



Kuster Company

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K10 Geothermal PTS-Memory Tool

Operation & Service Manual



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I. Scope.

The manual applies to the Kuster Company K10 HT EMR Geothermal PTS Tool.

II. Purpose.

The purpose of this manual is to describe in sufficient detail all necessary steps to assemble, program, disassemble, download and maintain the tool.

III. Description.

The Kuster K10 PTS tool is a subsurface high temperature tool designed to continuously measure and record downhole temperature, pressure and flow in geothermal wells.

Features:

- Robust electronic section
- Piezoresistive pressure sensor
- Fast response RTD temperature sensor
- Depth data with serial encoder for Pressure/Temperature/Flow

The K10 PTS tool is able to be downhole for up to 6 hours at 300C and 4 hours at 350C. The electronic section of the instrument is encased in a pressure housing, which thermally protects it from the high geothermal temperatures. The pressure transducer senses well bore pressure through a capillary tube, while the RTD sensor remains exposed to the well bore for accurate and fast response temperature sensing and recording. Interchangeable flow meters and impellers allow you to choose what is best suited for the flow conditions. All materials meet NACE MRO175 specifications for corrosive well bore media.

Specifications

Dimensions:

Outside diameter:.....1.75"
 Length:......66"
 Outer housing pressure collapse:.....5,000 psi

Pressure:

Range:.....up to 5,000 psi
 Accuracy:.....0.05% F.S.
 Resolution:.....0.0003% F.S.

Flowmeter/Spinner (Continuous):

O.D.:.....2-1/8" and 1-11/16"
 Sensors:.....Reed switch/Magnetic
 Resolution:.....0.25 RPS 0.8 RPS
 Data:.....Flow with directional sensing
 Flow rate:.....300 RPM (Min)/20,000 RPM (Max)

Temperature:

Accuracy:.....0.015% F.S.
 Resolution:.....0.002% F.S.
 Downhole time:.....6 hours at 300C
4 hours at 350C





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Electronics:

Power:.....single "AA" battery
Number of data points:.....1,400,000
Minimum sample range:.....1 sec
Interface:.....USB
Software:.....Windows 98 and higher

IV. Performance.

The K10 HT EMR Geothermal PTS Tool is designed for geothermal bottom hole pressure and temperature and for flow work. It has been tested in a variety of time/temperature scenarios, but not all. There exists a complex relationship between external temperature, internal temperature, and down hole time.

If there is any doubt as to the suitability of the instrument for a planned survey, please contact Kuster Company.

V. Definitions.

There are three specific definitions, which are used through out this document, which are necessary to understand.

Note: A note indicates a step, procedure, or process, which is necessary to highlight for successful operation.

CAUTION:

A caution indicates a step, procedure, or process which if not followed correctly could result in damage to equipment.

WARNING:

A warning indicates a step, procedure, or process which if not followed correctly could result in damage to equipment and/or injury to personnel.

VI. Assembly

A. Flow Meter Assembly, Reference Drawing 18600-500

1. Inspect Impeller, does it move freely?
2. Inspect Lower Bearing. Part #: 18600 - 509
3. Check O-ring
4. Inspect Upper Bearing. Part #: 18600 - 509
5. Inspect Magnet. Part #: 18600 - 507
6. Weight Balance - Non-Magnetic. Part #: 18600 - 506

CAUTION

Protect Magnet Hub with Protective Guard while Flow Meter is not installed with tool. So that magnet will not be able to magnetize any particular object.



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B. Sub Assembly

CAUTION

Exercise caution when handling the Sub Assembly. Two particular areas, which are subject to damage due to mishandling, are the wires coming from the flowmeter and temp. sensor to the board and the Insulator Tube. See Reference Drawing.

1. Inspect Sub Assembly, Part Number 18600-510, for damage, cleanliness, and serviceability. In particular, all threads should be looked at closely for signs of debris or damage.
2. Inspect outside diameter of O-ring glands for signs of damage or galling.
3. Inspect lead wires from temperature sensor for cuts, nicks and abrasions.
4. Install Metal C-ring, Part Number 18500-413.
5. Install O-rings, 2 each, Part Number 707-123.
6. Remove Gauge Bulkhead Cover, Part Number 18500-421, if installed.
7. Inspect external threads and O-ring glands on gauge bulkhead for damage, cleanliness and serviceability.
8. Install O-rings, 2 each, Part Number 706-015.

Note: Kuster Company Hi-Temp Lubricant, Part Number 915-001, is the factory recommended lubricant to be used for this tool. It has been formulated for high temperature applications and as an anti-galling agent. Other substitutions could be acceptable, but have not been tested.

9. Lubricate the external threads of the gauge bulkhead and the both O-rings with Hi-Temp Lubricant and set aside.

C. Gauge – Sub Assembly: See Reference Drawing

1. With nose of Gauge Assembly pointed upward, pour into the nose cavity about 10 cc of Kuster Company Transfer Fluid, Part Number 901-103. Put thumb over the locking screw to protect fluid leakage.
2. With the Gauge Assembly maintained in a nose upward attitude, install the sub assembly until pressure can be felt. This will be approximately 5 numbers of turns or 0.3” of travel.
3. Secure the Gauge – Sub Assembly in a vice clamping mid-body on the Gauge Assembly. Using a wrench on the gauge bulkhead only. Slowly rotate sub assembly in a clockwise direction until the sub assembly bottoms out on the nose of the gauge assembly. The additional force felt is the silicone oil being forced up the capillary tube to the pressure port.
4. Once the gauge has bottomed out on the gauge bulkhead, secure the gauge assembly to the gauge bulkhead using the setscrew.
5. Install 1/8”-27 NPT Plug, Part Number 18600 - 346 in filter cavity. Put Kuster High Temp Lube on thread. Use 7/16” Nut Driver to tightened plug. Do not over torque.
6. Connect the temperature sensor and flow meter leads.
Note: Match the colors of wire when connect each other.



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7. Using High Temperature Polyimide Tape (Kapton), Part Number 18730-015, tape down all wires in the region shown on drawing.

8. Programming the tool. All software related issues are covered in the K10 Software Manual.

Note: When programming the tool, the computer time is synchronized with the tool and is kept active for approximately 5 minutes without power. You must connect the battery to the tool within the 5 minute time period in order to retain the time stamp. If the time period is going to be longer than 5 minutes, the start time can be set manually by using the "Set Start Time" option from the drop down menus.

D. Flask Assembly

Lubricate the external threads on the Gauge Bulkhead with Temperature Lubricant and install Gauge Cover.

1. Inspect battery to ensure that it:
 - Has sufficient Ah remaining for the survey.
 - Has sufficient voltage to start the tool.
 - Is clean, dry and serviceable.
2. Install battery.
3. Verify that the LED on the battery emits four flashes approximately 1 second apart and four flashes approximately 10 seconds apart.
4. Record the time that the battery was connected.
5. Lubricate the external threads on the heat sink and install Heat Sink on to Gauge Cover hand tight.
6. Lubricate remaining threads and O-rings on Sub Assembly.
7. Secure flask open end up and install Sub-Gauge Cover-Heat Sink assembly. Slowly screw assembly together until the Metal C-ring bottoms out. Tighten payload to heat shield and torque between 90-100 ft/lbs.
8. Remove plug from filter cavity and install filter, Part # 18600-535 with wrench hand tight.
9. Lubricate remaining external threads on sub.
11. Install the Flow Meter.



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VII. Operation

A. Rigging up.

1. Connect entire pre-assembled unit to wireline. Note that the pin on the flask is a 1.25"-8 UN-2A thread.
2. Tighten unit to rope socket using the 1.62" wrench flats nearest the pin.
3. The rigging up of the lubricator and associated equipment remains the same as any other bottom hole pressure work.
4. Dependent upon wellhead conditions, if there is significant pressure and/or temperature difference at surface, a 15-minute period of stabilization should be observed within the lubricator with the valve open.

B. Running the tool.

WARNING

Exceeding down hole time and temperature combinations could cause injury to personnel or damage to equipment.

1. The tool is run from this point forward like any other down hole recorder.
2. The tool should be run no faster than 150 feet/minute.
3. The tool should be pulled out of the hole no faster than 150 feet/minute.

C. Rigging Down

CAUTION

Do not submerge the tool in any liquid to advance the normal cooling rate, damage to equipment could occur.

1. Immediately after separating the Heat Shield Assembly from the rope socket, the tool should be placed horizontally on the ground or some other heat sink to allow it to cool as fast as possible.

D. Disassembly. Refer to Drawing 18500-500.

CAUTION

Do not attempt disassembly of tool until the exterior temperature reaches 115°F or you are able to hold it at the thread with your bare hand for a minute without discomfort.

1. Remove Flow Meter and Bull Nose.

CAUTION

Disassemble Flow meter right after each run, clean it up and dry it down. Calcium build up or corrosion may occur, which will make disassemble very difficult. Disassemble-Assemble procedure is covered later chapter of this manual.



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2. Remove Heat Shield.
3. Remove Heat Sink.

WARNING

Do not attempt to remove the battery unless it is cool to the touch. Safety glasses should be worn when removing the battery. It is a good practice to let the battery be exposed to ambient air for 10 minutes following removal of the heat sink and prior to removing the battery.

4. Remove battery by grasping at the base. Do not pull on the battery cell itself.
5. Remove Gauge Cover

E. Downloading Tool.

1. All steps necessary to download data from the tool are covered in the K10 software manual.

VIII. Maintenance.

A. Temperature Probe Cover.

1. Inspect for damage and serviceability.

B. Heat Shield.

1. Wash with solvent internal threads and O-ring surfaces.
2. Inspect internal threads and O-ring surfaces for damage, signs of galling, and serviceability.
3. Wash the exterior of the heat shield with solvent to remove any corrosive residue left from the well bore media.
4. Install Dust cover on open side to protect.
5. Store in case.

C. Heat Sink.

1. Wash external threads with solvent.
2. Inspect external threads for damage and serviceability.
3. Store in case.

D. Gauge Cover.

1. Wash completely with solvent.
2. Inspect internal threads for damage and serviceability.
3. Store in case.

E. Gauge – Sub Assembly.

1. Remove Kapton tape.



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2. Disconnect 9-pin micro connector.
3. Remove Gauge Assembly from Sub Assembly.
4. Gauge Assembly. The Gauge Assembly requires no operator maintenance. Store in case.

F. Sub Assembly.

1. Remove all O-rings, the metal C-ring and discard them. These consumable parts are a “one time use” only component.
2. Wash external threads and O-ring glands with solvent.
3. Flush capillary tube with solvent.
4. Inspect all external threads and O-ring glands for damage, signs of galling, and serviceability.
5. Install Temperature Sensor Protective Cover.
6. Install Gauge Bulkhead Protective Cover.
7. Store in case.

G. Flow Meter Disassembly.

There is sequence of maintenance for Flow Meter Assembly.

- 1- Snap ring from top of Magnet Holder
- 2- Unscrew cap screw on the top of the magnet hub



- 3- Unscrew set screws and remove magnet hub from the shaft.





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- 4- Remove Shim (Shims)



- 5- Remove Bushing from the shaft.



- 6- Remove flow meter nose.



- 7- Unscrew two set screws from the impeller. You need to line up impeller set screw with a hole in the cage body and unscrew it using Allen wrench, which comes with the field kit. Then turn the impeller 180° and unscrew the second set screw.





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- 8- Remove the impeller from the shaft. If you have difficulties of doing that use Impeller puller, which comes with the field kit. There is a procedure of using the impeller puller.



Screw the Impeller puller housing onto the impeller. Note, that it is a left hand thread. Screw Impeller puller plunger into the puller's housing. Using two open-end wrenches that come with the field kit, push the impeller from the shaft.

- 9- Unscrew the flow meter's cage



- 10- Unscrew bearing cap from flow meter body.





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- 11- Take snap rings from the lower and upper ball bearings.



- 12- Remove the bearings off the shaft.



- 13- Remove the shaft.



- If you intended to reuse bearings, use the contact cleaner to wash them.
- Remove all o'rings and install new one.



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How to Replace Magnet:

If you would like to replace the magnet in the magnet hub, you need to:



- a) Take the snap ring from the hub.
- b) Remove the magnet that needs to be replaced.
- c) If Magnet is not coming out from Magnet Hub, try to push it out from the backside of the Magnet Hub.
- d) Put a new one in.

Note:

1. ***Depending on temperature replace magnet after every 2- 3 runs.***
2. ***There is only one magnet in the hub. The other piece is just a non-magnetic blank part for the balance.***
3. ***Bearing replacement is at the customer discretion. Having new bearings for every survey is preferable.***

4.6" PTS CENTRALIZER: In order to install a centralizer (see 6-9 above):

1. Remove flow meter nose.
2. Unscrew two setscrews from the impeller. You need to line up impeller set screw with a hole in the cage body and unscrew it using Allen wrench, which comes with the field kit. Then turn the impeller 180° and unscrew the second setscrew.
3. Remove the impeller from the shaft. If you have difficulties of doing that use Impeller puller, which comes with the field kit.
4. Unscrew the flow meter's cage
5. Replace a flow meter's cage with the centralizer and assemble in the reverse order.

Flow Meter Assembly

Here is the procedure to assemble Flow Meter.

1. Put upper bearing on impeller shaft
2. Insert shaft into a flow meter housing.
3. Fix bearing with a snap ring
4. Put the lower bearing on the shaft and fix it with the snap ring as well
5. Put bushing bearing on the shaft with smaller diameter ahead.
6. Install shim (shims) on the top of the bushing



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7. Install magnet hub assembly on the shaft. Be sure to line up set screws with the flats on the shaft. Do not tighten them at that time.
8. Install a cap screw inside the hub and tight it up. Do not over-torque.
9. Tight up magnet hub's set-screws on the flats of the shaft.
10. Install bearing cap on impeller body.
11. Install impeller on the shaft lining up set-screw of impeller with shafts flats and the hole in the cage. At the same time, impeller should be flushed up with shaft end.
12. Tighten up the set-screws with the Allen wrench through the hole in the cage.
13. Install a flow meter nose and tighten up.



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Filling the impeller housing with buffer fluid:

This procedure need is for protecting impeller bearings from the well fluids. Preferably it is need to be implemented right before running tool into the hole.

1. Assemble flow meter with the gauge



2. Remove one filler plug from impeller housing.
3. Insert fluid bottle nose tight inside the housing.



4. Squeeze the bottle and fill the housing with the oil until oil comes out of the bearing cap.
5. Install filler plug back and tight it up.



6. Turn the tool 180 and repeat the procedure on the second hole.



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IX. Flow Meter Part Numbers

Part #	Description
1. 18600 – 506	Weight Balance – Non Megnetic
2. 18600 – 507	Magnet, Alnico, 1/8"x1/2"
3. 18600 – 509	Bearing
4. 18600 – 510	K10 PTS Sub Assembly
5. 18600 – 520	K10 PTS Spinner Assy 2-1/8" O.D. Impeller 10"
6. 18600 – 525	K10 PTS Spinner Assy 1-11/16" O.D. Impeller 10"
7. 18600 – 530	Impeller Assy PTS 2-1/8" O.D., 5" Pitch
8. 18600 – 531	Impeller Assy PTS 2-1/8" O.D., 10 Pitch
9. 18600 – 533	Impeller Assy PTS 1-11/16" O.D. 5" Pitch
10. 18600 – 534	Impeller Assy PTS 1-11/16" O.D. 10" Pitch
11. 18600 – 535	Filter PTS, 1/8" NPT
12. 18600 – 536	Impeller Puller PTS
13. 18600 – 537	Impeller Puller Housing
14. 18600 – 538	Impeller Puller Bolt
15. 18600 – 539	Impeller Puller Plunger
16. 18600 – 540	Impeller Puller Plunger Assy

X. Storage.

Geothermal PTS tool should be stored in the case when not in use.

XI. References.

- A. Performance curves.
- B. Drawings.
- C. Bill of Materials.
- D. Calibration Verification Table.

XII. Technical Support.

Technical support can be obtained by contacting:

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Email kuster@kusterco.com

John Jacobson, General Manager: johnjacobson@kusterco.com

Javier Serrano, Engineering: javierserrano@kusterco.com

Igor Yevdayev, Engineering: igoryevdayev@kusterco.com



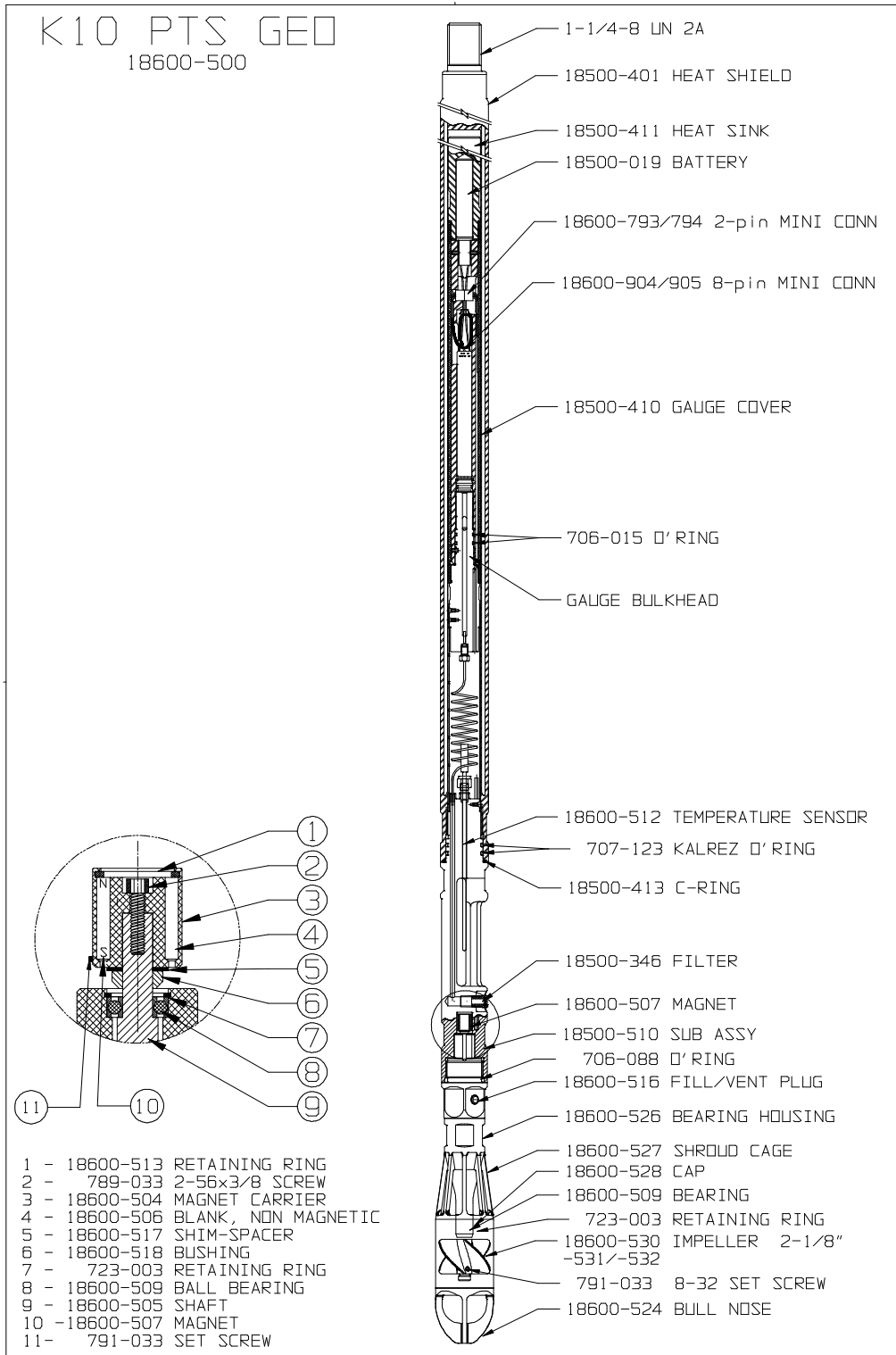
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XIII. K10 PTS ASSEMBLY





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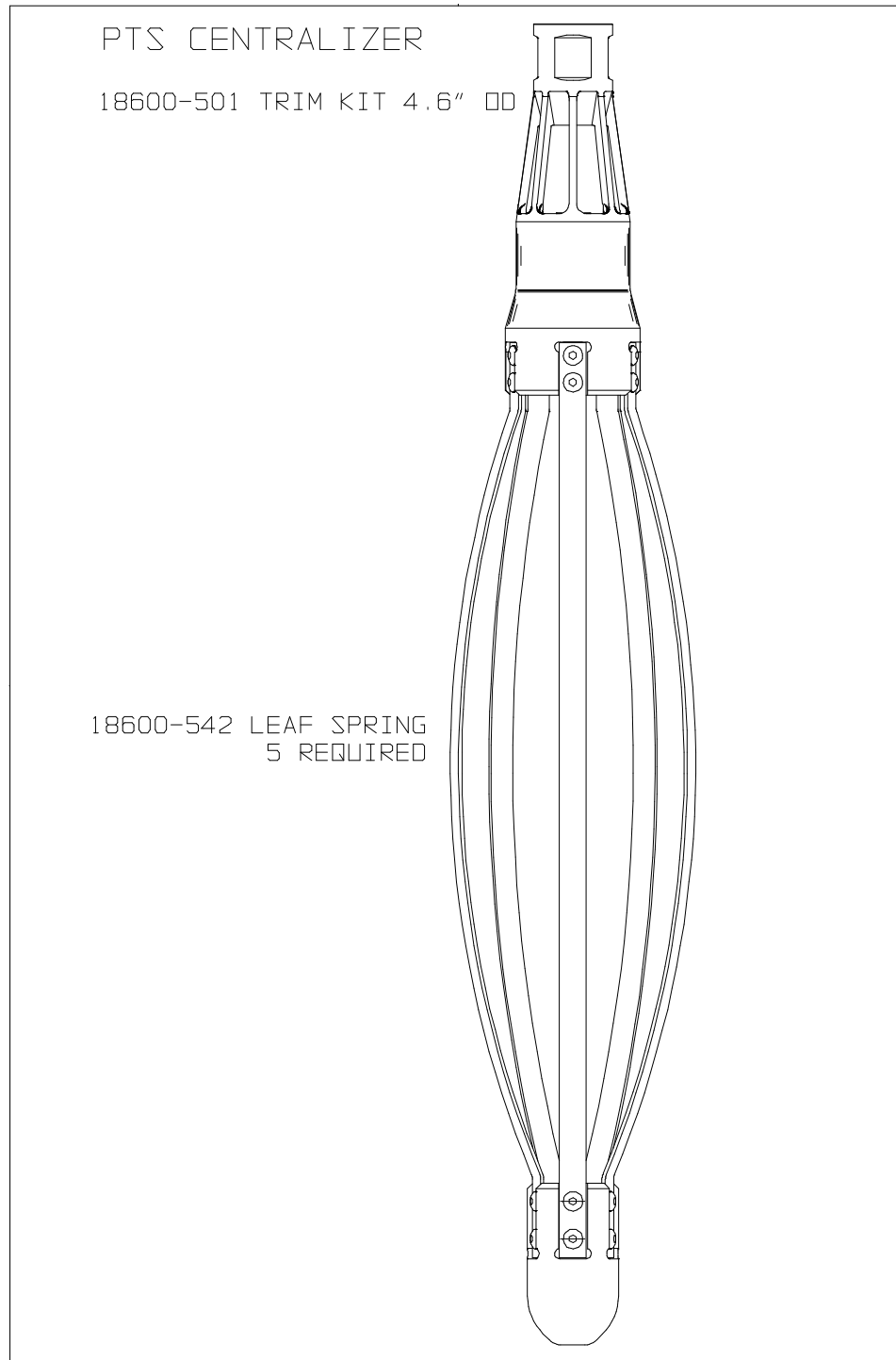
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XIV. CENTRALIZERS

4.6" SPRING CENTRALIZER

The PTS tool can be used with a 4.6" O.D. centralizer, which can be purchased from Kuster company as an accessory.





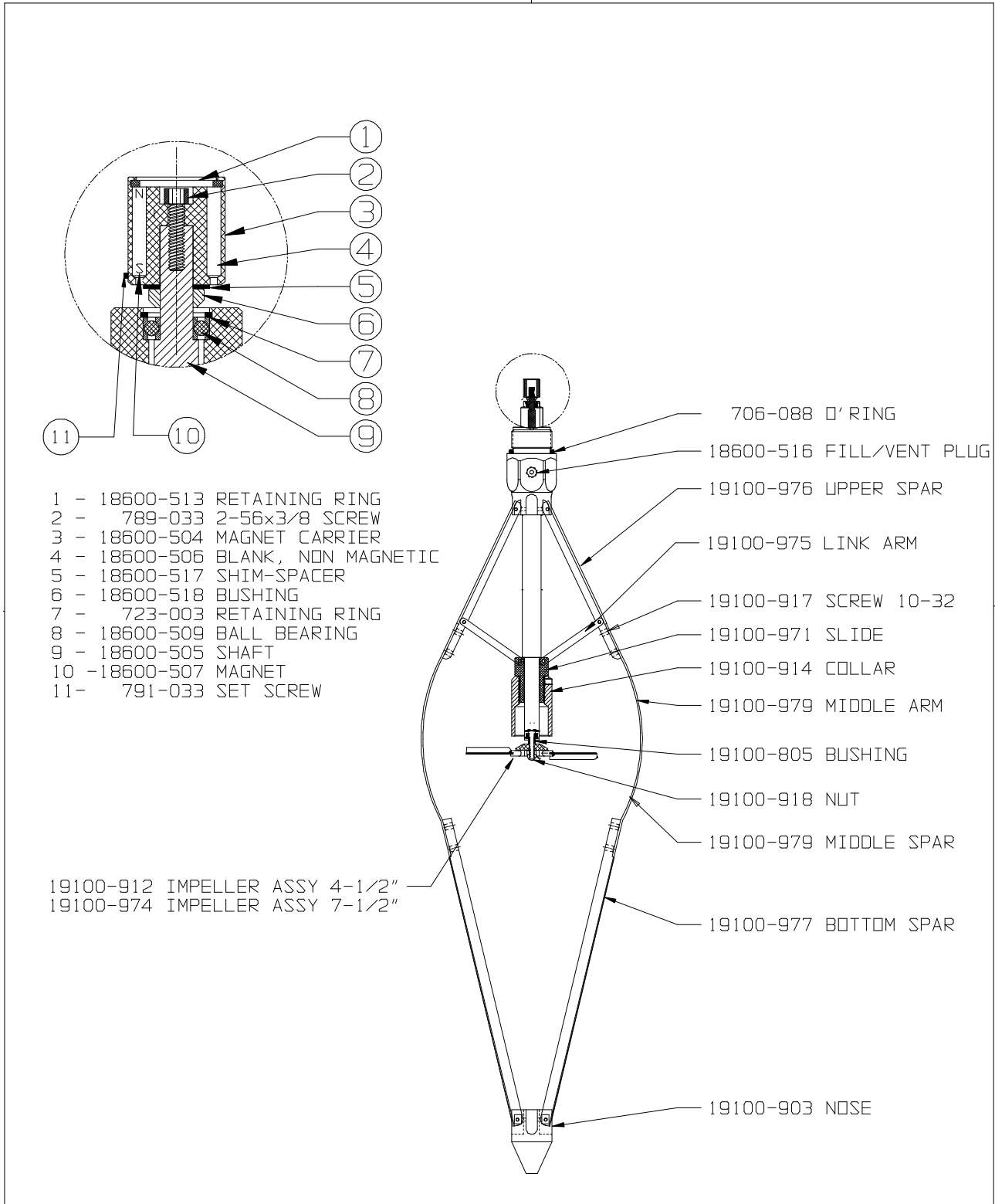
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XV. 7.5" FULL BORE FLOWMETER





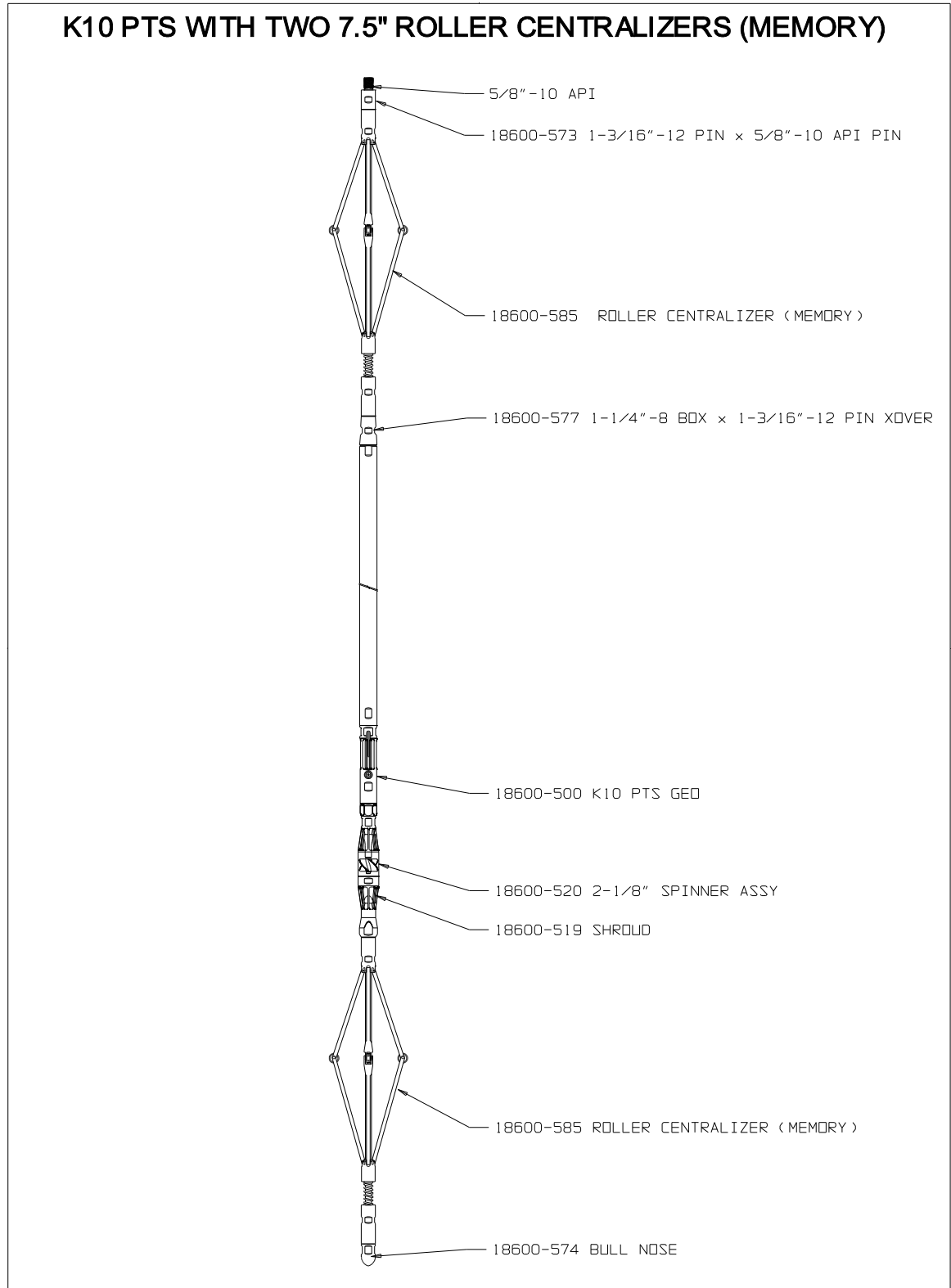
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XVI. 7.5" ROLLER CENTRALIZER

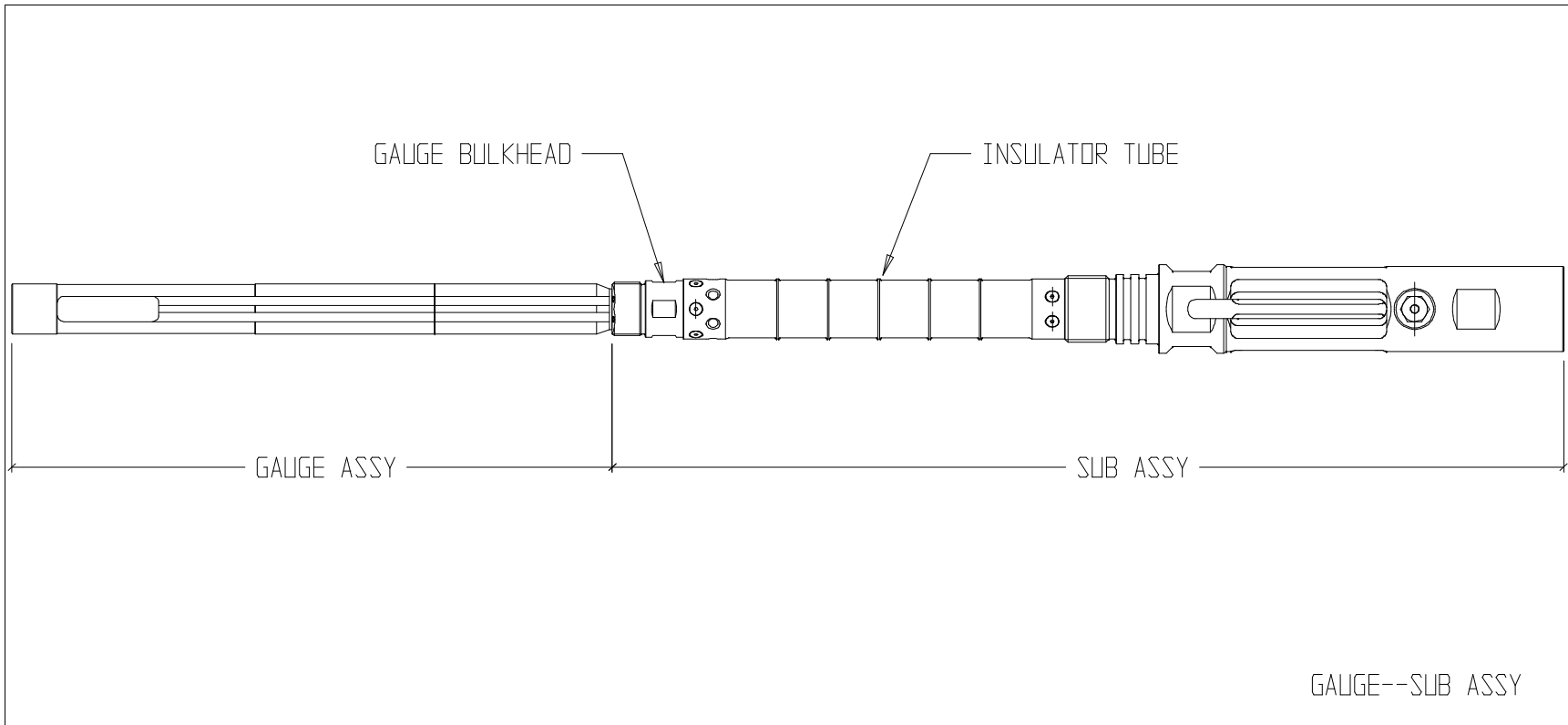




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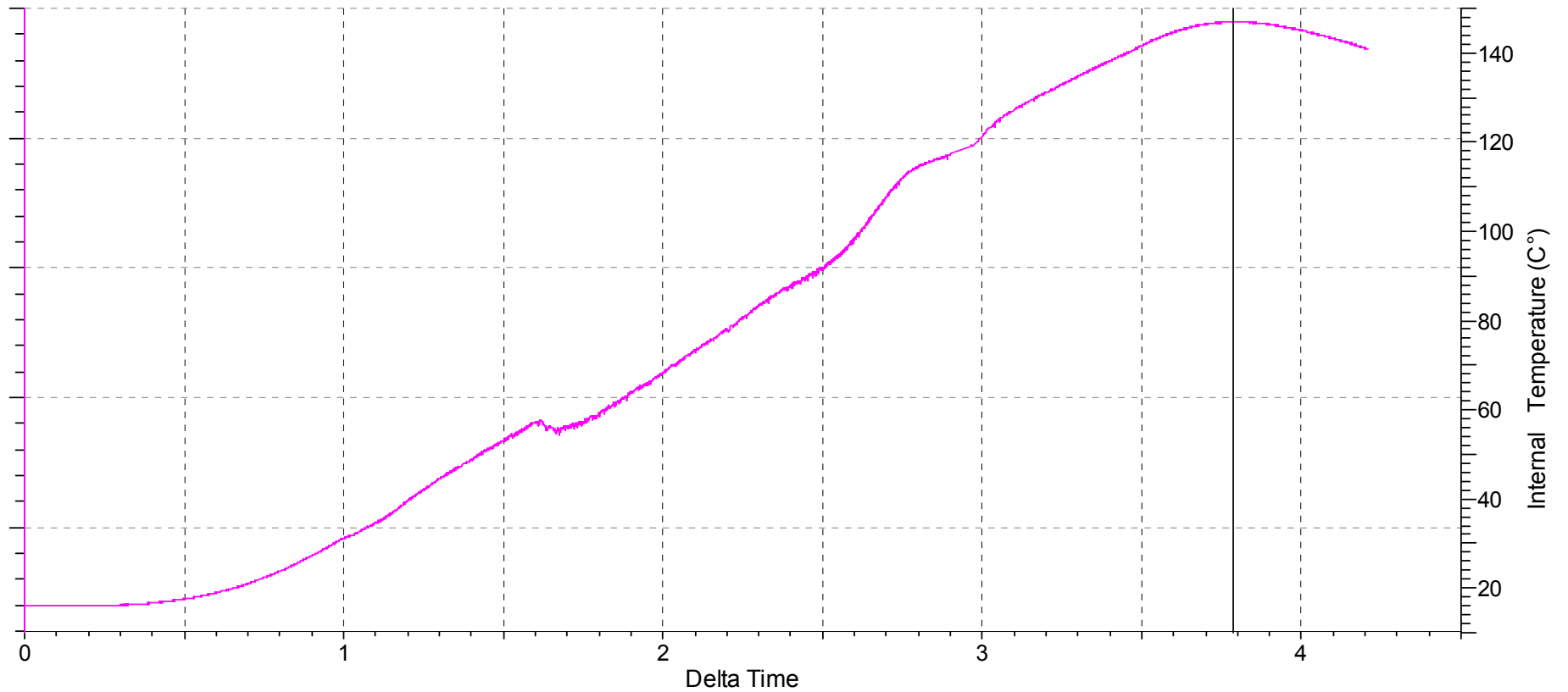
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XVIII. HEAT SHIELD PERFORMANCE CURVES:

KUSTER GEO 400C BATH TEST



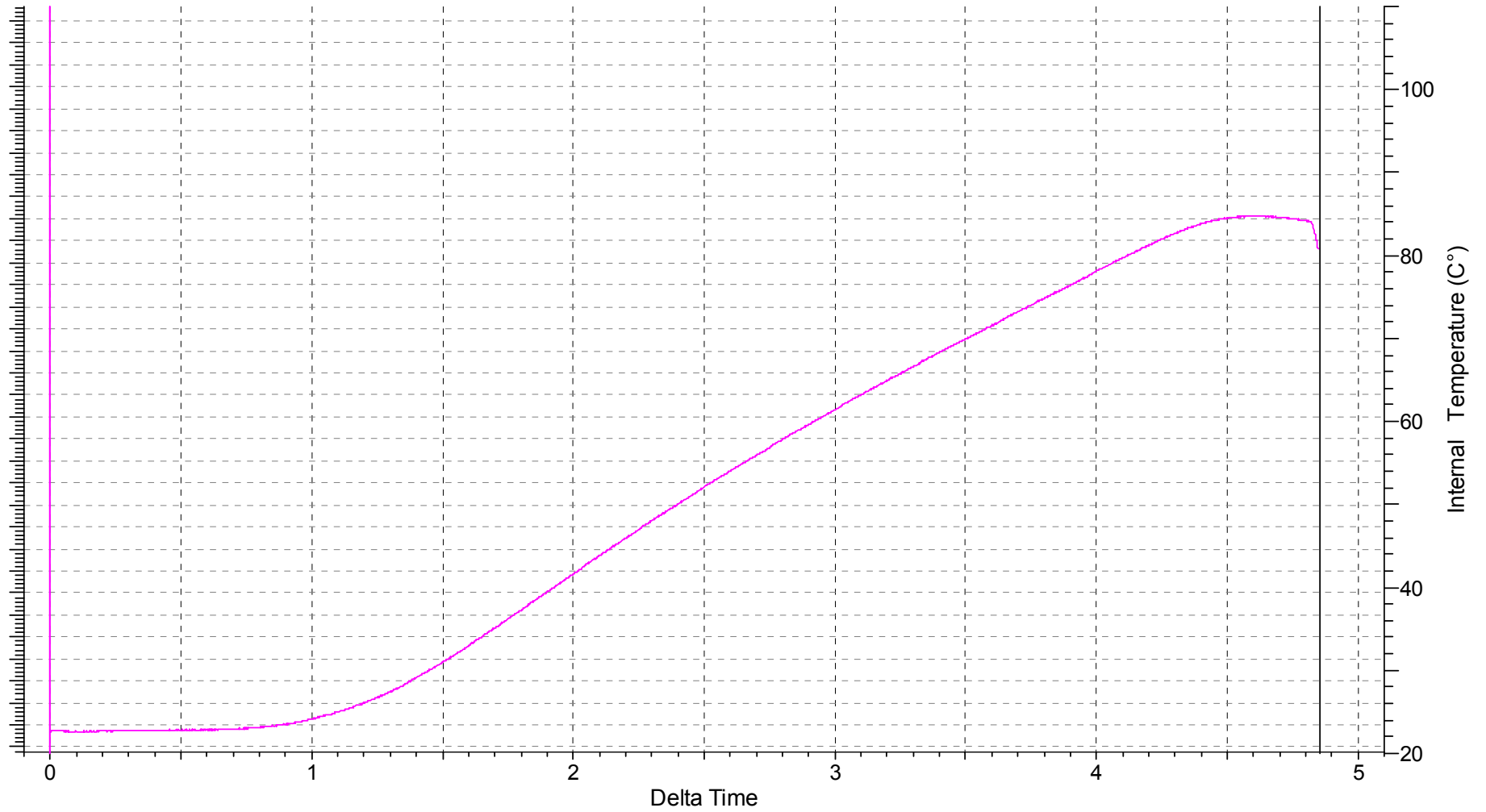


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KUSTER GEO 300C BATH TEST



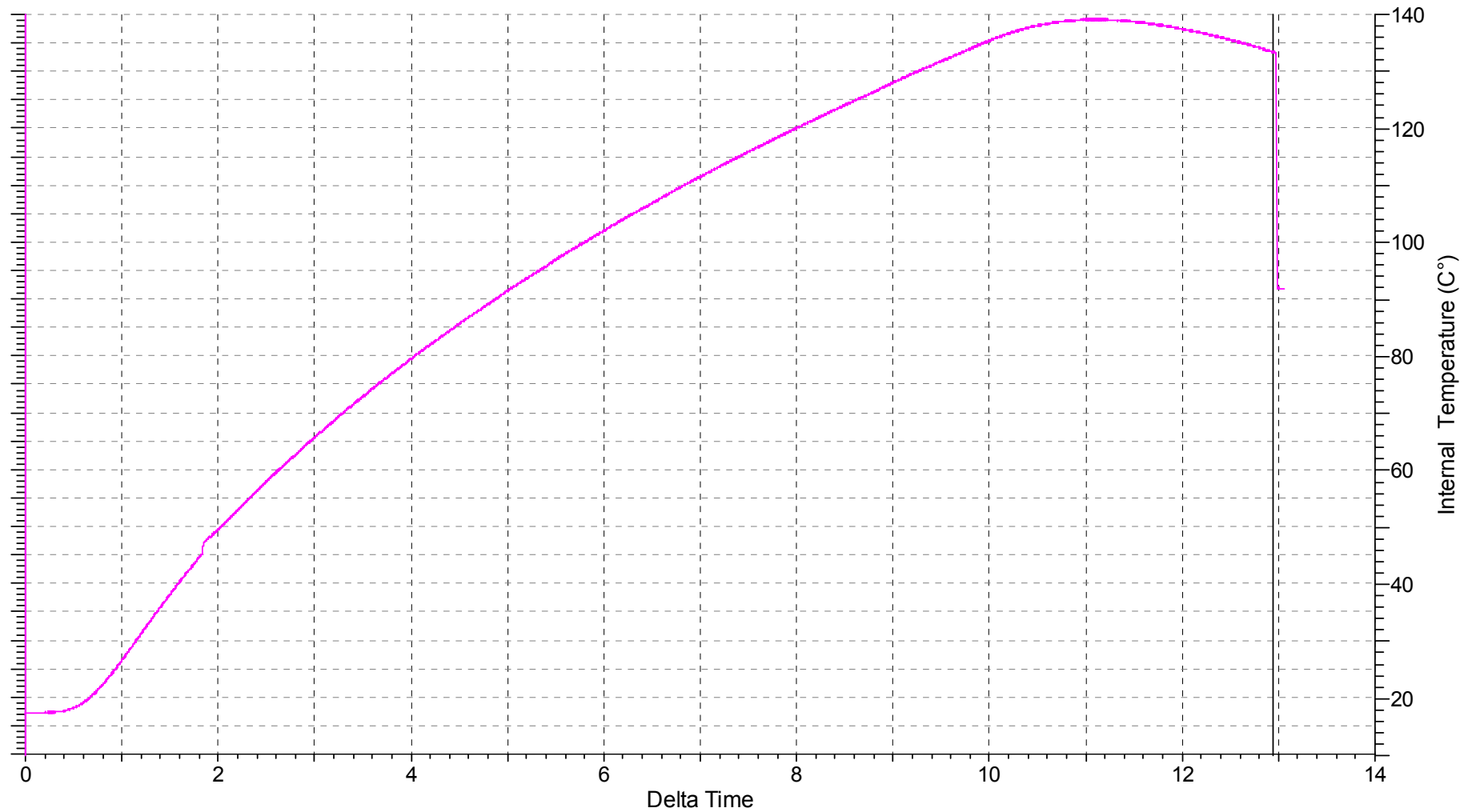


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KUSTER GEO 250C BATH TEST



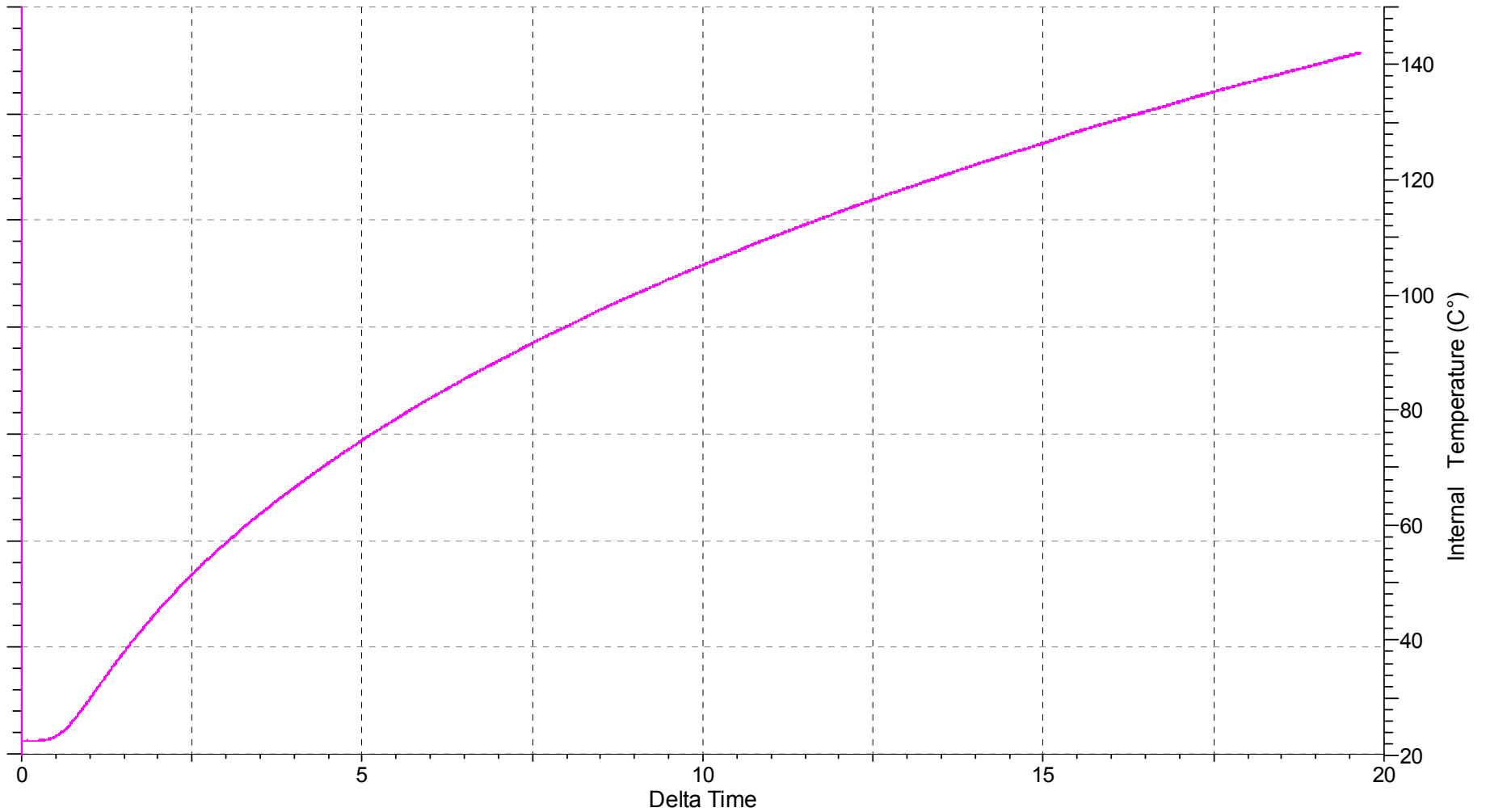


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KUSTER GEO 200C BATH TEST





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XIX. K10 PTS OPERATIONAL CHECKLIST



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Objective. The objective of this document is to provide step-by-step instructions on the preparation, use, and post-operative maintenance of the K10 PTS Geo Gauge. For more detailed instructions consult the K10 PTS Geo Service Manual and the K10 Software Operation Manual.

Definitions.

Note – A step, procedure, or piece of information that is necessary to highlight.

CAUTION – A step or procedure that if not followed could prevent operational use of the equipment.

WARNING – A step or procedure that if not followed could cause damage to equipment or personnel.



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Preparation

- Receive well survey tasking.
- Select tool.
- Meets temperature requirements.
- Meets pressure requirements.
- Verify o-rings are suitable for well bore conditions.
- Verify current calibration and DWT check.
- Select battery.
- Meets temperature requirements.
- Has sufficient Charge(Ah) remaining.
- Visually inspect battery.
- Connector is clean, dry, and serviceable.
- Insulation wrap has no cuts or abrasions.

WARNING

Under no circumstances is the temperature rating of the batteries to be exceeded.

Assembly

- Inspect Sub Assembly, Part #18600-510 for damage, cleanliness and serviceability. In particular, threads should be looked at closely for signs of debris or damage.
- Inspect outside diameter of O-ring glands for signs of damage of galling.
- Inspect lead wires for temperature sensor and flow meter for cuts, nicks and abrasion
- Install metal C-ring 18500-413
- Install o-rings, 2 each, 707-123
- Inspect external tread and O-ring glands of Bulkhead for damage.
- Install O-rings, 2 each, part #706-015
- Lubricate the external thread and O-rings of the bulkhead with Kuster Hi-Tem Lubricant (915-001) and set aside.
- Take the set screw off the nose cavity and close the hole with your thumb.
- With nose of Gauge assembly pointed upward, pour 27 cc of Kuster company Transfer Fluid into the nose cavity.
- With Gauge assembly maintained in upward attitude, install sub assembly until it bottoms out on the nose of the gauge assy. You will notice that oil is coming out of the pressure port. As soon as it happens, install Pressure port plug.

- Lined up the grooves with the Temp and Flow sensors leads and secure gauge assembly to the gauge bulkhead using a setscrew.
- Clean up whole assembly thoroughly and connect temp sensor 2-pin micro connectors and flow sensor 3-pin micro connectors. Match the colors when connect.
- Using High Temp Kapton tape, secure temp and flow sensors leads inside the groove.



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Note

See Software Operation Manual for a more detailed explanation of programming and programming options. This checklist is intended for a simplified, fixed rate well test.

- Program The Tool
- Turn on the computer.
- Start K10 Program
- Connect gauge to PC through I-Box.
- Communication LED will be on steady bright for approximately 10 seconds during the POST (Power On Self Test) and then go out for approximately 2-3 seconds. Then it will flash 4 times with 2 second interval, and then flash continuously every 1 second as the tool samples, but does not record. Any other sequenced flashing than indicated above may be an error code.
- Click Update button. Gauge information will appear in the Active Tool dialogue box, and button turned out green.
- Select the Program Tool page.
- Select the desired sample rate.
- Click Program now button.
- Disconnect gauge from the I-box.

-Finishing Assembly-

- Install battery.
- Verify that battery is sampling-you suppose to see a double flash, when gauge records a sample.
- Record the time that the battery was connected.
- Lubricate external thread on the Gauge Bulkhead and install Gauge Cover.
- Lubricate external thread and install Heat Sink on the top of the Gauge Cover. Hand tight it.
- Lubricate external thread and O-rings on Sub Assembly
- Slide the whole assembly into the Heat Shield (Flask).
- Slowly screw assembly together until metal C-ring bottoms out.
- Tighten to Heat Shield with 90-100 ft/lbs torque.
- When ready to put tool into lubricator, remove plug from the pressure port and replace it with a filter.

Flow Meter Assembly

- Inspect Impeller, does it move freely?
- Assemble flow meter with the rest of the tool.
- Remove one plug from impeller housing
- Insert bottle nose tight inside the housing
- Squeeze the bottle and fill the housing with oil until oil comes out of the bearing cap.
- Install plug back and tight it up
- Turn tool 180 degree and repeat the procedure.



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Running Well Survey.

- Connect entire unit to wireline. Note that the pin on the flask is a 1.25"-8 UN 2A thread.
- With the lubricator pressured up, allow the instrument at least fifteen minutes within the lubricator to stabilize before running in the hole.

CAUTION

The tool should not run into the hole faster than 50m/minute. Damage to gauge could occur if this limitation is not adhered to.

- RIH

WARNING:

Exceeding Down hole time and temperature combinations could cause injury to personnel or damage to equipment.

- POOH

CAUTION

After tool is out of the well do not submerge it in any liquid to advance the normal cooling rate. Damage to equipment could occur.

Tool should be place horizontally on the ground and cool down. Do not disassembly tool until you are able to hold it at the thread with your bear hand without discomfort.

- Remove Flow meter.

CAUTION

Disassemble Flow meter right after each run, clean it up and dry it down. Calcium build up or corrosion may occur, which will make disassemble very difficult.

- Remove Filter and replace with a plug.
- Remove Heat Shield, clean it, dry it and set in case
- Remove Heat Sink and Gauge Cover

WARNING:

Do not attempt to remove the battery unless it is cool to the touch. It is a good practice to let the battery be exposed to ambient air for 10 min prior removing from the gauge.

- Important: Remove battery by grasping at the base. Do not pull on the battery cell itself.
- Downloading Data From Gauge.
- Start K10 Program.
- Connect gauge to PC through I-box
- Communication LED will be on steady bright for approximately 10 seconds during the POST (Power On Self Test) and then go out for approximately 2-3 seconds. Then it will flash 4 times with 2 second interval, and then flash continuously every 1 second as the tool samples, but does not record.



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Any other sequenced flashing than indicated above may be an error code.

- Click Update button. Gauge information will appear in the Active Tool dialogue box, and button turned out green.
- Click Download Data button, give file a name and file would be downloaded to the computer.

Data manipulation is covered in the software manual.

Servicing Gauge.

Materials Required:

- A clean workbench with good lighting.
- 1 each Kuster High Temperature Thread Lube, P/N 915-001.
- Silicone oil – Dow Corning 200 Fluid (50cs to 200cs viscosity or similar)
- H₂S Inhibitor Oil – TRETOLITE KONTOL K-142 OR KP-12 manufactured by PETROLITE.
- Varsol or similar solvent.
- Clean rags.

Service Tool

CAUTION

Pipe wrenches should never be used on Kuster instruments.

Note

See attached diagram for reference to parts and part numbers.

-Heat Shield.

- Wash with solvent internal thread and O-ring surfaces.
- Inspect them for damage, signs of galling and serviceability.
- Wash the exterior of the heat shield with solvent to remove any corrosive residue left from the well-bore media.
- Store in case.

-Heat Sink

- Wash external thread with solvent.
- Inspect it for damage and serviceability.
- Store in case.

-Gauge Cover.

- Wash completely with solvent
- Inspect internal threads for damage and serviceability.
- Store in case.



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-Gauge-Sub Assy.

- Remove Kapton tape.
- Disconnect Temperature sensor 2-pin connector.
- Disconnect Flow sensor 3-pin connector
- Remove Gauge Assembly for Sub Assembly.
- Gauge assembly requires no maintenance. Store in case.

-Sub Assembly

- Remove all O-rings, metal C-ring and discard them. These consumable parts are "one time use" only components.
- Wash the external threads and O-ring glands with solvent.
- Flush capillary tube with solvent.
- Inspect all external threads and O-ring glands for damage, signs of galling, and serviceability.
- Install Gauge Bulkhead Protective cover
- Store in Case.

-Flow meter

- Unscrew cap screw from the top of magnet hub
- Unscrew set screws and remove magnet hub from the shaft
- Remove snap ring from the top of Magnet Holder
- Remove magnet from Magnet Holder and replace it with new one.
- Remove shim (shims)
- Remove bushing from the shaft
- Remove flow meter nose
- Unscrew two set screws from the impeller. For that, you need to line up impeller set screw with a hole in the cage body and use an Allen wrench. Turn 180 degree and remove the second set screw.
- Remove impeller from the shaft. Check for damage, replace if needed, clean it and put aside.
- Unscrew flow meter's cage
- Unscrew bearing cap from flowmeter body
- Take the snap rings from lower and upper ball bearings
- Remove the bearings check them, clean them using contact cleaner or replace if needed (replacement every other survey is recommended).
- Remove shaft. Check for damage and wear.

Assemble in reverse order and store in case.

Run Sheet

Oil Company Name: _____

Contact Name: _____

Report Required By (YY/MM/DD): ____/____/____



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Well No.: _____

Field and Pool: _____

Status: _____

Type Of Test: _____

Estimated Bottom Hole Pressure: _____

Estimated Bottom Hole Temperature: _____

Shut-In-Date (YY/MM/DD/HR:MM:SS)

Start: _____ / _____

End: _____ / _____

On Bottom: _____ / _____

Off Bottom: _____ / _____

Duration: _____

Battery Information

Pre-Test Battery Stats			
Gauge S/N	Battery S/N	Voltage	Total Hours used



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Notes:

Kuster Company supplies on all tools a general purpose o-ring of fluorocarbon compound suitable for most applications. However, it is the decision of each individual end user to determine which o-rings are best for his/her own application. Selection of inappropriate o-rings for well bore conditions may damage the tool and nullify any warranty policy. Consult the factory if you are unsure what type of o-ring is best for your application.