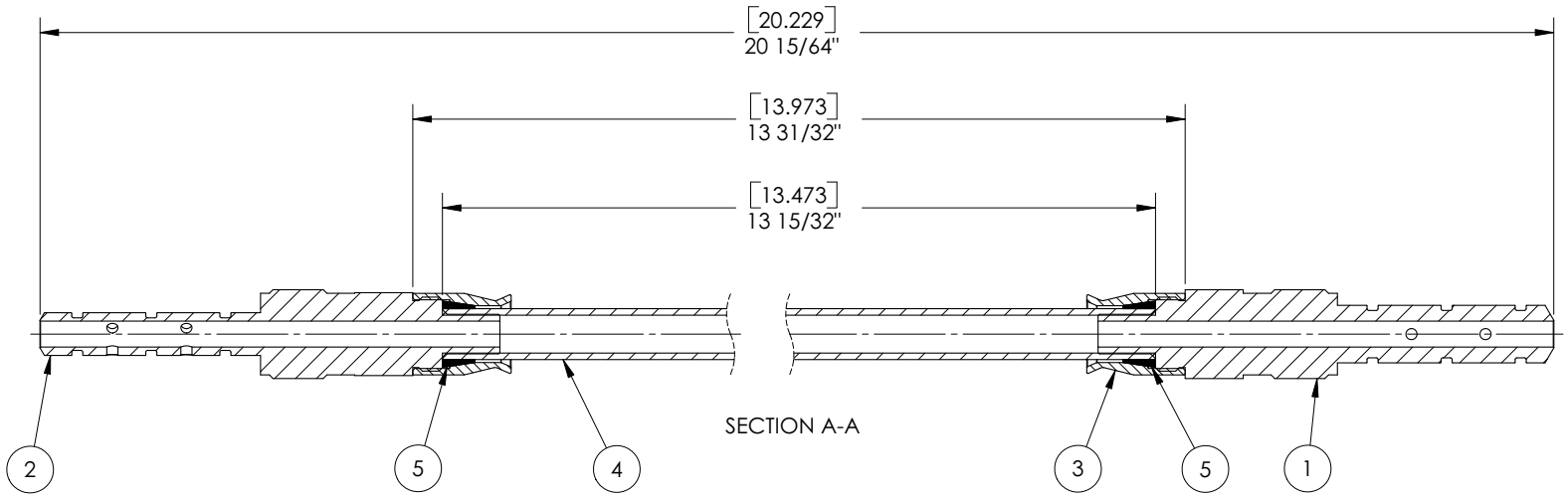
Thursday, September 08, 2005 4:05:01 PM

R:\R&D\Mechanical DWG\4-1-29\4-1-29-1550798\OLD REVS\4-1-29-1550798A

DO NOT SCALE

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL	QTY.
1	2-2-09-15531181	RX2 HOSE END TERMINATION TOP	303 STAINLESS STEEL	1
2	2-2-09-15573051	LOWER HOSE END TERMINATION	303 STAINLESS STEEL	1
3	1206-6C	Colar	Stainless Steel	2
4	2807-6	HOSE	PTFE HOSE W/ SS BRAID	1
5	900568-6C	Ferrule	Stainless Steel	2





SECTION A-A

DRAWN: CB	CHECKED: DP	APP'D: -	ISS	DESCRIPTION	APPD	DATE	
DATE: 14/01/05	DATE: 14/01/05	DATE: -	-01	INITAL RELEASE	-	-	
DIM IN: INCHES	MATERIAL: -						
SCALE: 1:1	SIZE: B	HEAT TREATMENT/CONDITION: -					

Apegga Permit No. P08402

Sondex CSS
Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

USED ON: -

MACHINE FINISH: 63

GEN TOL: 0.X 0.020" / 0.XX 0.010" / 0.XXX 0.005" / ANGLE ±0.5°

TITLE: 1 11/16 BOND PLATFORM HOSE RX1 TO RX2

SHEET: 1/1

DRAWING No.: 4-1-29-1551347A

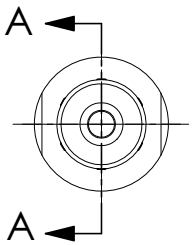
ISSUE: -01

S W

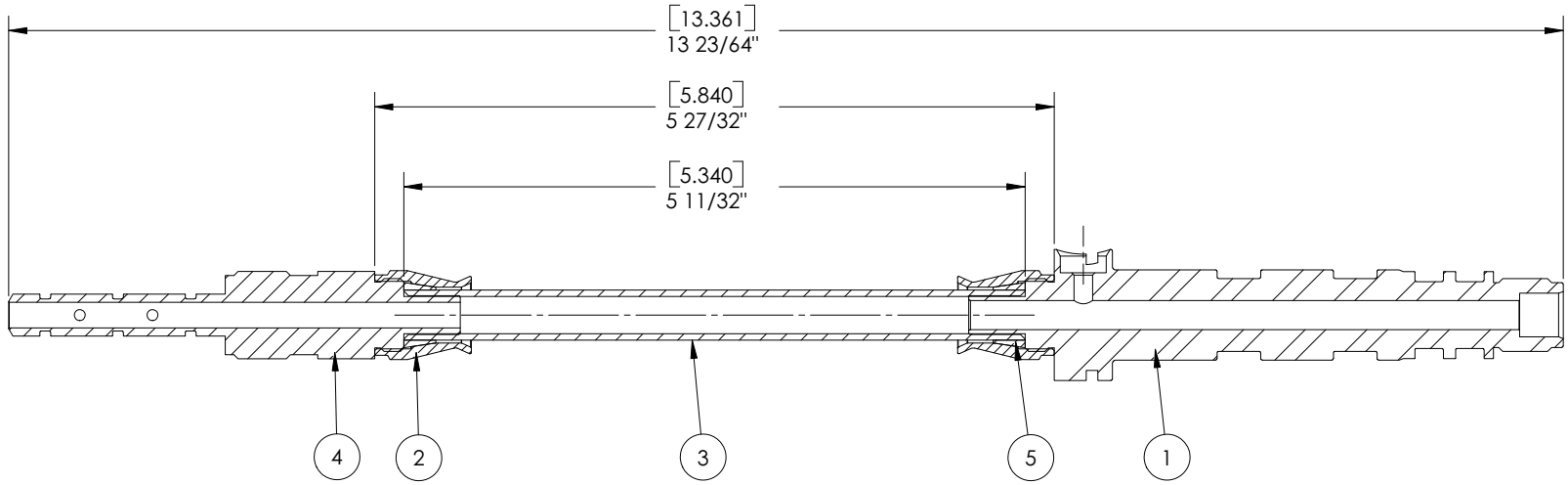
Thursday, September 08, 2005 4:09:16 PM

R:\R&D\Mechanical DWG\4-1-29\4-1-29-1551347\OLD REVS\4-1-29-1551347A

DO NOT SCALE



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	2-2-09-15541011	BOTTOM SUB INSIDE A
2	2	1206-6C	Colar
3	1	2807-6	HOSE
4	1	2-2-09-15573051	1 11/16 RBT LOWER HOSE END TERMINATION
5	2	900568-6C	Ferrule



SECTION A-A

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DIM IN: INCHES	MATERIAL: -	
SCALE: 1:1	SIZE: B	HEAT TREATMENT/CONDITION: -

ISS	DESCRIPTION	APPD	DATE
-01	INITIAL RELEASE	-	-

Apegga Permit No. P08402

cbadea

Sondex CSS

Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

30 November, 2005 11:05:18 AM

USED ON: -

MACHINE FINISH: 63

GEN TOL: 0.X 0.020" 0.XX 0.010" 0.XXX 0.005" ANGLE ±0.5°

TITLE: 1 11/16 BOND PLATFORM HOSE RX2 TO END

SHEET: 1/1

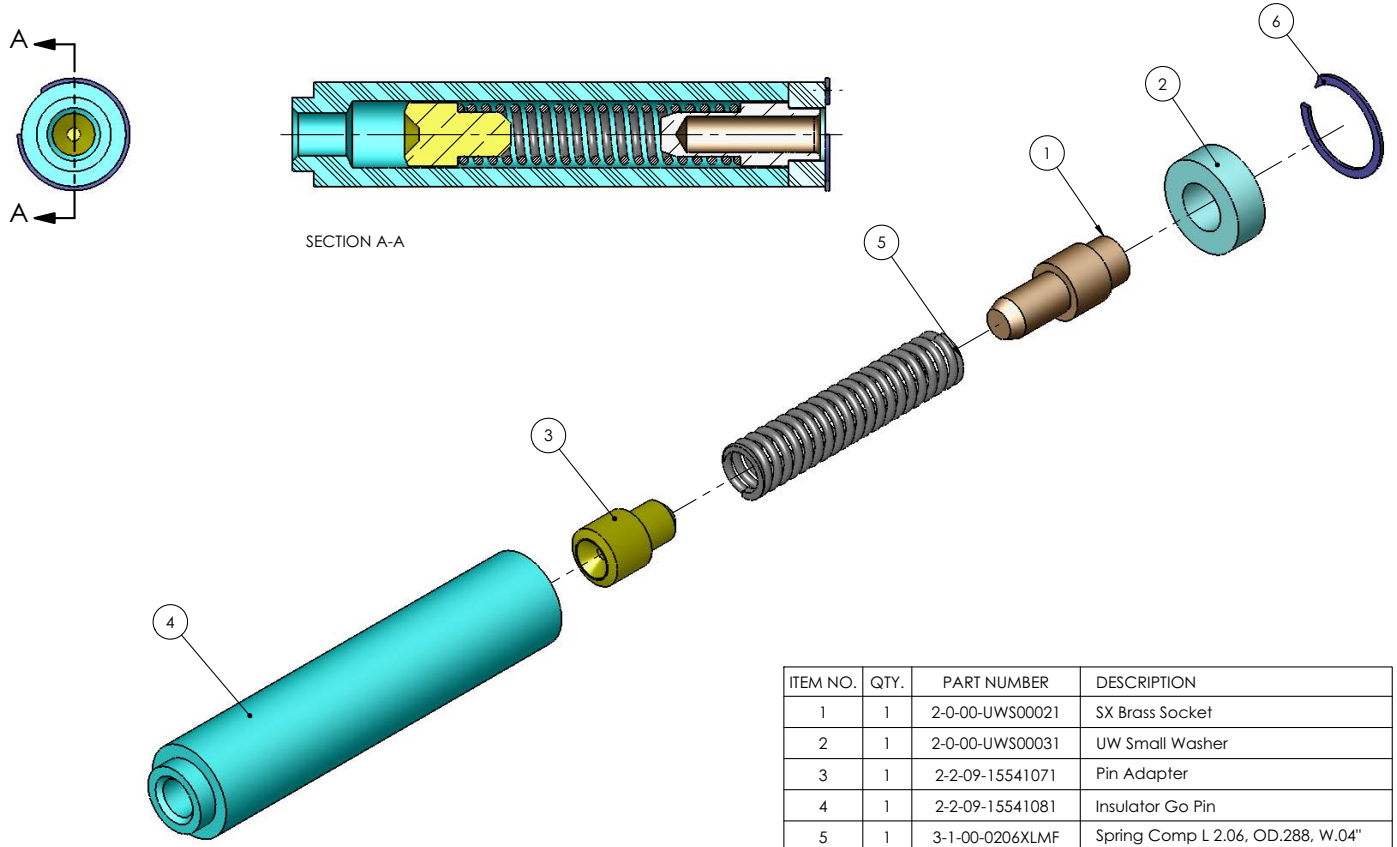
DRAWING No.: 4-1-29-1550534A

ISSUE: -01

S W

R:\R&D\Mechanical DWG\4-1-29\4-1-29-1550534\OLD REVS\4-1-29-1550534A

DO NOT SCALE



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	2-0-00-UWS00021	SX Brass Socket
2	1	2-0-00-UWS00031	UW Small Washer
3	1	2-2-09-15541071	Pin Adapter
4	1	2-2-09-15541081	Insulator Go Pin
5	1	3-1-00-0206XLMF	Spring Comp L 2.06, OD.288, W.04"
6	1	3-1-01-VH050S02	RETAINING RING INT SPIRAL 1T SS .5

DRAWN: CB	CHECKED: DP	APP'D: -
DATE: 02/Dec/04	DATE: 16/Dec/04	DATE: -
DIM IN: INCHES	MATERIAL: -	
SCALE: 4:3	SIZE: A	HEAT TREATMENT/CONDITION: -

ISS	DESCRIPTION	APPD	DATE
-01	Initial Release	-	-

Aprgga Permit No. P08402

29 November, 2005 9:29:47 AM cbadea

R:\R&D\Mechanical DWG\9-4-03\9-4-03-HBTMSXC1\OLD REVS\9-4-03-HBTMSXC1

Sondex CSS
Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

GEN TOL
0.X ±0.020"
0.XX ±0.010"
0.XXX ±0.005"
ANGLE ±0.5°

MACHINE FINISH 63

SHEET 1/1

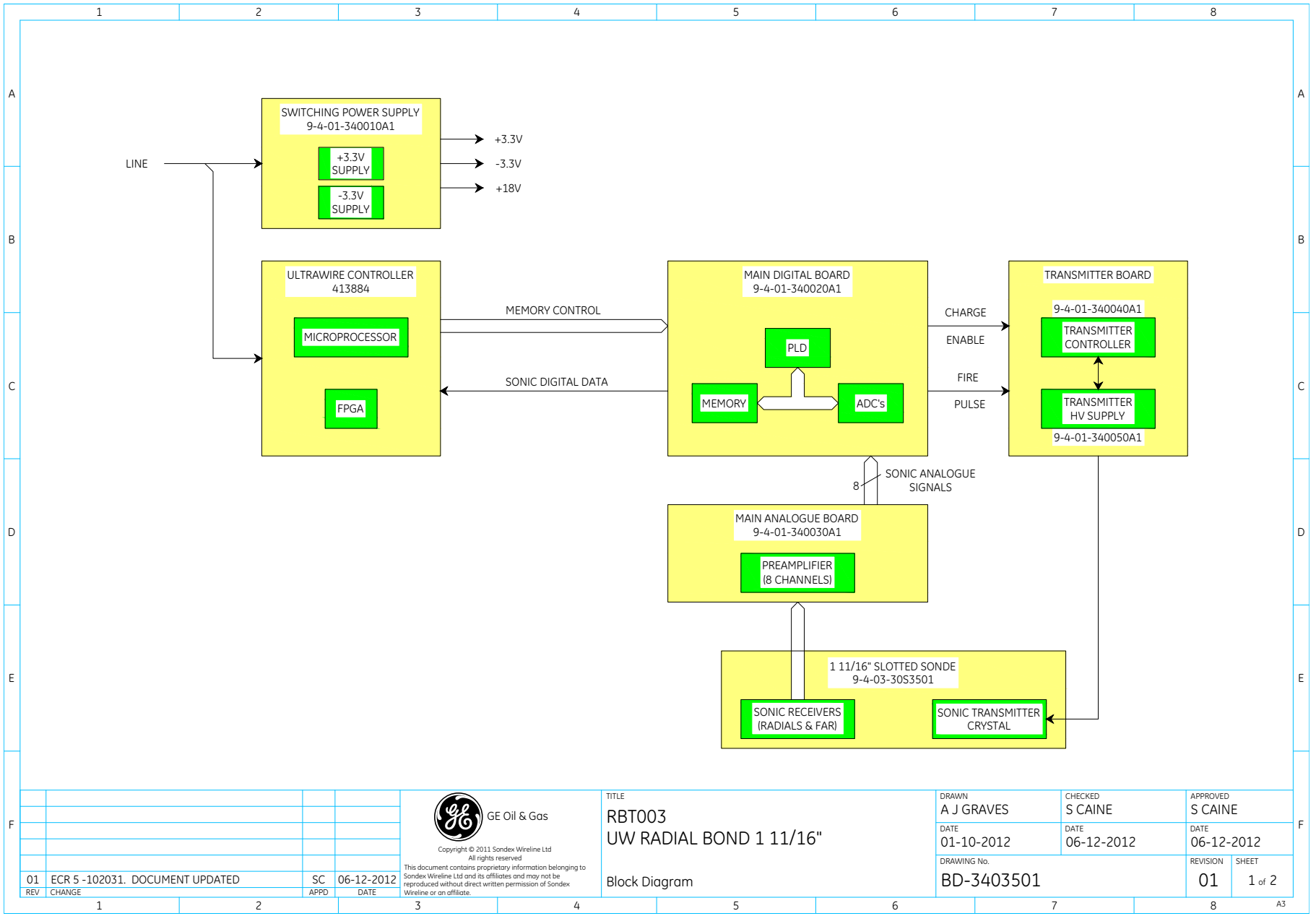
TITLE: - SASM Connect Hyper Bottom SX

USED ON: Common

DRAWING No.: 9-4-03-HBTMSXC1

ISSUE: -01

S W



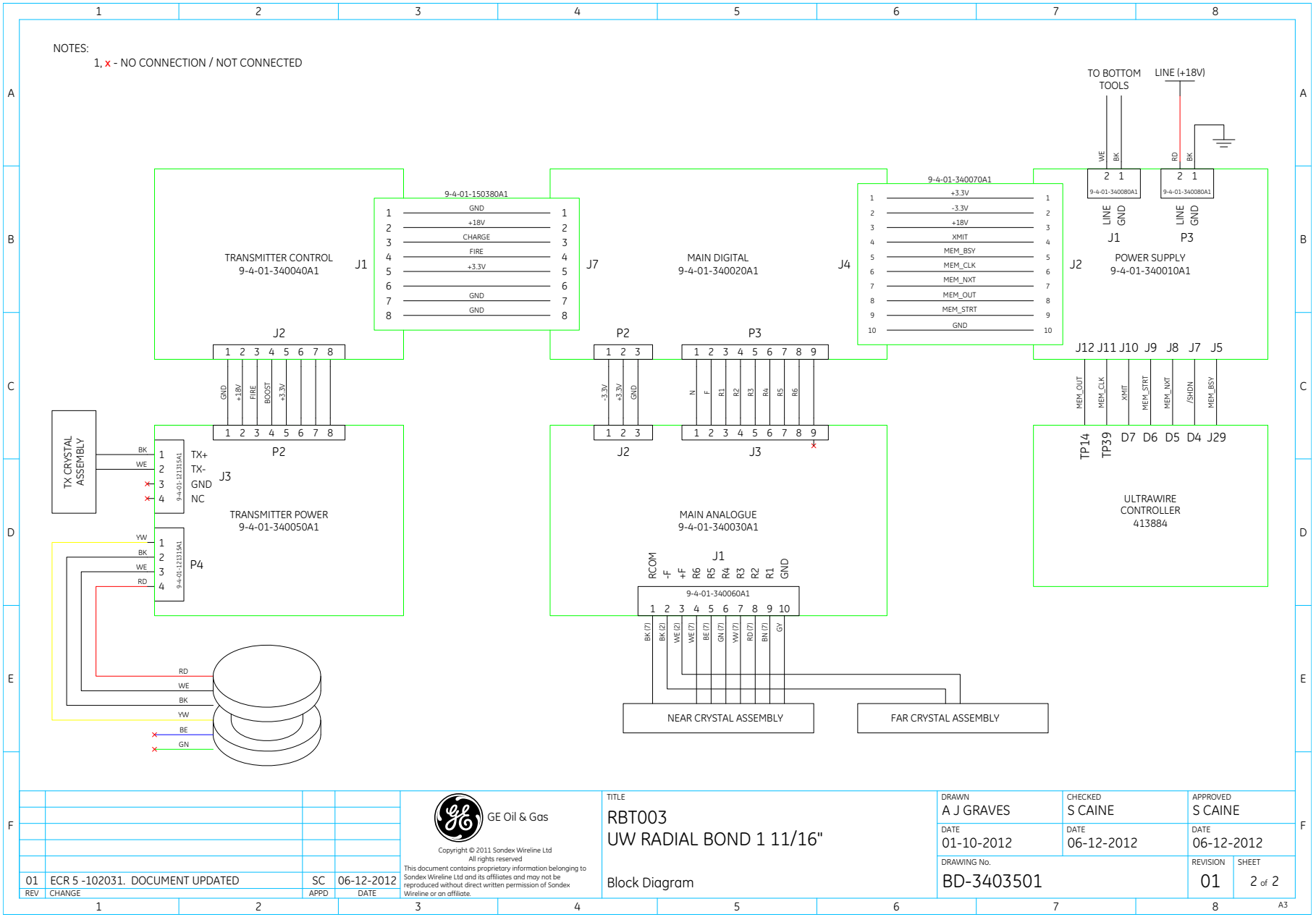
REV	CHANGE	APPD	DATE
01	ECR 5 -102031. DOCUMENT UPDATED	SC	06-12-2012

GE Oil & Gas

TITLE
RBT003
UW RADIAL BOND 1 11/16"
Block Diagram

DRAWN	CHECKED	APPROVED
A J GRAVES	S CAINE	S CAINE
DATE 01-10-2012	DATE 06-12-2012	DATE 06-12-2012

DRAWING No. BD-3403501
REVISION 01
SHEET 1 of 2
A3



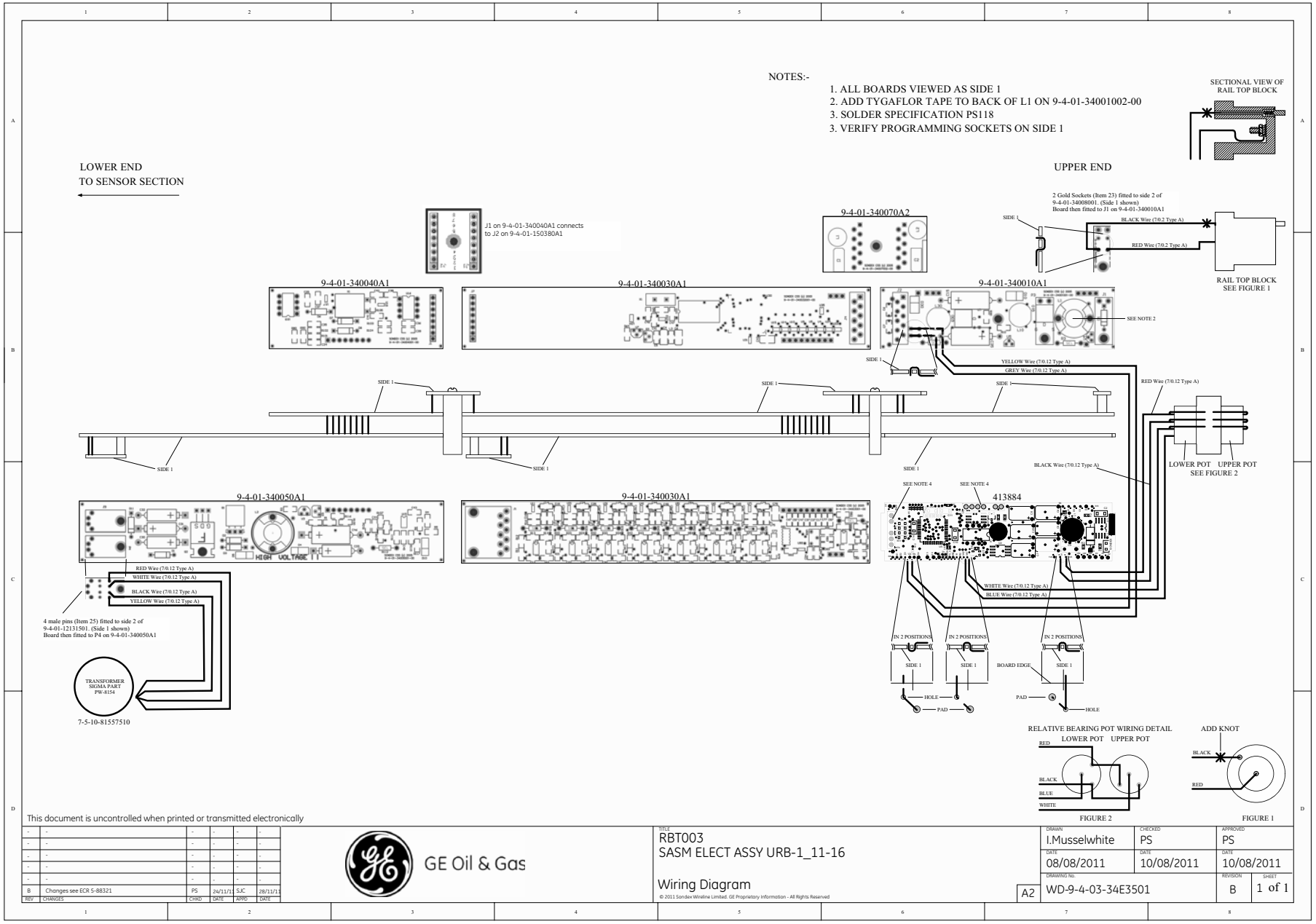
REV	CHANGE	APPD	DATE
01	ECR 5 -102031. DOCUMENT UPDATED	SC	06-12-2012

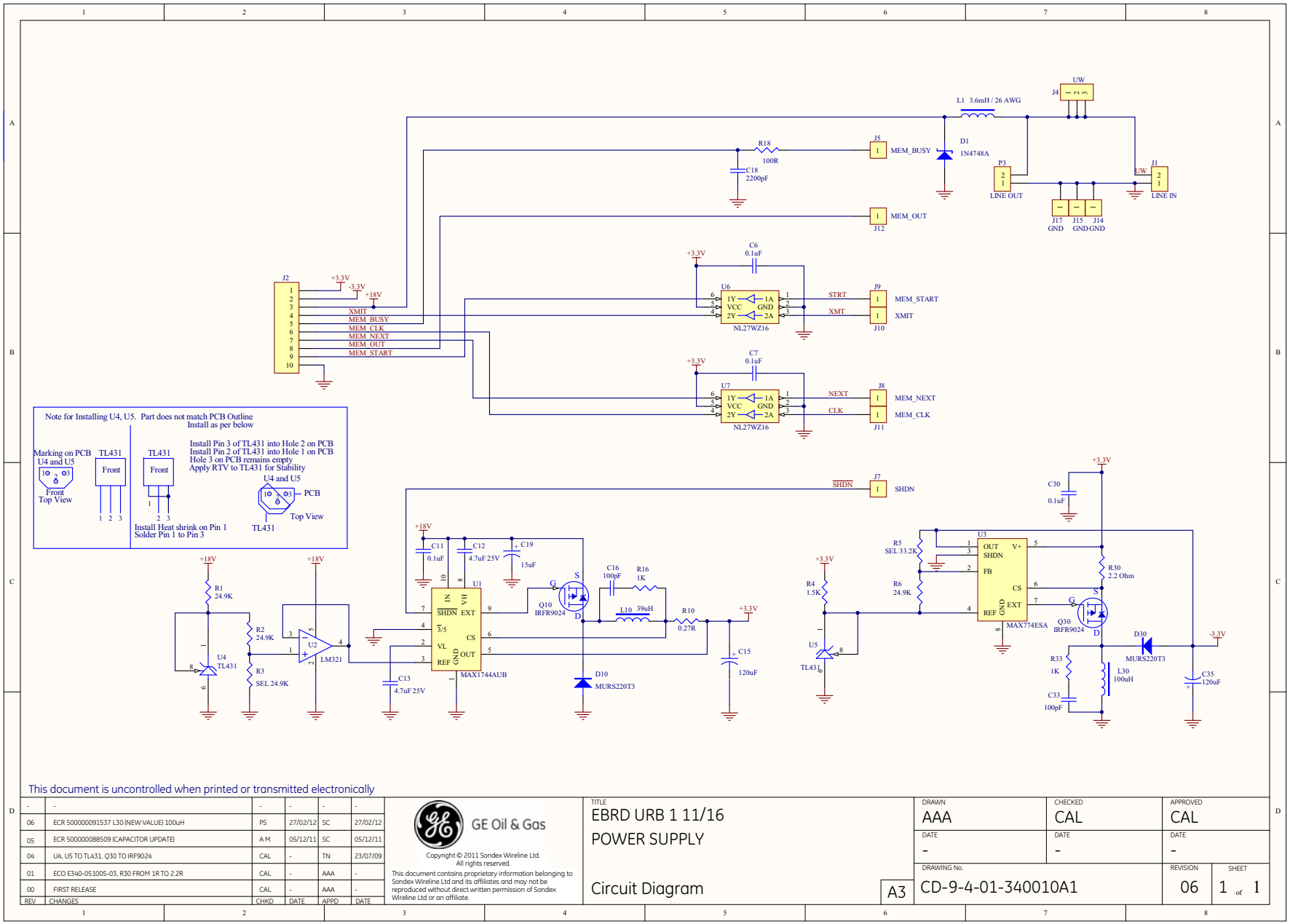
GE Oil & Gas

TITLE
RBT003
UW RADIAL BOND 1 11/16"
Block Diagram

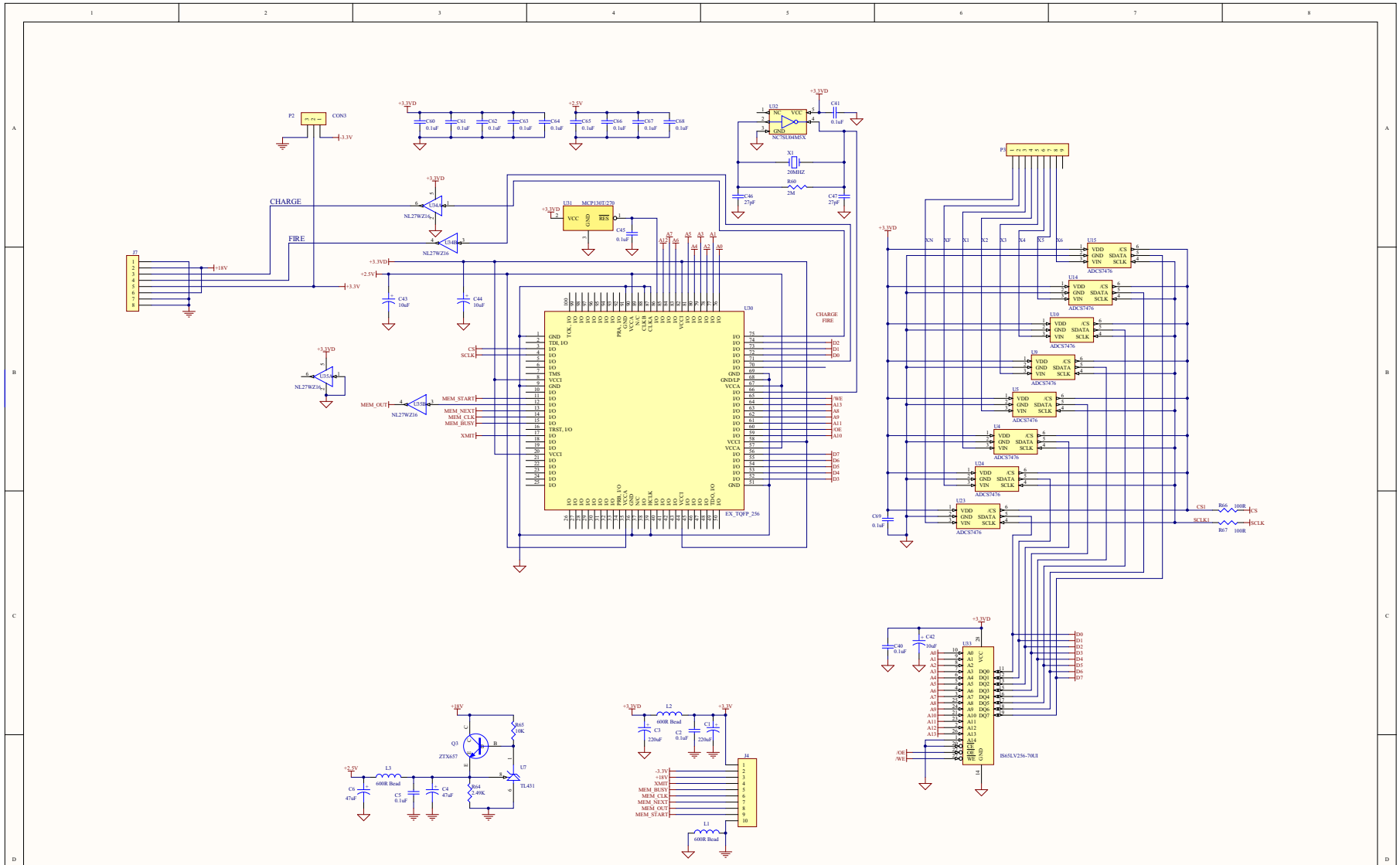
DRAWN	CHECKED	APPROVED
A J GRAVES	S CAINE	S CAINE
DATE 01-10-2012	DATE 06-12-2012	DATE 06-12-2012

DRAWING No. BD-3403501
REVISION 01
SHEET 2 of 2
A3



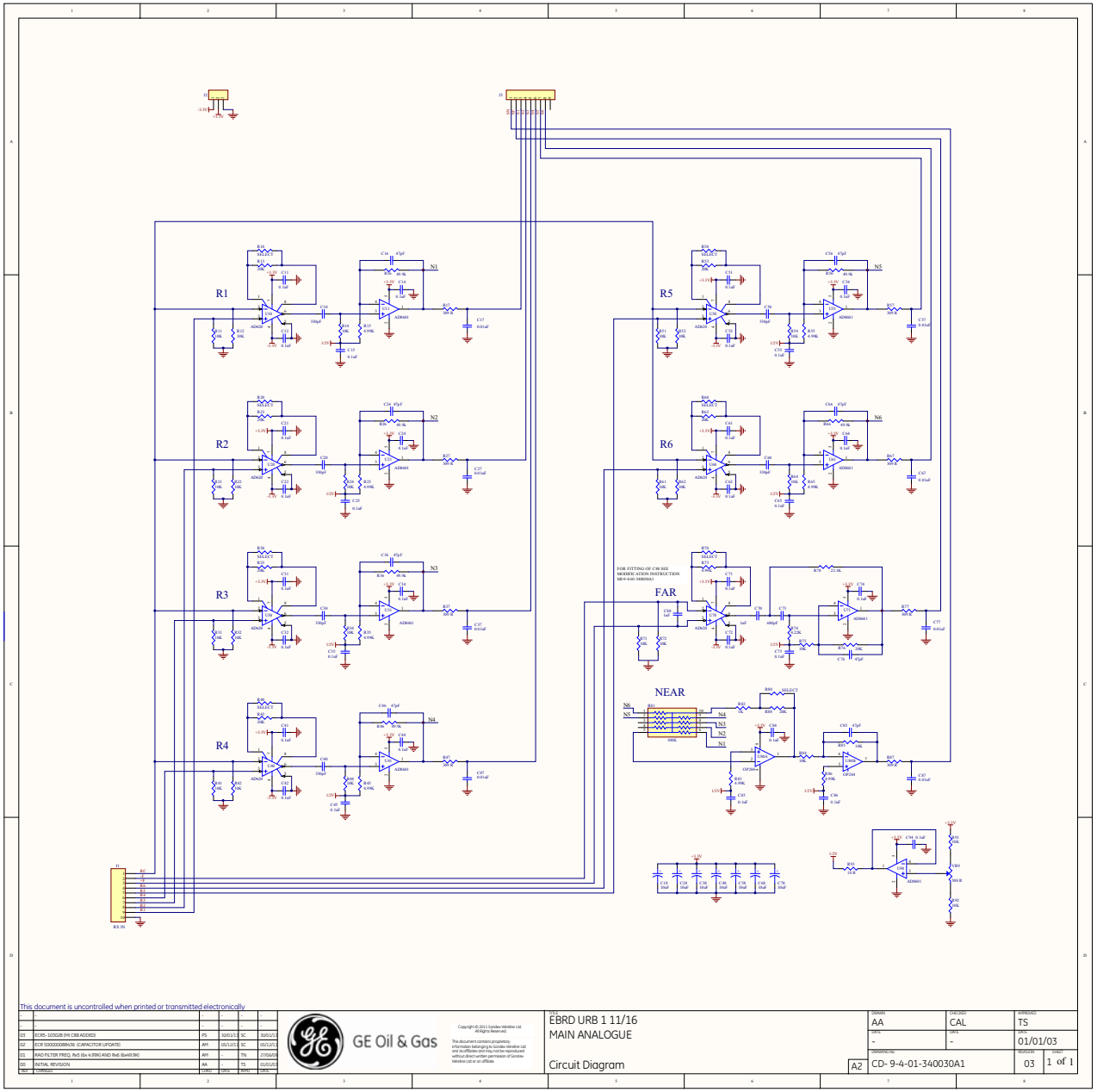


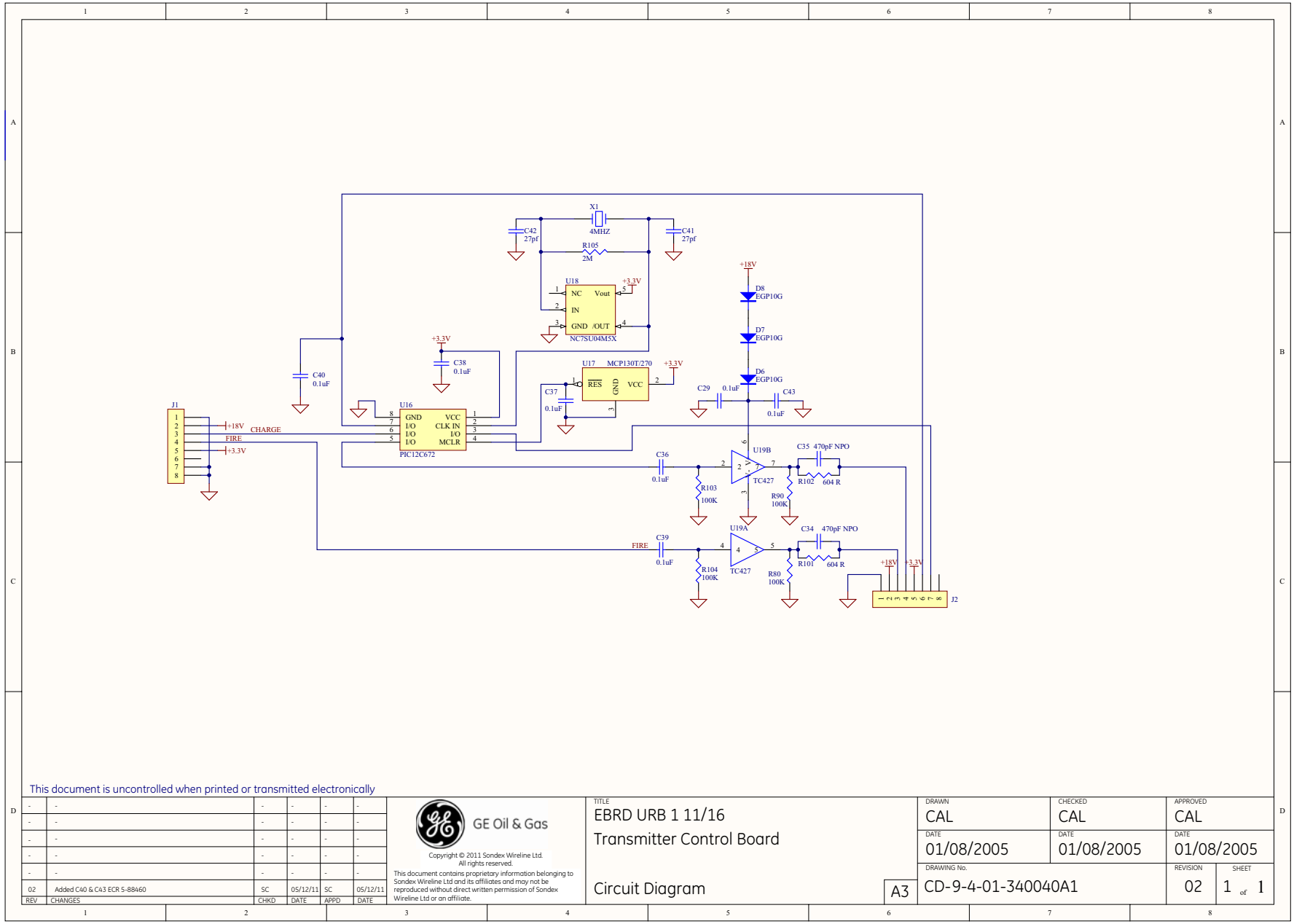
REV	CHANGES	CHKD	DATE	APPD	DATE
-	-	-	-	-	-
06	ECR 500000091537 L30 (NEW VALUE) 100uH	PS	27/02/12	SC	27/02/12
05	ECR 500000088509 (CAPACITOR UPDATE)	A M	05/12/11	SC	05/12/11
04	U4, U5 TO TL431. Q30 TO IRF9024	CAL	-	TN	23/07/09
01	ECO E340-051005-03, R30 FROM 1R TO 2.2R	CAL	-	AAA	-
00	FIRST RELEASE	CAL	-	AAA	-



Radial Bond Tool *RBT003*

Document: MN-RBT003 Revision: 2 Created: 14 February 2013





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REV	CHANGES	CHKD	DATE	APPD	DATE
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-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
02	Added C40 & C43 ECR 5-88460	SC	05/12/11	SC	05/12/11

GE Oil & Gas

TITLE
EBRD URB 1 11/16
Transmitter Control Board

Circuit Diagram

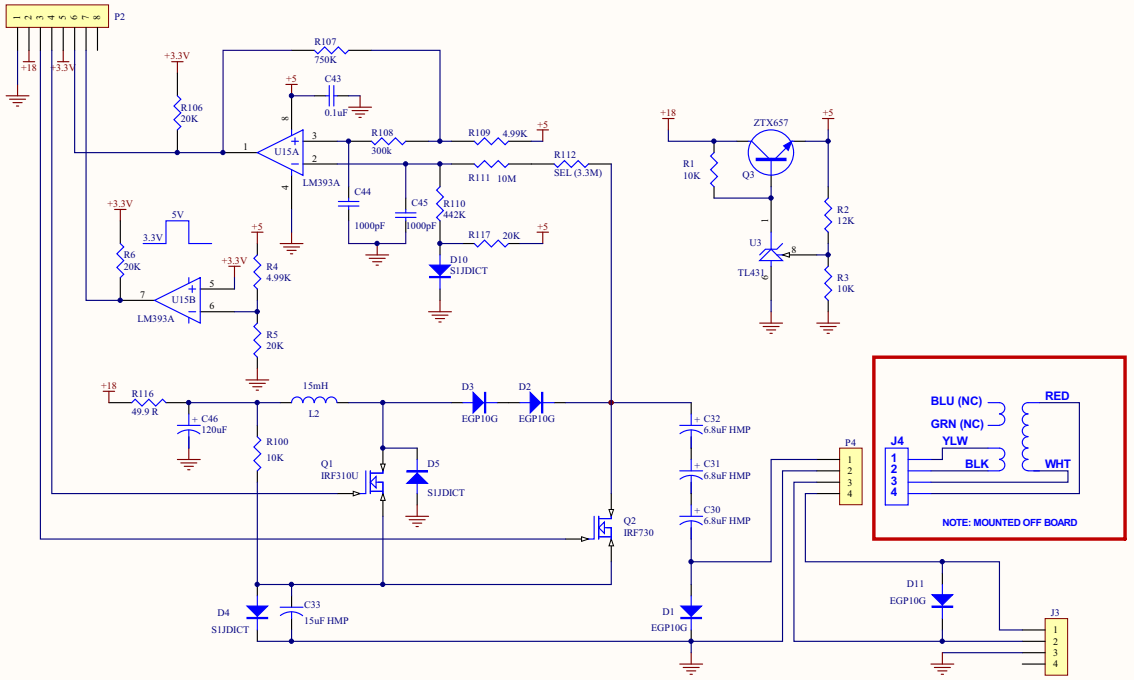
A3

DRAWN	CHECKED	APPROVED
CAL	CAL	CAL
DATE 01/08/2005	DATE 01/08/2005	DATE 01/08/2005

DRAWING No. CD-9-4-01-340040A1

REVISION 02

SHEET 1 of 1



This document is uncontrolled when printed or transmitted electronically

REV	CHANGES	CHKD	DATE	APPD	DATE
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
02	ECR 500000088462 (CAPACITOR UPDATE)	AM	06/12/11	SC	06/12/11
01	AD+CD VERSION	CAL	11/08/05	CAL	11/08/05
00	INITIAL RELEASE	CAL	-	CAL	-

GE Oil & Gas

TITLE
EBRD URB 1 11/16
TRANSMITTER POWER

Circuit Diagram

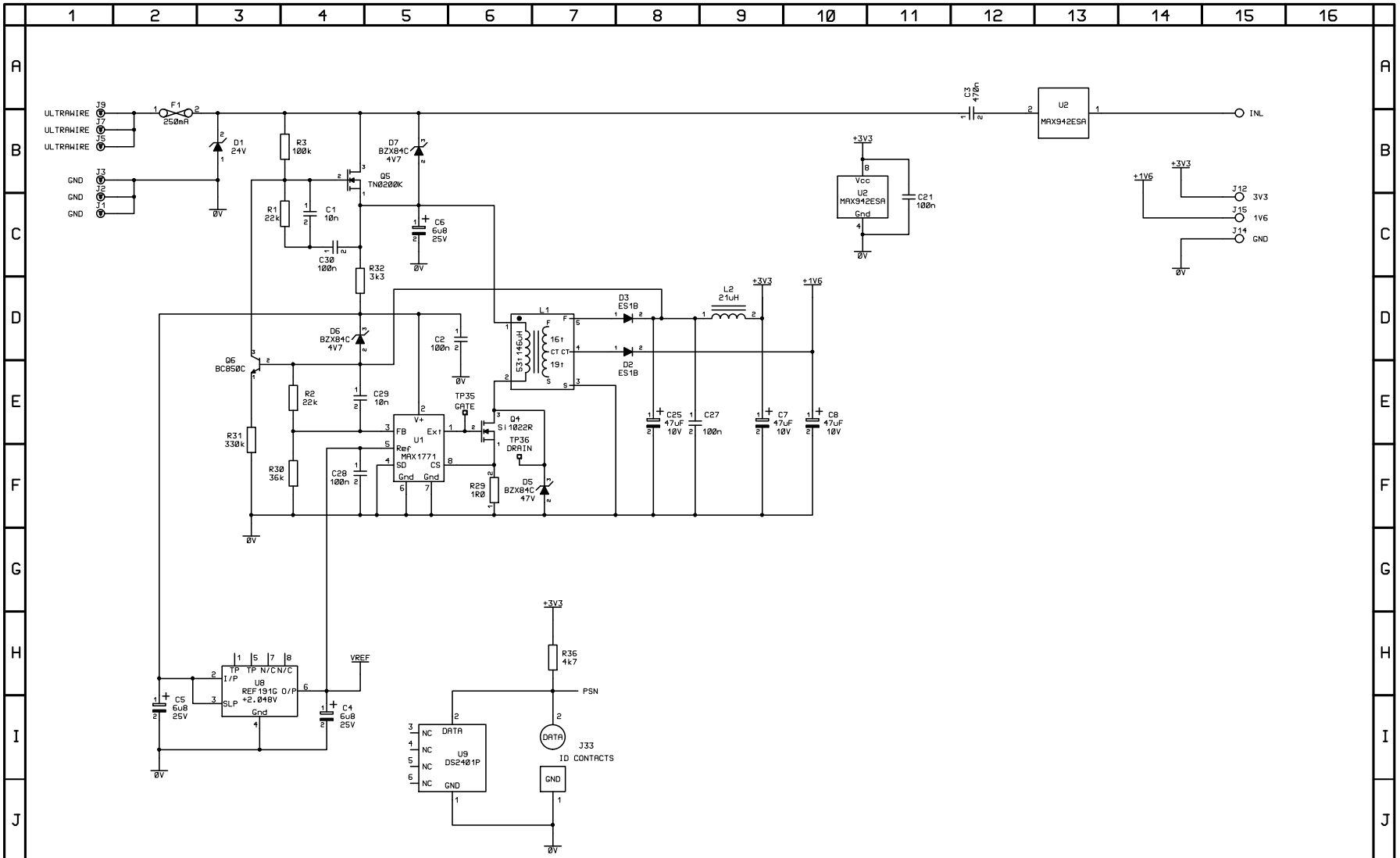
A3

DRAWN	CHECKED	APPROVED
CAL	CAL	CAL
DATE -	DATE -	DATE -

DRAWING No. CD-9-4-01-340050A1

REVISION 02

SHEET 1 of 1



REV.	ECR NUMBER, REMARKS	CHKD	APPR	DATE
G	ECR5525 C7,C8,C25 was 47U 6v3	PEJR	PEJR	22/04/08
H	ECR59595 R26 & Q3 was Fitted	PEJR	PEJR	13/05/09
J	ECR60008 Add Mods into Design	PEJR	PEJR	06/08/09
K	ECR73218 D4 change value	PEJR	PEJR	18/8/10
.	.	.	.	.
.	.	.		.

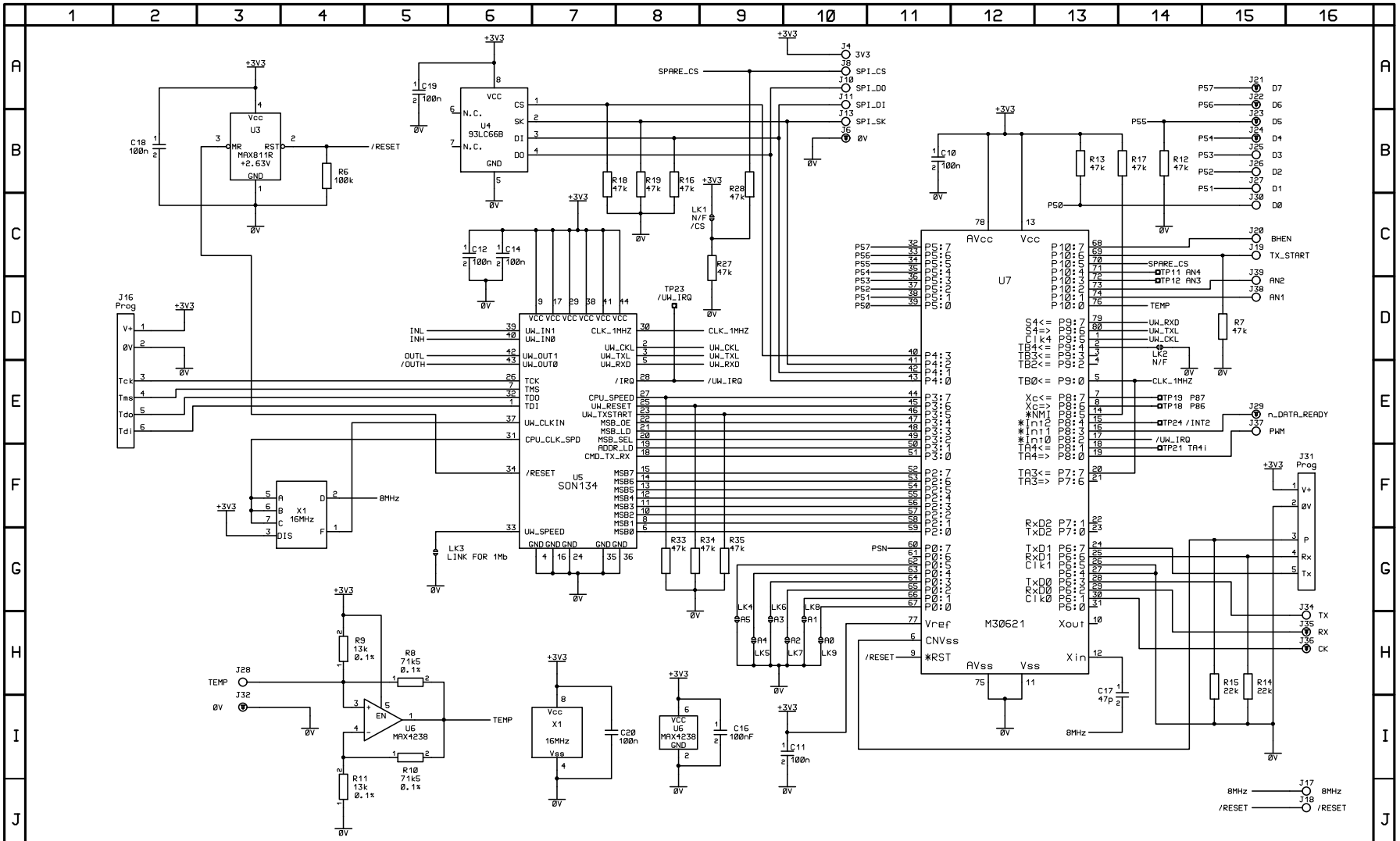
SONDEX LTD
FORD LANE, BRAMSHILL,
HOOK, HAMPSHIRE,
RG27 0RH, ENGLAND
TEL: +44 (0) 118 932 6755
FAX: +44 (0) 118 932 6704

TITLE: Digital Board Circuit Diagram

DRAWING NUMBER	REVISION
CD-82333	Kx

DRAWN	CHECKED	APPROVED
APB	DJ	APB
DATE 10/12/03	DATE 10/03/04	DATE 12/03/04

SHEET 1 OF 2



REV.	ECR NUMBER, REMARKS	CHKD	APPR	DATE
G	ECR5525 C7,C8,C25 was 47U 6v3	PEJR	PEJR	22/01/08
H	ECR59595 R26 & Q3 was Fitted	PEJR	PEJR	13/05/09
J	ECR60008 Add Mods into Design	PEJR	PEJR	06/08/09
K	ECR73218 D4 change value	PEJR	PEJR	18/8/10
.	.	.	.	.
.	.	.	.	.

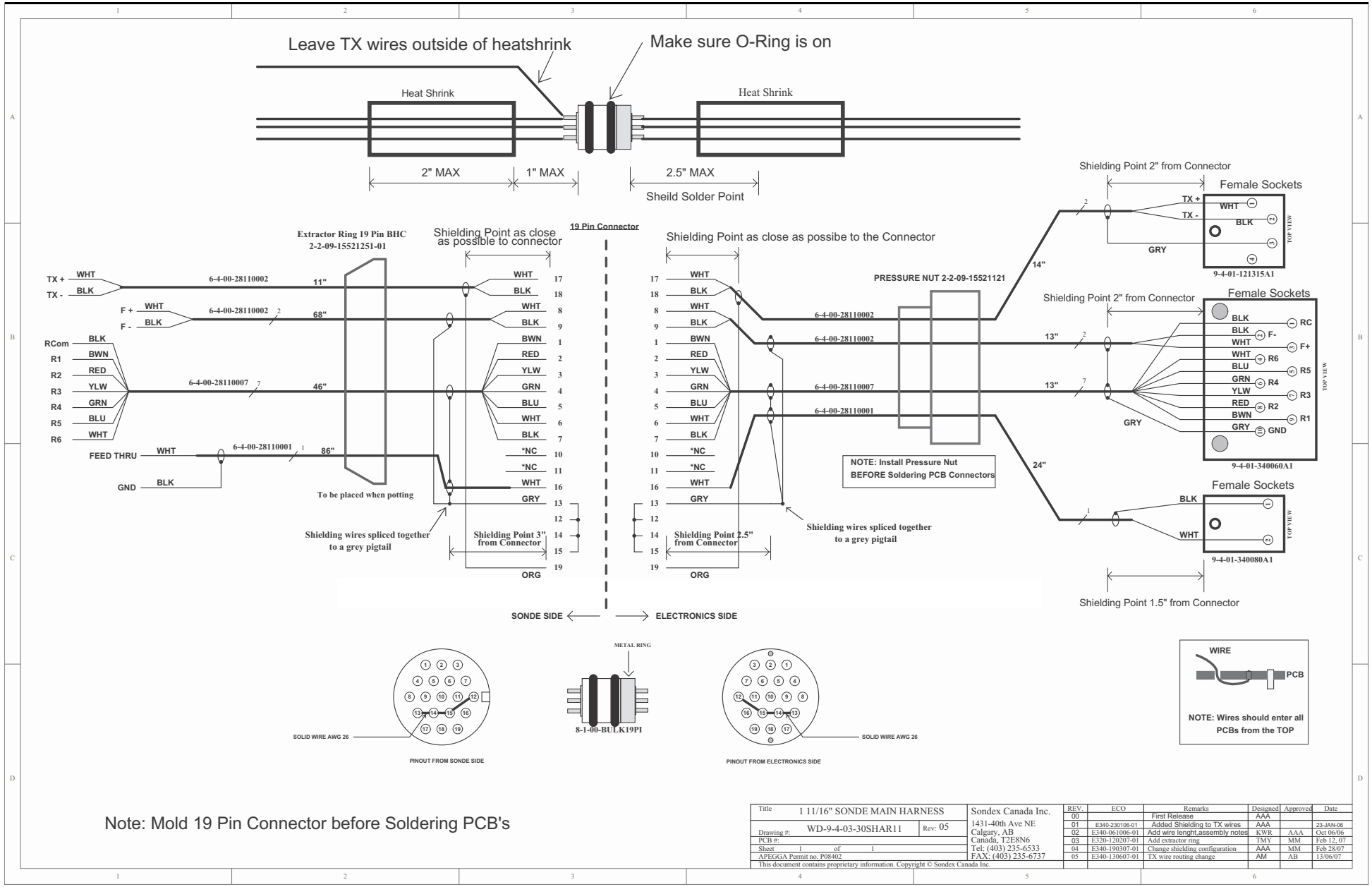
SONDEX LTD
FORD LANE, BRAMSHILL,
HOOK, HAMPSHIRE,
RG27 0RH, ENGLAND
TEL: +44 (0) 118 932 6755
FAX: +44 (0) 118 932 6704

TITLE: Digital Board Circuit Diagram

DRAWING NUMBER: CD-82333
REVISION: Kx

DRAWN	CHECKED	APPROVED
APB	DJ	APB
DATE 10/12/03	DATE 10/03/04	DATE 12/03/04

SHEET 2 OF 2



Note: Mold 19 Pin Connector before Soldering PCB's

Title	1 11/16" SONDE MAIN HARNESS	Sondex Canada Inc.	
Drawing #:	WD-9-4-03-30SHAR11	Rev: 05	1431-40th Ave NE Calgary, AB Canada, T2E8N6 Tel: (403) 235-6533 FAX: (403) 235-6737
PCB #:			
Sheet 1 of 1			
APEGGA Permit no. P08402			

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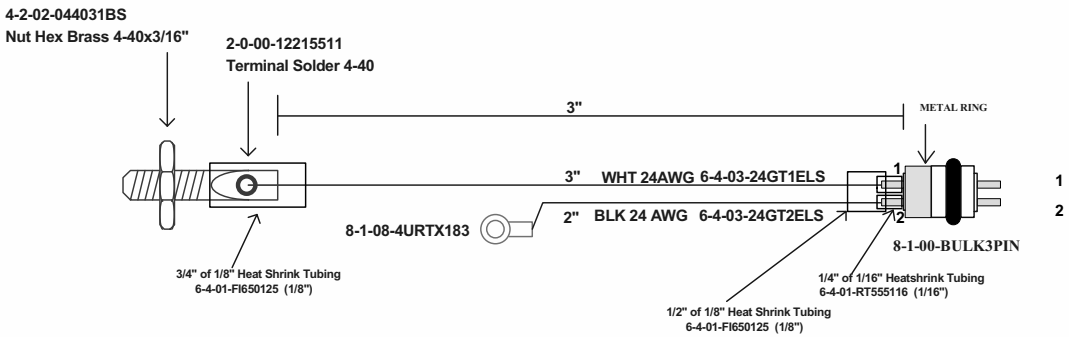
REV.	ECO	Remarks	Designed	Approved	Date
00		First Release	AAA		
01	E340-230106-01	Added Shielding to TX wires	AAA		23-JAN-06
02	E340-061006-01	Add wire lenght,assembly notes	KWR	AAA	Oct 06/06
03	E320-120207-01	Add extractor ring	TMY	MM	Feb 12, 07
04	E340-190307-01	Change shielding configuration	AAA	MM	Feb 28/07
05	E340-130607-01	TX wire routing change	AM	AB	13/06/07



Title: SLOTTED SONDE BOTTOM WIRING	Sondex Canada Inc.	REV.	ECO	Remarks	Designed	Approved	Date
Drawing #: WD-9-4-03-40SHAR21 Rev: 02	1431-40th Ave NE	00		First Release	AAA		
PCB #:	Calgary, AB	01	E400-201005-02	LINE Lug Replaced	KR	TS	20/10/ 05
Sheet 1 of 1	Canada, T2E8N6	02	E400-240907-01	Heat Shrink Locations/length	AM	MM	24/09/07
APEGGA Permit no. P08402	Tel: (403) 235-6533						
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APPENDIX C FITTING OF ANTI-EXTRUSION RINGS

At high temperatures O-Rings become very soft and with corresponding high pressures they begin 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).

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

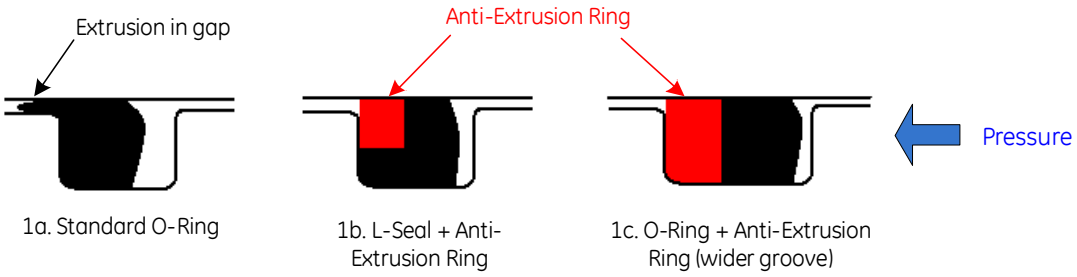


Figure C-1 Installation of a single Anti-Extrusion Ring

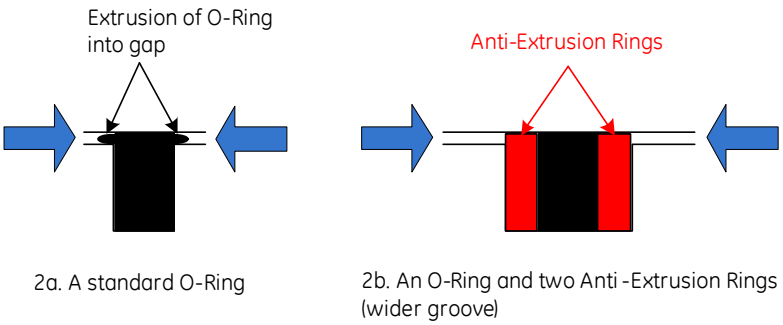


Figure C-2 Installation of two Anti-Extrusion Rings

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 may damage the ring and/or the seal. Slowly back off the joint, check the seating of the Anti-Extrusion Ring and then retighten.

APPENDIX D RBT003 CALIBRATION KIT

D.1 Overview

This section describes the maintenance of the $1^{11}/_{16}$" Hyper Calibration Kit (***P/N: 3400006***) equipment required for setting up and calibrating the RBT003.

It is recommended the RBT Calibration Kit equipment is checked before it is used with the RBT Calibration Tank (RCT001). Refer to the RCT001 manual (***MN-RCT001***) for further instructions.

Refer to ***Section 7.1.6*** for Software Calibration details and to ***Section 7.2.1*** for Hardware Setup details.

D.2 Maintenance

Reference: $1^{11}/_{16}$" Hyper Calibration Kit ***3400006***

D.2.1 HYPER SOFTWARE CAL ADAPTER

Reference: Hyper Software Cal Adapter ***AD-9-5-03-000200A1***

1 Unscrew and remove the Software Cal Adapter (***item 4***) from the Cal Tank Flange (***item 5***).

2 Inspect the two O-Rings (***item 10***) on the Cal Tank Flange (***item 5***) for damage or ageing/ hardening, and replace where required.

3 Lubricate the two O-Rings (***item 10***) with Liquid-O-Ring® (***P/N: LOR101***).

4 Screw the Software Cal Adapter (***item 4***) onto the Cal Tank Flange (***item 5***).

5 Inspect the two O-Rings (***item 9***) on the Software Cal Tank Adapter (***item 4***) for damage or ageing/hardening, and replace where required.

6 Lubricate the two O-Rings (***item 9***) with Liquid-O-Ring® (***P/N: LOR101***).

D.2.2 $1\ ^{11}/_{16}$" CAL ADAPTER

Reference: $1\ ^{11}/_{16}$" Cal Adapter ***AD-9-5-03-000301A1***

1 Unscrew and remove the Cal Tank Adapter Housing (***item 3***) from the Cal Tank Flange (***item 1***).

2 Inspect the two O-Rings (***item 2***) on the Cal Tank Flange (***item 1***) for damage or ageing/ hardening, and replace where required.

3 Lubricate the two O-Rings (***item 2***) with Liquid-O-Ring® (***P/N: LOR101***).

4 Screw the Cal Tank Adapter Housing (***item 3***) onto the Cal Tank Flange (***item 1***).

D.2.3 CLAM SHELL CENTRALISER

Reference: Sonic Clam Shell Assembly *AD-9-5-03-000215A2*

Check that the six Clam Wheels (***item 5***) on each Clam Shell Centraliser move freely and are not worn. Replace any Wheels that are worn or defective as follows:

1 Unscrew and remove the Shoulder Screw (***item 2***) securing the Clam Wheel (***item 5***) to the Clam Shell (***item 1***).

2 Remove the Clam Wheel (***item 5***), fit the replacement Clam Wheel and tighten the Shoulder Screw (***item 2***) on the Clam Shell (***item 1***).

Figure D-1 Clam Shell Centraliser

3 Unscrew and remove the Socket Cap Screw (***item 7***) on each Clam Shell Centraliser and check that the Clam Shell opens and closes freely. If the Clam Shell hinge is stiff, lubricate the Hinge Plate (***item 4***).

4 Lubricate the six Clam Wheels (***item 5***) on each Clam Shell Centraliser.

D.3 Drawings & Parts Lists

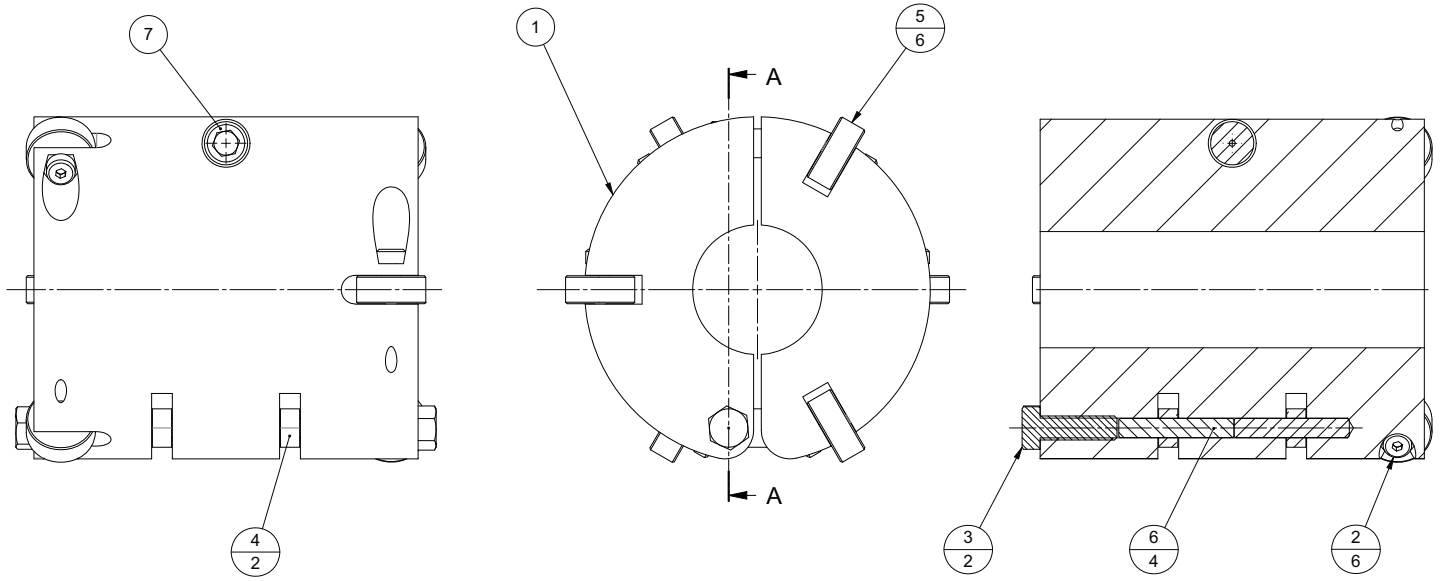
D.3.1 Mechanical Drawings

Description	Drawing	Parts List
1 $^{11}/_{16}$" Sonic Clam Shell Assembly	*AD-9-5-03-000215A2-02*	See Drawing
1 $^{11}/_{16}$" Cal Adapter	*AD-9-5-03-000301A1-01*	See Drawing
Hyper Software Cal Adapter Assembly	*AD-9-5-03-000200A1-02*	See Drawing

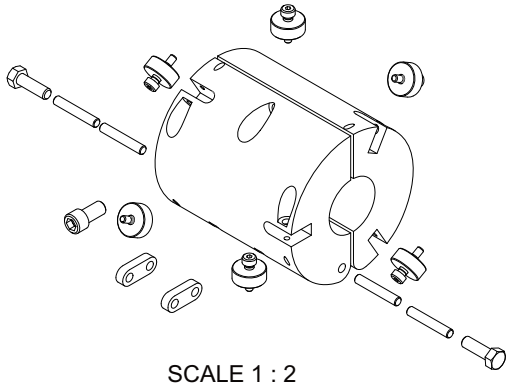
D.3.2 Electrical Drawings

Description	Type	Drawing
RBT003 Test Harness (8')	Wiring Diagram	*WD-9-4-03-30SHAR31-02*
RBT003 Calibration Cable (27")	Wiring Diagram	*WD-414193-A*

DO NOT SCALE



SECTION A-A



SCALE 1 : 2

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	413971	5 1/2" SONIC TEST TANK CLAMS 1 11/16 TOOL
2	6	4-2-03-250500SS	SCREW, SHLDR Sock SS 1/4 x 1/2
3	2	4-2-03-516181SS	SCREW HEX CAP SS 5/16-18 X 1"
4	2	2-5-03-00021571	Hinge Plate for Clams
5	6	414028	CLAM WHEEL FOR 5 1/2" I/D
6	4	4-2-06-23804300	PIN DOWEL SS, .250 X 1.50
7	1	4-2-03-3751634A	SCREW SOCKET CAP HD 3/8-16 UNC 3/4" LG SS

ISS	DESCRIPTION	APPR'D	DATE
02	REF ECR 5-84153	TG	06/01/12

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: 1 11/16 TEST TOOL
MASS: 2.93 kg

MODEL'D	DRAWN	CHECK'D	APPV'D
DVH	DVH	RPM	TG
08/12/11	08/12/11	C DATE	A DATE

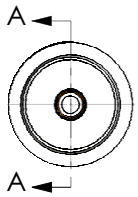
MATERIAL: SEE PARTS LIST
HEAT TREATMENT: N/A

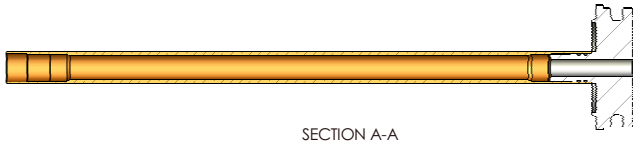
GE Oil & Gas

TITLE: ASSEMBLY SONIC CLAM SHELL 1 11/16

SCALE: 1:1
DRAWING No.: 9-5-03-000215A2
REVISION: 02
SHEET: 1 OF 1
A2

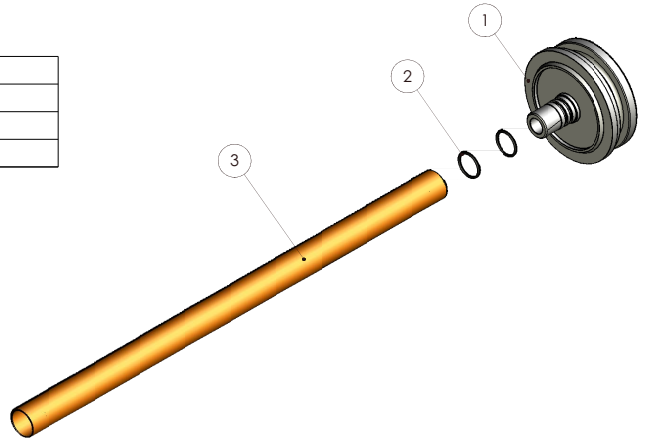
DO NOT SCALE





SECTION A-A

ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2-5-03-00010041	CAL TANK FLANGE - 1 11/16"
2	2	4-2-09-V2189000	O-RING VITON 90 218
3	1	2-5-00-00010141	Cal Tank Adapter Housing



DRAWN: CB	CHECKED: DP	APP'D: -
DATE: 6/Sep/05	DATE: 6/Sep/05	DATE: -

DIM IN	MATERIAL:
INCHES	-
SCALE 1:8 / SIZE A	HEAT TREATMENT/CONDITION: -

ISS	DESCRIPTION	APPD	DATE
-01	Initial Release	-	-

Sondex CSS
Tel. 1 403 235 6533

THIRD ANGLE PROJECTION

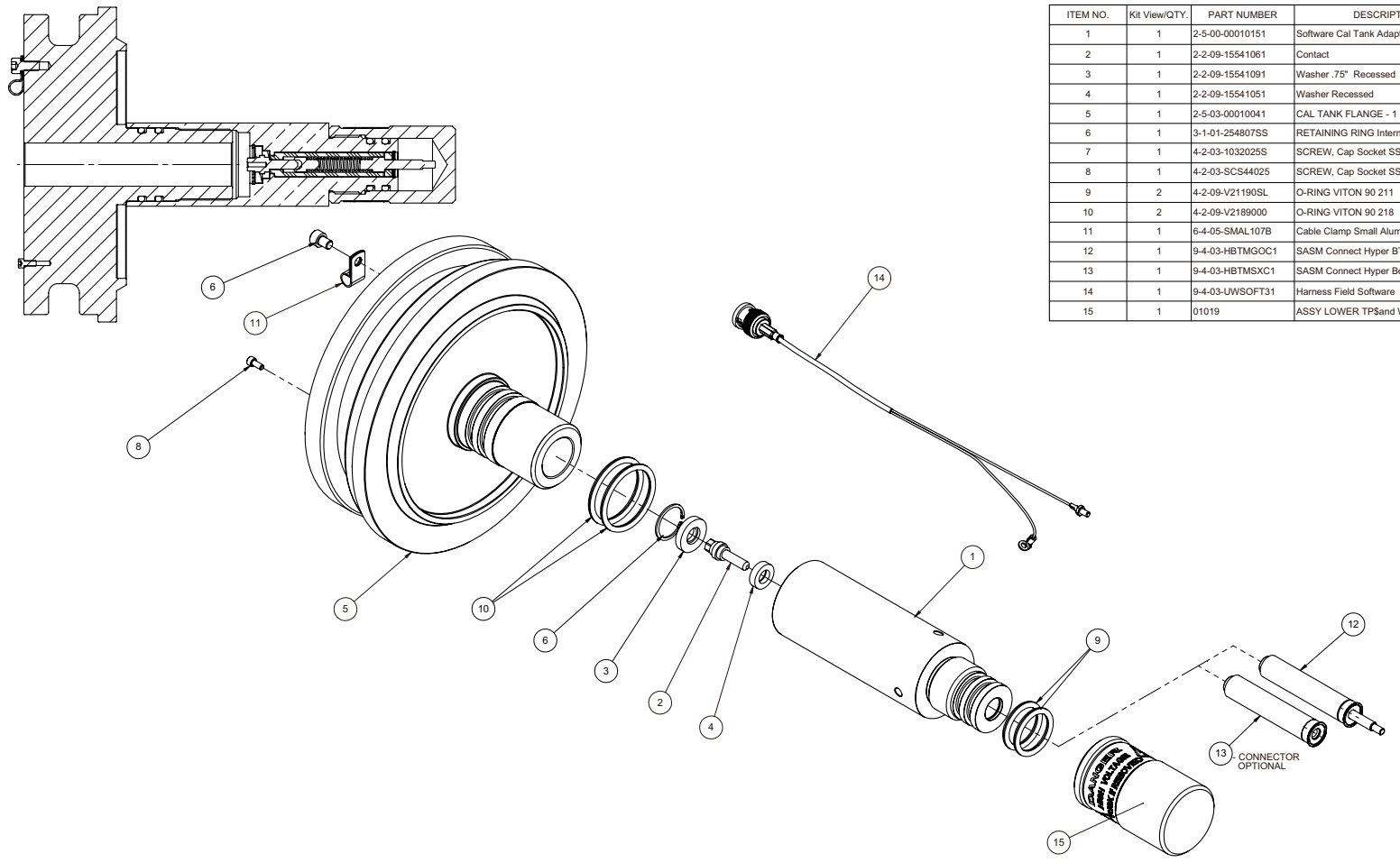
GEN TOL	
0.X	±0.020"
0.XX	±0.010"
0.XXX	±0.005"
ANGLE	±0.5°

MACHINE FINISH 63
SHEET 1/1

TITLE: - 1 11/16 Cal Adapter
USED ON: -
DRAWING No. 9-5-03-000301A1
ISSUE -01
S W

Nov 30, 06 3:42:50 PM dpark
V:\Development\Wireline Division\Mechanical DWG\9-5-03\9-5-03-000301A1\OLD REVS\9-5-03-000301A1

DO NOT SCALE



ITEM NO.	Kit View/QTY.	PART NUMBER	DESCRIPTION
1	1	2-5-00-00010151	Software Cal Tank Adapter
2	1	2-2-09-15541061	Contact
3	1	2-2-09-15541091	Washer .75" Recessed
4	1	2-2-09-15541051	Washer Recessed
5	1	2-5-03-00010041	CAL TANK FLANGE - 1 11/16"
6	1	3-1-01-254807SS	RETAINING RING Internal 0.750"
7	1	4-2-03-1032025S	SCREW, Cap Socket SS 10-32x0.250
8	1	4-2-03-SCS44025	SCREW, Cap Socket SS 4-40x0.25
9	2	4-2-09-V21190SL	O-RING VITON 90 211
10	2	4-2-09-V2189000	O-RING VITON 90 218
11	1	6-4-05-SMAL107B	Cable Clamp Small Aluminum 1/4"
12	1	9-4-03-HBTMGOC1	SASM Connect Hyper BTM Go
13	1	9-4-03-HBTMSXC1	SASM Connect Hyper Bottom SX
14	1	9-4-03-UWSOFT31	Harness Field Software
15	1	01019	ASSY LOWER TP$and WARNING LABEL

Rev	Date	Approver	ECR Comments
02	02/10/12	GC	ECR 5-97311
01			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: CAL116 & CAL318

MASS: 1.628 kg

MODELLED	DRAWN	CHECKED	APPR'D
KR	KR	TA	GC
17/05/07	17/05/07	27/06/07	03/10/12

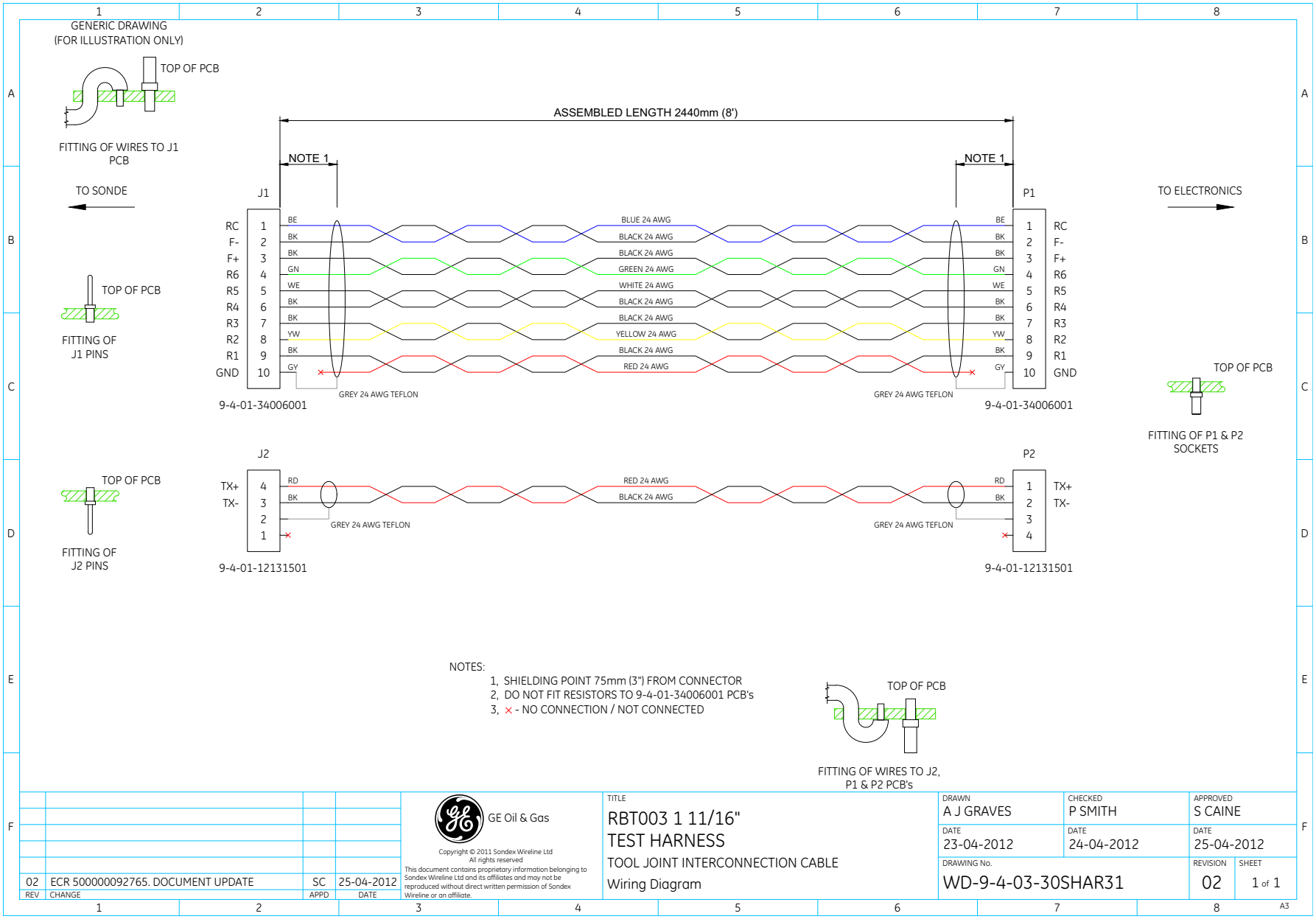
MATERIAL: N/A

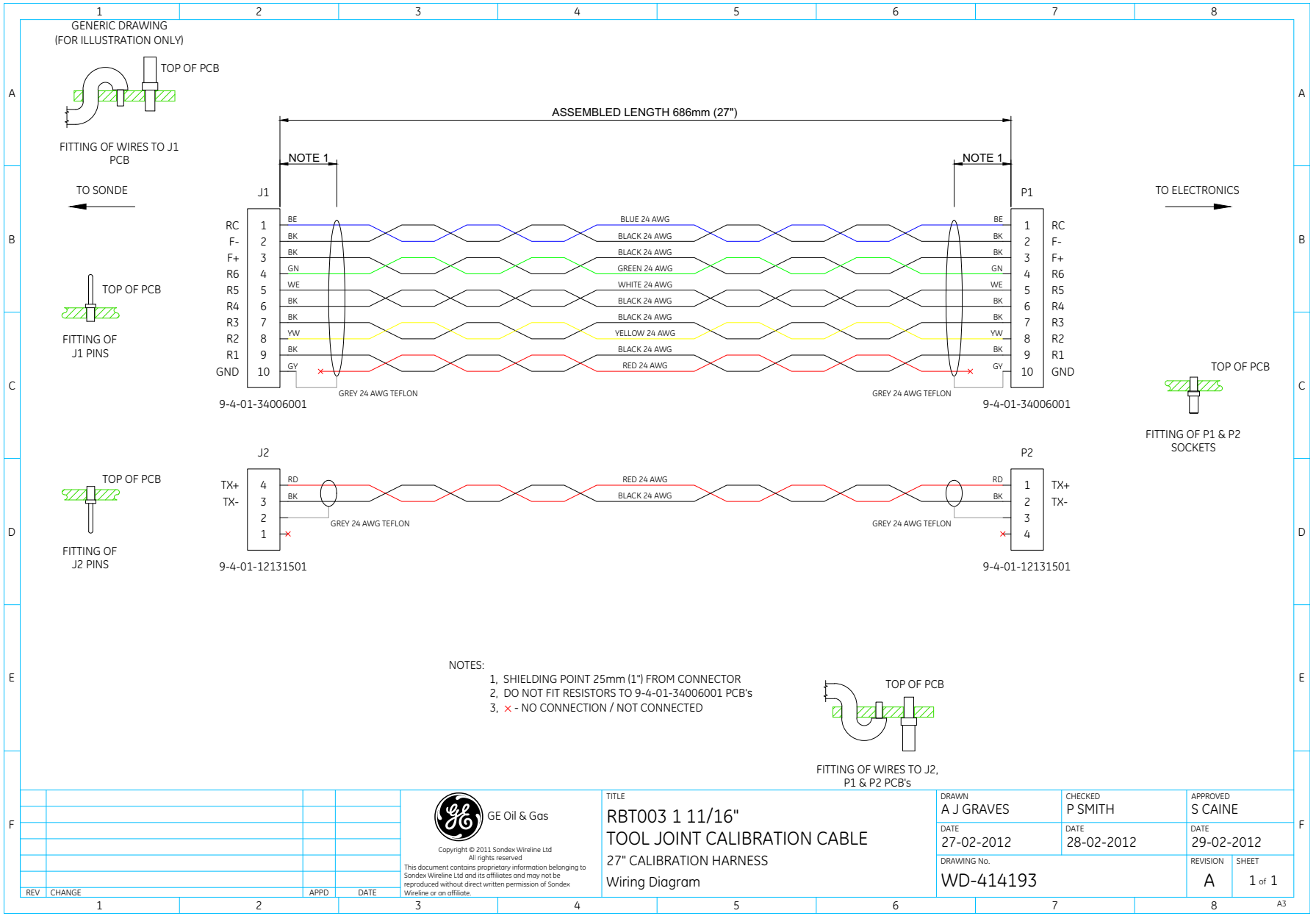
HEAT TREATMENT: N/A

GE Oil & Gas

TITLE: Adapter, Hyper Software Cal

SCALE	DRAWING No.	REVISION	SHEET	
1:2	9-5-03-000200A1	02	1 OF 1	A3





APPENDIX E INTERPRETATION CHART

OD Inches	Max Amplitude mV	Weight lb/ft	3 ft Receiver Travel Time µs	Minimum Amplitude mV	Nominal ID Inches	Drift Dia. Inches
4.5	81.2	9.50	198	0.2	4.090	3.965
		11.60	197	0.7	4.000	3.875
		13.50	195	1.2	3.920	3.795
5	77	15.00	203	1.0	4.408	4.283
		18.00	201	2.4	4.276	4.151
		21.00	199	4.0	4.154	4.029
5.5	71.9	15.50	213	0.8	4.950	4.825
		17.00	212	1.1	4.892	4.767
		20.00	210	2.3	4.778	4.653
		23.00	208	3.8	4.670	4.555
7	62.2	23.00	237	1.1	6.366	6.241
		26.00	235	1.8	6.276	6.151
		29.00	234	2.5	6.184	6.059
		32.00	232	3.5	6.094	5.969
		35.00	231	4.2	6.004	5.879
		38.00	229	5.3	5.920	5.795
		40.00	228	6.4	5.836	5.711
7.625	59	26.40	247	1.2	6.969	6.844
		29.70	245	1.9	6.875	6.750
		33.70	244	2.8	6.765	6.640
		39.00	241	3.7	6.625	6.500
9.625	51.3	40.00	279	2.0	8.835	8.679
		43.50	277	2.5	8.755	8.599
		47.00	276	3.0	8.681	8.525
		53.50	274	4.5	8.535	8.389
13.375	41.9					

Note: The maximum amplitude for the 13.375" diameter was extrapolated using the data above.

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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

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