PHASE 2 INITIAL BOREHOLE DRILLING AND TESTING AT IG_BH04/05/06 - IGNACE AREA

WP08 Data Report - Temporary Well Sealing for IG_BH04

APM-REP-01332-0282 **March 2022**

Golder Associates Ltd.

nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Nuclear Waste Management Organization
22 St. Clair Avenue East, 4th Floor
Toronto, Ontario
M4T 2S3
Canada

Tel: 416-934-9814
Web: www.nwmo.ca

GOLDER
MEMBER OF WSP

REPORT

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WP08 Data Report - Temporary Well Sealing for IG_BH04

Submitted to:

Nuclear Waste Management Organization

4th Floor
22 St. Clair Avenue East
Toronto, Ontario, M4T2S3

Submitted by:

Golder Associates Ltd.

6925 Century Avenue, Suite #100 Mississauga, Ontario, L5N 7K2 Canada

+1 905 567 4444

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WP08 DATA REPORT
TEMPORARY WELL SEALING FOR IG_BH04

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Address:	22 St. Clair Avenue East, 4th Floor
City:	Toronto
Province:	Ontario
Postal Code:	M4T 2S3

Client Contact:	Alec Blyth	Maria Sánchez-Rico Castejón	Natacha Bizarro Lugo
Telephone:	647-259-3724	647-259-3720	
Email:	ablyth@nwmo.ca	msanchez@nwmo.ca	nlugo@nwmo.ca

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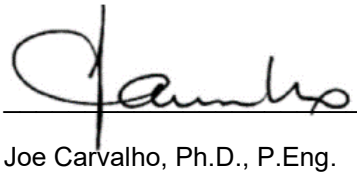
SIGNATURES

Prepared by: 

Steve Hales, P.Geo.
Hydrogeologist

Reviewed by: 

Michael Lemon
Associate

Approved by: 

Joe Carvalho, Ph.D., P.Eng.
Senior Geotechnical Engineer – Principal

Table of Contents

1.0 INTRODUCTION 1

2.0 BACKGROUND INFORMATION 1

2.1 Geological Setting 1

3.0 DESCRIPTION OF ACTIVITIES 5

3.1 Technical Objectives 5

3.2 Sealing with Bridge Plugs and Mechanical Packer 5

3.3 Determining Bridge Plug Locations 5

3.3.1 Inputs from Groundwater Chemistry (WP07) 6

3.3.2 Hydraulic Gradients and Hydraulically Conductive Zones (WP05, WP06) 6

3.3.3 Inputs from Borehole Core and Wall Conditions (WP03 and WP05) 8

3.4 Field Inspection of Bridge Plugs 9

3.5 Running Bridge Plug into Borehole 9

3.6 Setting the Bridge Plug 9

3.7 Verification of Borehole Seal 9

3.8 Mechanical Packer Installation 10

4.0 INSTALLATION OF PROTECTIVE CASING 10

5.0 REFERENCES 11

TABLES

Table 1: Description of Bridge Plugs and Mechanical Packer 5

Table 2: Locations and Rationale for Bridge Plug Installation Depths 8

FIGURES

Figure 1: Location of IG_BH04 in Relation to the Ignace Area 3

Figure 2: Geological Setting and Location of Boreholes IG_BH01, IG_BH02, IG_BH03, IG_BH04, IG_BH05, and IG_BH06 in the Northern Portion of the Revell Batholith 4

APPENDICES

APPENDIX A
Weatherford Installation Report

APPENDIX B
Weatherford Technical Operating Procedures

1.0 INTRODUCTION

The Phase 2 Initial Borehole Drilling and Testing at IG_BH04/05/06 project in the Ignace area of Ontario, is part of the Phase 2 Geoscientific Preliminary Field Investigations of the NWMO's Adaptive Phased Management (APM) Site Selection Phase.

This project involves testing of deep borehole IG_BH04 and the drilling and testing of deep boreholes IG_BH05 and IG_BH06 in the Ignace area within the identified Potential Repository Area (PRA) as shown on Figure 1. The work comprises a total of seven work packages and will be carried out by a team led by Golder Associates Ltd. (Golder) on behalf of the NWMO. The IG_BH04 program is described in the Borehole Characterization Plan (BCP) for IG_BH04 (Golder 2021a).

This report describes the methodology, activities and results for Work Package 8 (WP08): Temporary Well Sealing for IG_BH04.

2.0 BACKGROUND INFORMATION

2.1 Geological Setting

The approximately 2.7 billion year old Revell batholith is located in the western part of the Wabigoon Subprovince of the Archean Superior Province. The batholith is roughly elliptical in shape trending northwest, is approximately 40 km in length, 15 km in width, and covers an area of approximately 455 km^2. Based on geophysical modelling, the batholith is approximately 2 km to 3 km thick through the center of the northern portion (SGL 2015). The batholith is surrounded by supracrustal rocks of the Raleigh Lake (to the north and east) and Bending Lake (to the southwest) greenstone belts (Figure 2).

IG_BH04 is located within an investigation area of approximately 19 km^2 in size, situated in the northern portion of the Revell batholith. Bedrock exposure in the area is generally very good due to minimal overburden, few water bodies, and relatively recent logging activities. Ground elevations generally range from 400 to 450 m above sea level. The ground surface broadly slopes towards the northwest as indicated by the flow direction of the main rivers in the area. Local water courses tend to flow to the southwest towards Mennin Lake (Figure 1).

Four main rock units are identified in the supracrustal rock group: mafic metavolcanic rocks, intermediate to felsic metavolcanic rocks, metasedimentary rocks, and mafic intrusive rocks (Figure 2). Sedimentation within the supracrustal rock assemblage was largely synvolcanic, although sediment deposition in the Bending Lake area may have continued past the volcanic period (Stone 2009; Stone 2010a; Stone 2010b). All supracrustal rocks are affected, to varying degrees, by penetrative brittle-ductile to ductile deformation under greenschist- to amphibolite-facies metamorphic conditions (Blackburn and Hinz 1996; Stone et al. 1998). In some locations, primary features, such as pillow basalt or bedding in sedimentary rocks are preserved, in other locations, primary relationships are completely masked by penetrative deformation. Uranium-lead (U-Pb) geochronological analysis of the supracrustal rocks produced ages that range between 2734.6 +/-1.1 Ma and 2725 +/-5 Ma (Stone et al. 2010).

Three main suites of plutonic rock are recognized in the Revell batholith, including, from oldest to youngest: a Biotite Tonalite to Granodiorite suite, a Hornblende Tonalite to Granodiorite suite, and a Biotite Granite to Granodiorite suite (Figure 2). Plutonic rocks of the Biotite Tonalite to Granodiorite suite occur along the southwestern and northeastern margins of the Revell batholith. The principal type of rock within this suite is a white to grey, medium-grained, variably massive to foliated or weakly gneissic, biotite tonalite to granodiorite. One sample of foliated and medium-grained biotite tonalite produced a U-Pb age of 2734.2+/-0.8 Ma (Stone et al.

2010). The Hornblende Tonalite to Granodiorite suite occurs in two irregularly-shaped zones surrounding the central core of the Revell batholith. Rocks of the Hornblende Tonalite to Granodiorite suite range compositionally from tonalite through granodiorite to granite and also include significant proportions of quartz diorite and quartz monzodiorite. One sample of coarse-grained grey mesocratic hornblende tonalite produced a U-Pb age of 2732.3+/-0.8 Ma (Stone et al. 2010). Rocks of the Biotite Granite to Granodiorite suite underlie most of the northern, central and southern portions of the Revell batholith. Rocks of this suite are typically coarse-grained, massive to weakly foliated, and white to pink in colour. The Biotite Granite to Granodiorite suite ranges compositionally from granite through granodiorite to tonalite. A distinct potassium (K)-Feldspar Megacrystic Granite phase of the Biotite Granite to Granodiorite suite occurs as an oval-shaped body in the central portion of the Revell batholith (Figure 2). One sample of coarse-grained, pink, massive K-feldspar megacrystic biotite granite produced a U-Pb age of 2694.0+/-0.9 Ma (Stone et al. 2010).

The bedrock surrounding IG_BH04 is composed mainly of massive to weakly foliated felsic intrusive rocks that vary in composition between granodiorite and tonalite, and together form a relatively homogeneous intrusive complex. Bedrock identified as tonalite transitions gradationally into granodiorite and no distinct contact relationships between these two rock types are typically observed (SRK and Golder 2015; Golder and PGW 2017). Massive to weakly foliated granite is identified at the ground surface to the northwest of the feldspar-megacrystic granite. The granite is observed to intrude into the granodiorite-tonalite bedrock, indicating it is distinct from, and younger than, the intrusive complex (Golder and PGW 2017).

West-northwest trending mafic dykes interpreted from aeromagnetic data extend across the northern portion of the Revell batholith and into the surrounding greenstone belts. One mafic dyke occurrence, located to the northwest of IG_BH01, is approximately 15-20 m wide (Figure 2). All of these mafic dykes have a similar character and are interpreted to be part of the Wabigoon dyke swarm. One sample from the same Wabigoon swarm produced a U-Pb age of 1887+/-13 Ma (Stone et al. 2010), indicating that these mafic dykes are Proterozoic in age. It is assumed based on surface measurements that these mafic dykes are sub-vertical (Golder and PGW 2017).

Long, narrow valleys are located along the western and southern limits of the investigation area (Figure 1). These local valleys host creeks and small lakes that drain to the southwest and may represent the surface expression of structural features that extend into the bedrock. A broad valley is located along the eastern limits of the investigation area and hosts a more continuous, un-named water body that flows to the south. The linear and segmented nature of this waterbody's shorelines may also represent the surface expression of structural features that extend into the bedrock.

Regional observations from mapping have indicated that structural features are widely spaced (typical 30 to 500 cm spacing range) and dominantly comprised of sub-vertical joints with two dominant orientations, northeast and northwest trending (Golder and PGW 2017). Interpreted bedrock lineaments generally follow these same dominant orientations in the northern portion of the Revell batholith (Figure 2; DesRoches et al. 2018). Minor sub-horizontal joints have been observed with minimal alteration, suggesting they are younger and perhaps related to glacial unloading. One mapped regional-scale fault, the Washeibemaga Lake fault, trends east and is located to the west of the Revell batholith (Figure 2). Ductile lineaments, also shown on Figure 2, follow the trend of foliation mapped in the surrounding greenstone belts. Additional details of the lithological units and structures found at surface within the investigation area are reported in Golder and PGW (2017).

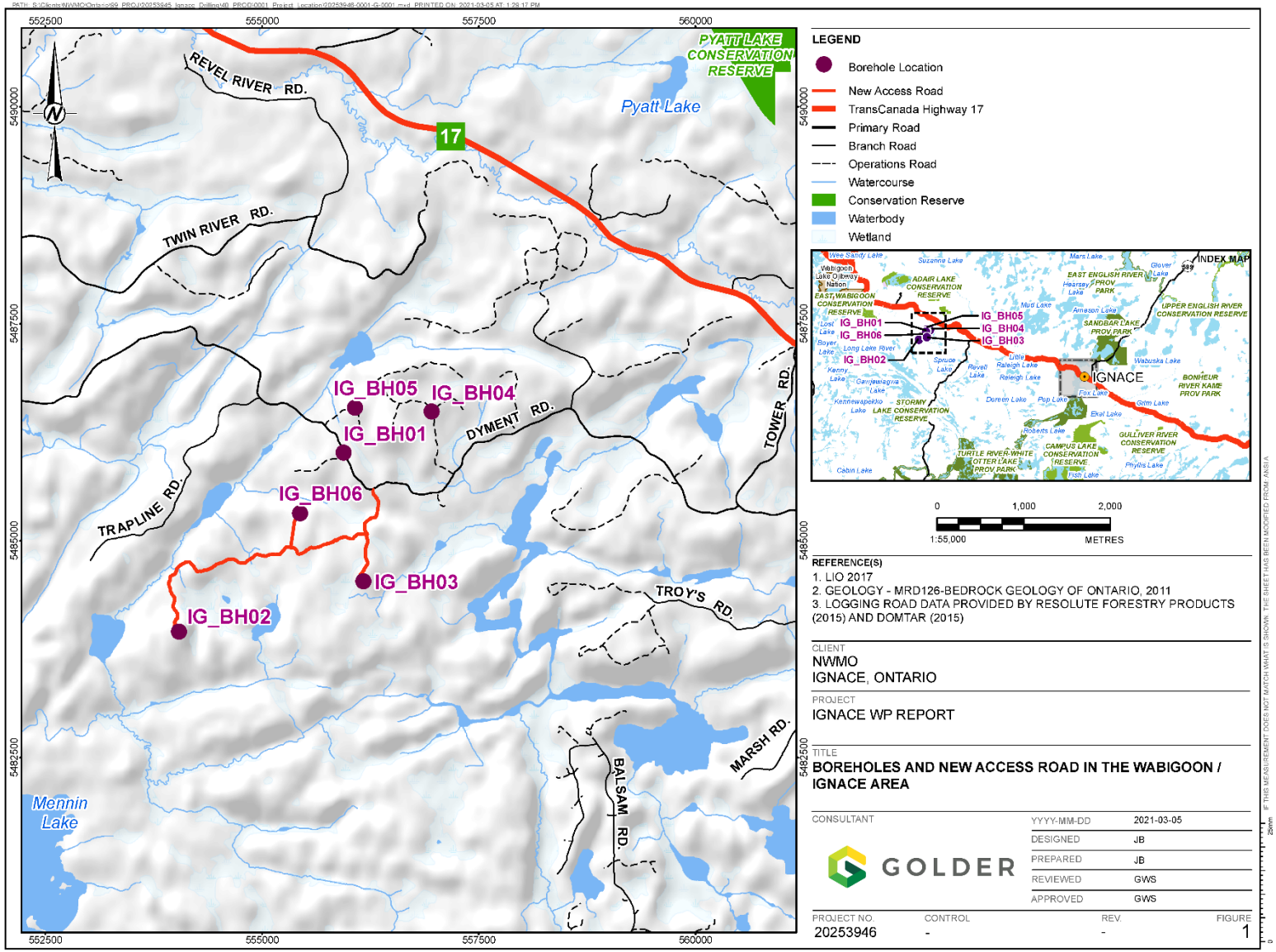


Figure 1: Location of IG_BH04 in Relation to the Ignace Area

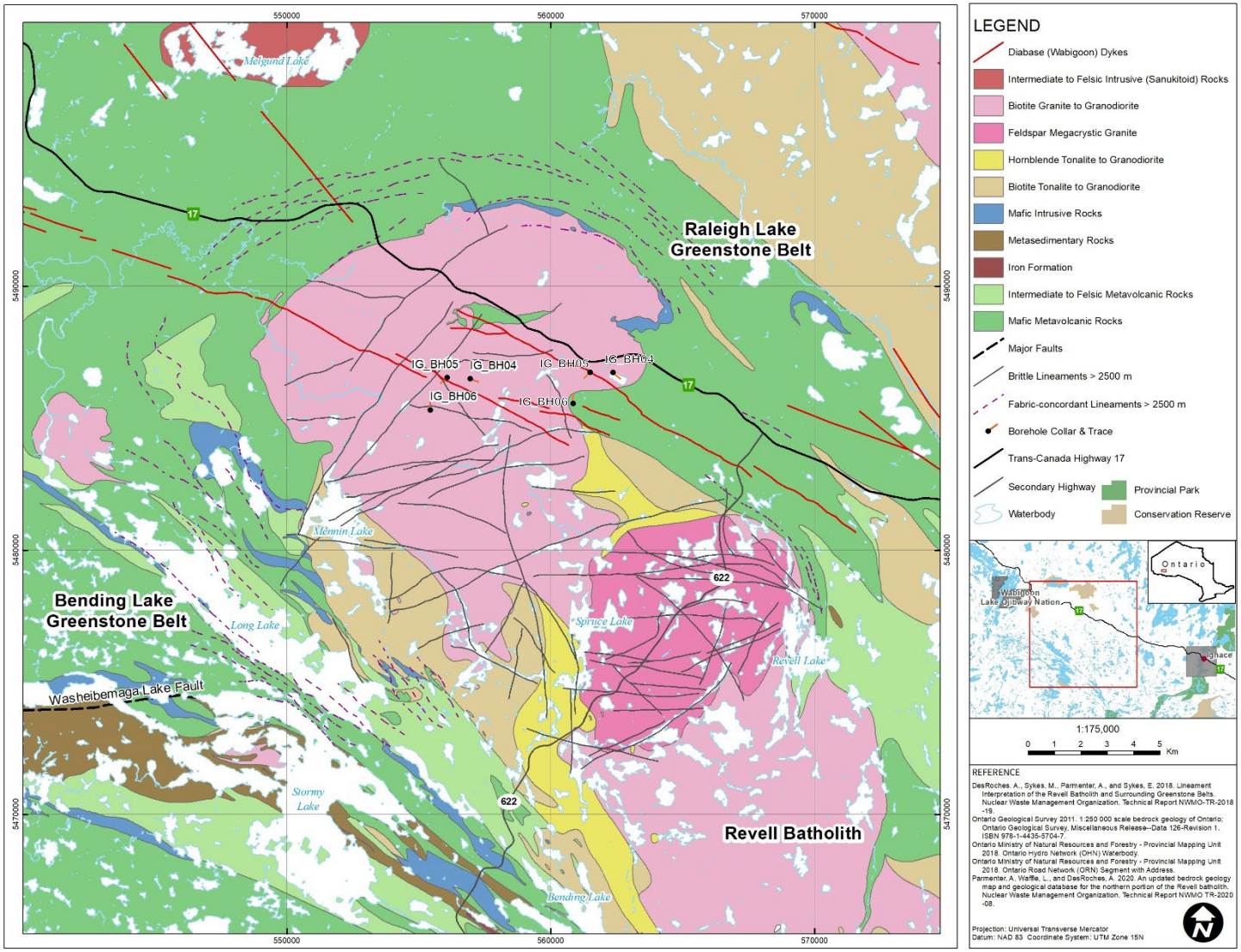


Figure 2: Geological Setting and Location of Boreholes IG_BH04, IG_BH05, and IG_BH06 in the Northern Portion of the Revell Batholith

3.0 DESCRIPTION OF ACTIVITIES

3.1 Technical Objectives

Following the completion of drilling and testing activities at IG_BH04 in 2021, the NWMO requested the borehole be temporarily sealed so the borehole could be re-opened in the future for potential follow-up testing. The temporary sealing included the installation of four bridge plugs at various depths to prevent migration of fluids between zones with significant differences in hydraulic pressure or groundwater chemistry and one mechanical packer inside the surface casing to prevent material from entering the borehole. The bridge plugs consisted of Weatherford Wireline Set Retrievable Heavy duty (WRP) bridge plugs, which are set and retrieved by wireline. The bridge plugs were installed following the completion of hydraulic testing (WP06), with work performed by Weatherford, and supervised by Golder. The mechanical packer was installed by Golder following the installation of the bridge plugs.

3.2 Sealing with Bridge Plugs and Mechanical Packer

Bridge plugs were selected as the preferred sealing approach in the open borehole due to their design which allows for high sealing pressures with the available clearance within the borehole. This results in a limited amount of radial expansion of the bridge plug element to achieve the high sealing pressures. The bridge plug is manufactured in several different diameters based on industry standard casing diameters. The bridge plug size was selected to reduce the risk of the bridge plug jamming in the borehole while ensuring the bridge plug elements could expand to seal against the borehole walls. The bridge plugs can be removed at a later date using Weatherford retrieval tools deployed on a wireline.

A mechanical packer manufactured by QSP Packer LLC. was selected for the sealing of the inside of the surface casing due to its robust and easy to install design. The mechanical packer can be installed and removed quickly by hand with no specialized equipment.

A description of the bridge plugs and mechanical packer is provided in Table 1.

Table 1: Description of Bridge Plugs and Mechanical Packer

Description	WRH (4.5, 16.6) Bridge Plug	QSP Mechanical Packer
Setting Location	Open HQ Borehole	HWT Conductor Casing
Setting Location Inner Diameter	96.0 mm	101.6 mm
Overall Plug Tool Length	1270 mm	1.75 m
Packer Element Length	139 mm (3 elements and 2 spacers)	152 mm
Uninflated Diameter	91.3 mm	95.3 mm
Design Inflated Diameter	94.8 – 97.4 mm	95.4 – 101.6 mm

3.3 Determining Bridge Plug Locations

Initial bridge plug installation locations were identified using general expectations of what would be encountered at the location. The initial installation depths included:

- Near surface: A mechanical packer installed in the surface casing to prevent foreign materials from entering the borehole from the surface.
- 300 metres below ground surface along hole (mbgsah): Experience in shield environments indicates that fracture frequency and hydraulic conductivity typically tend to decrease at approximately 300 m below ground surface. A bridge plug installed at this general depth would isolate the potentially higher hydraulic conductivity above 300 m with the deeper, lower hydraulic conductivity rock.
- 400 mbgsah: The repository zone is anticipated to be developed between 400 and 600 m below ground surface. Positioning a bridge plug at this depth would hydraulically isolate the repository zone from the overlying rock.
- 600 mbgsah: The base of the repository zone is anticipated at approximately 600 m. A bridge plug at 600 m would hydraulically isolate the repository zone from the underlying rock.

In addition to these four initial installation locations, the results of borehole characterization activities were used to identify zones with relatively higher conductivity, variations in hydraulic gradients, and/or variations in groundwater chemistry. These results were obtained from other Work Packages including WP02 – Borehole Drilling and Flushing (Wood, 2021a and Golder, 2021b), WP03 – Geological and Geotechnical Core Logging (Wood, 2021b), WP05 – Geophysical Well Logging (Golder, 2021c), WP06 – Hydraulic Testing (Golder, 2021d), and WP07 – Opportunistic Groundwater Sampling (Wood, 2021c). The results were used to determine the best installation locations for the bridge plugs to prevent migration of fluids between zones with significantly different hydraulic pressure or groundwater chemistry. The inputs from borehole characterization activities are outlined in the following sub-sections.

3.3.1 Inputs from Groundwater Chemistry (WP07)

Opportunistic groundwater samples were collected at two locations during drilling of the borehole, as described in the WP07 – Opportunistic Groundwater Sampling data report (Wood, 2021c). The following groundwater samples were collected based on observations during drilling and summarized below:

- **GW001 (105.31 to 110.00 mbgsah):** A groundwater sample was collected at this location after 600 L of drill water was lost during coring with a prominent fracture zone containing an epidote vein observed in the drill core.
- **GW013 (576.00 to 581.21 mbgsah):** A groundwater sample was collected after 550 L of drill water was lost during coring with evidence of structures and faulting.

The conductive features encountered at the two groundwater sample intervals described above required isolation from the upper portion of the borehole, the repository zone, and the lower portion of the borehole using bridge plugs.

3.3.2 Hydraulic Gradients and Hydraulically Conductive Zones (WP05, WP06)

Hydraulic gradients were measured to determine the flow direction and velocity within the open borehole and were assessed during borehole geophysical logging (WP05) and hydraulic testing (WP06). The following information was recorded in the Data Quality Confirmation (DQC) workbook for each work package and was used to assess flows within the borehole.

- **Fluid Temperature Resistivity and Flowing Fluid Electrical Conductivity (WP05):** Fluid Temperature and Resistivity (FTR) was measured as part of the geophysical borehole logging in WP05 (Golder, 2021c). The temperatures and resistivities are used to identify zones in the borehole with fluid movement. In a crystalline rock environment, these zones would typically be associated with increased frequency of open fractures. Following the FTR logging, Flowing Fluid Electrical Conductivity (FFEC) testing was performed under various pumping conditions.
- **Heat Pulse Flow Meter (WP05):** The heat pulse flow meter (HPFM) directly measures the vertical flow in the well and was used by the WP08 lead to identify zones of inward and outward flow from the borehole (Golder, 2021c).
- **Posiva Flow Logging (WP05):** The Posiva flow logging was used to identify differential fluid flow rates from fractured rock relative to the overall flow rate within the borehole. Logging was completed using a high-resolution absolute pressure sensor to measure the total pressure along a borehole, with discrete measurements collected at chosen test intervals used to estimate the relative flow of each interval (Golder, 2021c). Three measurement runs were completed as part of logging at IG_BH04, one in ambient borehole conditions, and two while the borehole was being pumped to induce a gradient
- **Hydraulic Testing (WP06):** Hydraulic testing of 27 intervals was conducted between May 17, 2021 and June 24, 2021 (Golder, 2021d). The equivalent hydraulic head within each test interval was recorded on the field data tab of the WP06 DQC workbook at the end of the pressure static recovery phase. The hydraulic gradient between each tested interval was determined by the difference in equivalent measured head between test intervals over the vertical distance between the intervals. The measured head accounts for variations in fluid density related to temperature and/or potential salinity. The measured head at the test interval is referred to as the environmental head, to differentiate from a calculated hydraulic head using the density of water. The environmental head accounts for salinity and fluid electrical conductivity. However, the measured hydraulic head for each test interval is highly dependent on borehole history effects and may not represent actual in situ head conditions.

A review of the FTR and FFEC data prior to installation of the bridge plugs identified zones with higher measured electrical conductivity of the borehole fluid, at depths of about 560 to 593 mbgsah and 950 to 1,000 mgbsah (end of borehole). The electrical conductivity contrast measured at these zones typically indicate influence of groundwater from the formation resulting from a relative increase in hydraulic conductivity, albeit small, from the surrounding rock matrix.

A review of the HPFM data identified two zones with relatively higher hydraulic conductivity and flow rate from the rock matrix, at depths of approximately 320 and 600 mbgsah.

A review of the Posiva flow logging identified four fractured zones with measured flow and relatively higher hydraulic conductivity than the rock matrix at approximately 113.7, 580.9, 616.5, and 620.6 mbgsah.

Hydraulic testing identified three relatively higher transmissivity intervals (2 orders of magnitude), as compared to the hydraulic conductivity of adjacent intervals, from approximately 117.75 to 137.78, 605.00 to 645.14 and 959.65 to 1000.20 mbgsah. While the hydraulic conductivity in these intervals was relatively higher than adjacent intervals, the hydraulic conductivity was very low.

Following review of the results of FFEC logging, Posiva flow logging and WP06 hydraulic testing, conductive features were the primary targets that required isolation within the borehole.

3.3.3 Inputs from Borehole Core and Wall Conditions (WP03 and WP05)

Following reviews of the WP05, WP06, and WP07 inputs, bridge plug locations were identified to isolate the conductive features. The placement of bridge plugs was further determined by reviewing the borehole condition data from WP03 and WP05. The borehole at the bridge plug element depth must be of consistent diameter and free of fractures to ensure a seal is created to prevent fluid from bypassing the bridge plug. Assessments of the borehole condition were performed using information collected from geological core logging and geophysical logs. The geophysical logs used for condition assessment included mechanical caliper, optical televiewer (OTV), and acoustic televiewer (ATV). The installation depths of bridge plugs were limited by the following factors:

- **Geological Core Logging (WP03):** Zones identified with fractures, broken or lost core zones were eliminated from the potential bridge plug element depths.
- **Caliper Log (WP05):** Sections of the borehole with enlarged diameters or with open features could allow fluid to bypass the plug and therefore would be unsuitable for bridge plug placement.
- **OTV and ATV Logs (WP05):** The OTV and ATV logs were used to assess the apparent aperture of open fractures. Open fractures could allow fluid to bypass the plug and therefore would be unsuitable for bridge plug placement.

After accounting for the borehole condition factors that could allow fluids to bypass the bridge plugs, the following isolated zones shown in Table 2 were determined in collaboration with the NWMO:

Table 2: Locations and Rationale for Bridge Plug Installation Depths

Bridge Plug Name	From (top of element)*	To (bottom of element)*	Rationale for Bridge Plug Placement
IG_BH04_BP_001	699.93	700.07	Isolation of the feldspathic-phyric tonalite zone at the bottom of the borehole with higher fracture frequency from the feature with measured flow by Posiva flow logging and the relatively higher hydraulic conductivity zone at 615 m.
IG_BH04_BP_002	609.93	610.07	Isolation of the feature with measured flow by Posiva logging and the relatively higher hydraulic conductivity zone at 615 m from the grouted zone at 560 to 593 m. Hydraulically isolates the anticipated base of the repository zone from the underlying rock.
IG_BH04_BP_003	494.93	495.07	Isolation of the grouted zone at 560 to 593 m from shallower fractured zones at 312 to 321 m, 411 m, and 428 m.
IG_BH04_BP_004	304.93	305.07	Isolation of the shallow groundwater zone identified at 113.7 m by Posiva flow logging from the uppermost fractured zone below 300 m, which was identified from 312 to 321 m.
IG_BH04_BP_005	0.99	1.14	Mechanical packer installed within the surface casing to isolate the open borehole from surface.

* All element depths measured in mbgsah

The installation report from Weatherford is provided in Appendix A, and the installation procedures are outlined in Sections 3.4 through 3.7 below.

3.4 Field Inspection of Bridge Plugs

Weatherford's bridge plugs had been shipped to the NWMO Learn More Centre in Ignace, Ontario for storage in July of 2019. The bridge plugs were stored indoors at that location until Golder and Weatherford's field staff arrived to complete the installation in August 2021. Golder and Weatherford's technicians arrived at IG_BH04 on August 4, 2021 and unpacked the bridge plugs to check that they had arrived undamaged and in working condition. The dimensions of each plug, including total length, distance from top of tool to element, and the length of each element were measured and recorded prior to each plug being lowered into the borehole. The field inspections were performed by Weatherford and were supervised and documented by Golder WP08 staff. Inspection documentation is provided in the BP# Assembly Checklist tabs of the DQC workbook submitted to the NWMO as part of the WP08 data deliverable. Following inspection of each bridge plug, it was installed onto the bottom of the bridge plug setting tool and lowered downhole via a wireline rig operated by Weatherford.

3.5 Running Bridge Plug into Borehole

The technical operating procedures followed by Weatherford are provided in Appendix B and summarized below. Weatherford's technicians completed each of the four bridge plug installations under the supervision of Golder WP08 staff.

On August 4, 2021, Weatherford set up their truck-mounted wireline rig south of the borehole, and used a sheave suspended from the truck-mounted rig to orient the wireline for lowering the bridge plugs downhole. Prior to lowering the bridge plugs, a gauge ring was lowered to a depth of 719 mbgsah to ensure that there were no blockages or areas preventing clear passage of the deepest bridge plug, IG_BH04_BP_001. Each bridge plug was attached to the Baker Wireline Pressure Setting Assembly using a wireline adapter kit and lowered into the hole until the mid-point of the bridge plug aligned with the top of the surface casing. At this point, the wireline odometer was calibrated to ground surface, set to zero, and the bridge plug was lowered downhole to the installation depth using the depth counter on the Weatherford wireline rig. The deepest of the four plugs (IG_BH04_BP_001) was installed first, with subsequent plugs being installed at progressively shallower depths.

3.6 Setting the Bridge Plug

After a plug was lowered to its proposed depth, Golder documented the odometer of the wireline to verify that the mid-point of the bridge plug was set in the correct location. Following confirmation by Golder, the final weight of equipment suspended down-hole was recorded, and the bridge plug setting assembly was activated using an intrinsically safe, slow-set power charge. The pressure setting assembly uses compressed gases from the powder charge to extend a piston in the setting tool, which vertically compresses the bridge plug and causes the elements to expand and seal against the borehole wall. The suspended weight of the down-hole assembly was observed to decrease during the setting, indicating that the bridge plug elements had expanded to support the weight of the bridge plug and Baker Wireline Pressure Setting Assembly.

3.7 Verification of Borehole Seal

After setting the bridge plug, the setting tool was released and raised off the bridge plug to verify the reduced suspended weight without the bridge plug, which indicated that the bridge plug had detached. The setting tool was then lowered back onto the bridge plug so that the weight of the setting assembly would be supported by the bridge plug. A reduced suspended weight on the wireline indicated the bridge plug was now supporting the weight

of the setting tool, confirming that the bridge plug had set properly. The hanging weight of the setting tool plus bridge plug (pre-setting), and weight of assembly supported by bridge plug (set test) are recorded in the Confirmation of Bridge Plug Setting tabs of the DQC workbook. This verification was successful for every bridge plug, indicating that each bridge plug had set properly.

3.8 Mechanical Packer Installation

After all bridge plugs had been set, a mechanical packer was installed inside the surface casing to prevent foreign materials from entering the borehole through vandalism, accident, or other unforeseen circumstances. A mechanical packer custom manufactured by QSP Packers LLC. was hand lowered into the surface casing to a depth of 0.99 mbgsah. The mechanical packer element was set by hand tightening a nut at surface, which compresses the rubber gland at depth, forming a seal against the surface casing wall. The seal was confirmed by ensuring no movement of the packer while pulling up on the packer mandrel.

4.0 INSTALLATION OF PROTECTIVE CASING

Following the demobilization of Weatherford on August 4, 2021, and after the removal of the drill rig from the borehole, a lockable casing lid was welded to the outer conductor casing to prevent access to the borehole. The welding work was performed by Rodren Drilling Ltd., of West Saint Paul, Manitoba on September 5, 2021. A photograph of the lockable casing lid is provided below:

Photo 1: Lid removed to show mechanical packer installed, before painting and locking of extended casing monument.

Photo 2: Lockable lid installed onto conductor casing with secondary physical barrier (cage) to prevent incidental contact.

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Wood, 2021b. Phase 2 Initial Borehole Drilling and Testing at IG_BH04/05/06, Ignace Area – WP03 Data Report – Core Logging, Photography and Sampling for IG_BH04. NWMO Report Number: APM-REP-01332-0258

Wood, 2021c. Phase 2 Initial Borehole Drilling and Testing at IG_BH04/05/06, Ignace Area – WP07 Data Report – Opportunistic Groundwater Sampling for IG_BH04. NWMO Report Number: APM-REP-01332-0298

APPENDIX A

Weatherford Installation Report

Weatherford®

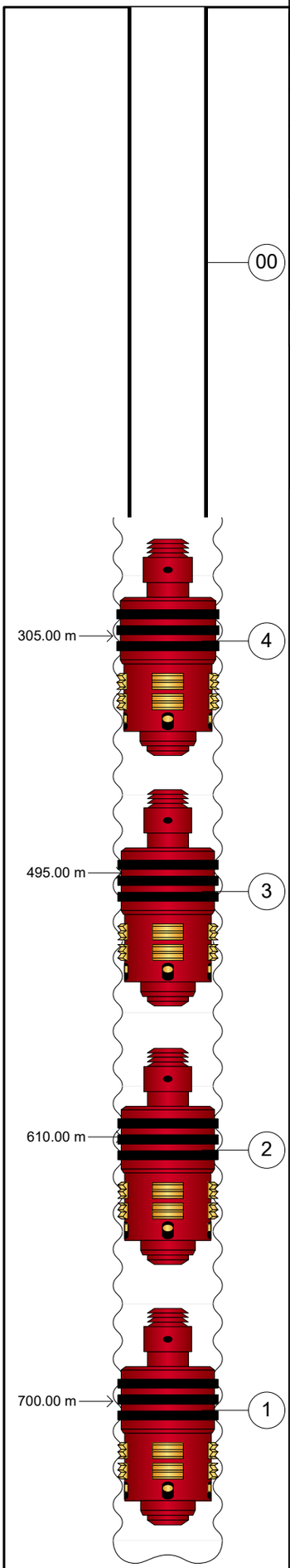
Page Title

Final Installation Report

Company	GOLDER			Reference	14632898
Prepared for	STEVE HALES	Phone	1-226-374-9386	Location	IG_04
Prepared by	TODD WEIRMEIR	Sales Rep	BLAIR NEIL		
Service Centre	Estevan 1-866-844-0315	Drawn by	TODD WEIRMEIR	Date	9/8/2021
				Page	1

TUBULAR	Size (mm)	Weight (kg/m)	Grade	Thread	Notes
Casing					
Tubing 1					

ITEM	DESCRIPTION	I.D. (mm)	O.D. (mm)	Length (m)
1.	WRH Wireline Set Bridge Plug & Retrievable		91.3	1.27
2.	WRH Wireline Set Bridge Plug & Retrievable		91.3	1.27
3.	WRH Wireline Set Bridge Plug & Retrievable		91.3	1.27
4.	WRH Wireline Set Bridge Plug & Retrievable		91.3	1.27



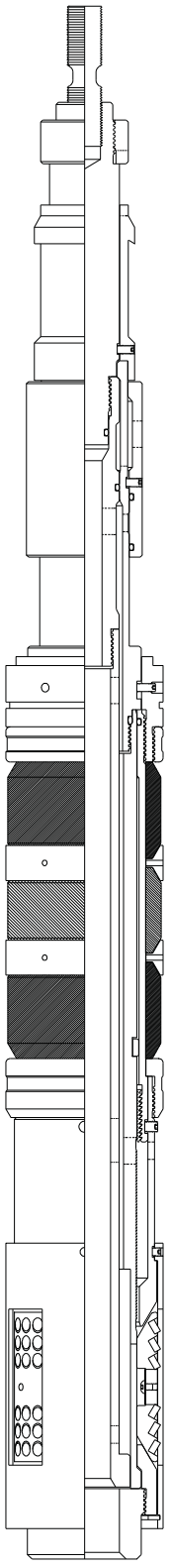
NOTES

APPENDIX B

Weatherford Technical Operating Procedures

INDEX NO.	500
UNIT	WRP 35 THRU 51
PN.	00175022 - 00172614
DATE	13-Oct-2011
Revision	13

WRP Bridge Plug



The Weatherford WRP is a wireline set, retrievable plug capable of holding differential pressure from above or below. The WRP may be set on conventional wireline or hydraulic packer-setting tools. The short design is easy to retrieve on tubing, coil tubing or sandline, using the appropriate retrieval tool. When the retrieving tool engages the top of the bridge plug, the equalizing valve opens before the bridge plug is released, preventing the bridge plug from moving with differential pressure.

Features

- Wireline, hydraulic, or coiled tubing set
- Caged bi-directional slips
- Equalizing valve opens before plug is released
- Straight pull release
- Over shot will wash to gage ring for easy retrieval
- Rotational safety release mechanism
- Optional sand line or coiled tubing retrieval
- Swab resistant packing element system

Benefits

- Carbide slips are standard for long life and durability
- Compact design for tight doglegs, short lubricators
- Simple, rig-friendly operation
- Holds pressure from above and below
- Easy, dependable retrieval

Applications

- Acidizing, fracturing and cementing
- Casing pressure testing
- Wellhead repair or replacement
- Zonal isolation

SPECIFICATION GUIDE

CASING				BRIDGE PLUG		
O.D. (IN./mm)	WEIGHT (LB/FT - kg/m)	MIN. I.D. (IN./mm)	MAX. I.D. (IN./mm)	MAX. O.D. (IN./mm)	COLLET LATCH PRODUCT NUMBER	J-LATCH PRODUCT NUMBER
3-1/2 88,90	10.2 15,18	2.992 76,00	2.992 76,00	2.781 70,64	00175022 35WRP.1002	--
3-1/2 88,90	7.7 - 9.2 11,46 - 13,69	2.992 76,00	3.068 77,93	2.867 72,82	00175071 35WRP.1001	--
4-1/2 114,30	9.5 - 13.5 14,14 - 20,09	3.910 99,31	4.090 103,89	3.771 95,78	00171318 43WRP.1001	00171293 43WRP.1002
5 127,00	15.0 - 18.0 22,32 - 26,78	4.250 107,95	4.408 111,96	4.125 104,78	00171854 43WRP.1003	00171191 43WRP.1004
5 127,00	11.5 - 15.0 17,11 - 22,32	4.408 111,96	4.560 115,82	4.250 107,95	00827674 43WRP.1007	--
5-1/2 139,70	26.0 38,69	4.408 111,96	4.560 115,82	4.250 107,95	00827674 43WRP.1007	--
5-1/2 139,70	20.0 - 23.0 29,76 - 34,22	4.625 117,48	4.778 121,36	4.500 114,30	00164892 45WRP.1001	00178056 45WRP.1002
5-1/2 139,70	20.0 - 23.0 29,76 - 34,22	4.625 117,48	4.778 121,36	4.500 114,30	01281068 45WRP.1011	001281073 45WRP.1012
5-1/2 139,70	15.5 - 20.0 23,06 - 29,76	4.778 121,36	4.950 125,73	4.641 117,88	00164797 45WRP.1003	00164776 45WRP.1004
5-1/2 139,70	15.5 - 20.0 23,06 - 29,76	4.778 121,36	4.950 125,73	4.641 117,88	01214580 45WRP.1013	00174907 45WRP.1014
5-1/2 139,70	13.5 - 15.5 20,09 - 23,06	4.950 125,73	5.190 131,83	4.781 121,44	00164902 45WRP.1005	00164720 45WRP.1006
5-1/2 139,70	13.5 - 15.5 20,09 - 23,06	4.950 125,73	5.190 131,83	4.781 121,44	01214624 45WRP.1015	01214626 45WRP.1016
6 152,40	26.0 38,69	4.950 125,73	5.190 131,83	4.781 121,44	00164902 45WRP.1005	00164720 45WRP.1006
6-5/8 168,28	24.0 - 32.0 35,71 - 47,62	5.610 142,49	5.921 150,39	5.484 139,29	00164732 45WRP.1009	45WRP.1010
6-5/8 168,28	24.0 35,71	5.830 148,08	5.937 150,80	5.656 143,66	00177487 47WRP.1001	00164738 47WRP.1002
7 177,80	38.0 56,54	5.830 148,08	5.937 150,80	5.656 143,66	00177487 47WRP.1001	00164738 47WRP.1002
6-5/8 168,28	17.0 - 20.0 25,30 - 29,76	5.938 150,83	6.135 155,83	5.812 147,62	00164718 47WRP.1003	00164852 47WRP.1004

CAUTION: Before starting work, ensure all personal protection equipment is available and being used. Evaluate job site to ensure work can be completed safely. All safety procedures are to be observed.

RUNNING

The Weatherford WRP Bridge Plug is set on a wireline pressure setting assembly and Wireline Adapter Kit. It is pulled using a special tool.

1. Make-up tension sub with shear stud and bridge plug.
2. Make-up adapter nut on pressure setting assembly and install set screws.
3. Make-up tension sub with pressure setting assembly and install set screws.
4. Slide setting sleeve and setting sleeve bushing over top of gun and into place over adapter nut.
5. Rotate setting sleeve down over adapter nut until it begins to put pressure against setting sleeve adapter of bridge plug.
6. Align holes in setting sleeve and setting sleeve bushing. Install set screws to lock setting sleeve in place.
7. Make-up firing head on pressure setting assembly and run assembly to depth.

TUBING RETRIEVAL

Make-up Pulling Tool on tubing string and run to setting depth. In the event sand or other debris is present on top of the plug, standard washing may be continued after pulling tool is latched onto plug. To equalize any differential pressures across plug, set down approximately 5,000 lb. This shifts the equalizing sleeve downward and opens equalizing ports. After differential is equalized, tool is released by application of 10,000 to 15,000 lb. tension. Move tool up hole a minimum of six feet to completely stretch out slip system before moving back down hole.

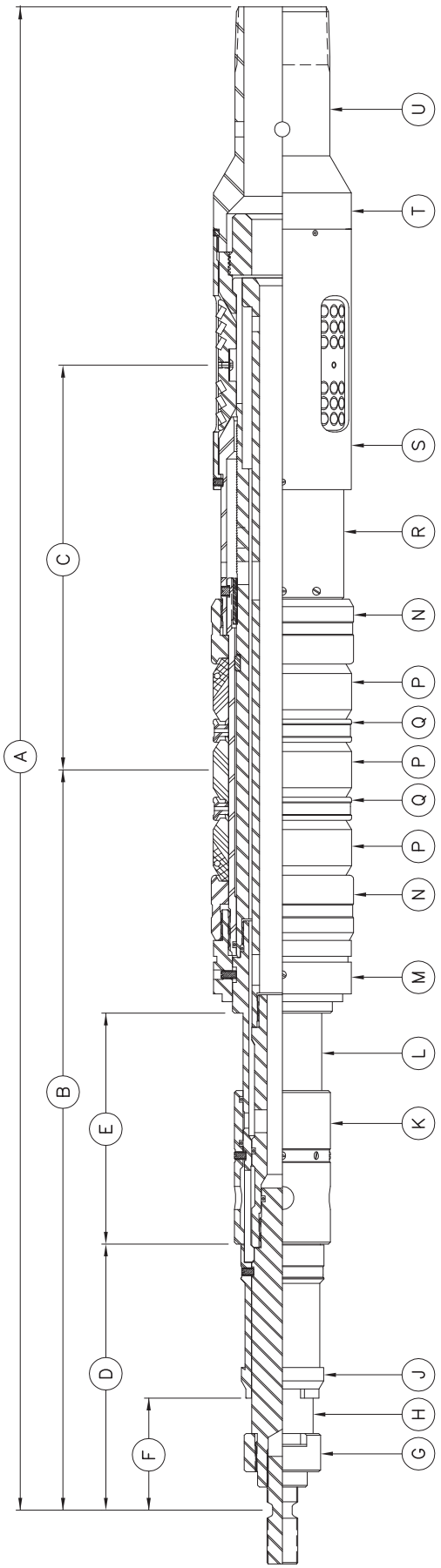
An emergency release is provided in the event the tool will not release when an upstrain is taken. Take an upstrain of 10,000 to 20,000 lb. and rotate to the right approximately five turns. This will break off safety sub and allow retrieval of tubing and retrieving head. The plug may then be retrieved by standard fishing operations, utilizing an overshot and tubing jars.

During retrieval, a calculated force of 65,000 lb. may be pulled on the 4-1/2” plug, 75,000 lb. on the 5-1/2” and larger plugs in an effort to free them from a sand bridge or other obstruction.

SANDLINE RETRIEVAL

Make-up Pulling Tool with stem and jars. Position jars immediately above Pulling Tool. Flag the line and run tools to setting depth. Jar down to open equalizing sleeve. Allow sufficient time for any pressure differential to equalize before releasing plug. Pull 10,000 lb. or jar upward to release plug. Slowly retrieve plug for 100 ft. to allow packing element system to relax and pass through the casing without hanging up.

An emergency release is provided for the Pulling Tool when the plug is retrieved on sandline. If the tool will not release in the normal manner, jarring down will shear the Pulling Tool loose and allow retrieval of the tool string with out the bridge plug.



LINER SIZE X CASING SIZE, WEIGHT / DIMENSION

REF	4–1/2, 9.5–13.5 *114.3, 14.1–20.1*		4–1/2, 15.1 *114.3, 22.5*		4–1/2, 16.6 *114.3, 24.7*		5, 23.2 *127.0, 34.5*		5–1/2, 15.5–20 *139.7, 23.1–29.8*		5–1/2, 23 *139.7, 34.2*	
A	50.6	*1285*	50.6	*1285*	50.6	*1285*	50.6	*1285*	49.5	*1257*	49.5	*1257*
B	24.0	*609*	24.0	*609*	24.0	*609*	24.0	*609*	23.9	*607*	23.9	*607*
C	14.3	*363*	14.3	*363*	14.3	*363*	14.3	*363*	13.2	*335*	13.2	*335*
D	8.7	*222*	8.7	*222*	8.7	*222*	8.7	*222*	8.4	*213*	8.4	*213*
E	7.5	*191*	7.5	*191*	7.5	*191*	7.5	*191*	7.5	*191*	7.5	*191*
F	3.7	*93*	3.7	*93*	3.7	*93*	3.7	*93*	3.4	*86*	3.4	*86*
G	2.250	*57.15*	2.250	*57.15*	2.250	*57.15*	2.250	*57.15*	2.250	*57.15*	2.250	*57.15*
H	1.995	*50.67*	1.995	*50.67*	1.995	*50.67*	1.995	*50.67*	1.995	*50.67*	1.995	*50.67*
J	2.682	*68.12*	2.682	*68.12*	2.682	*68.12*	2.682	*68.12*	2.680	*68.07*	2.680	*68.07*
K	3.125	*79.38*	3.125	*79.38*	3.125	*79.38*	3.125	*79.38*	3.125	*79.38*	3.125	*79.38*
L	2.562	*65.07*	2.562	*65.07*	2.562	*65.07*	2.562	*65.07*	2.562	*65.07*	2.562	*65.07*
M	3.745	*95.12*	3.568	*90.63*	3.568	*90.63*	3.745	*95.12*	4.495	*114.17*	4.495	*114.17*
N	3.771	*95.78*	3.677	*93.40*	3.594	*91.29*	3.895	*98.93*	4.641	*117.88*	4.510	*114.55*
P	3.630	*92.20*	3.630	*92.20*	3.450	*87.63*	3.630	*92.20*	4.500	*114.30*	4.500	*114.30*
Q	3.771	*95.78*	3.672	*93.27*	3.580	*90.93*	3.895	*98.93*	4.500	*114.30*	4.500	*114.30*
R	3.410	*86.61*	3.410	*86.61*	3.410	*86.61*	3.410	*86.61*	4.000	*101.60*	4.000	*101.60*
S	3.750	*95.25*	3.573	*90.75*	3.573	*90.75*	3.750	*95.25*	4.495	*114.17*	4.495	*114.17*
T	3.740	*95.00*	3.562	*90.47*	3.562	*90.47*	3.740	*95.00*	4.490	*114.05*	4.490	*114.05*
U	2.594	*65.89*	2.594	*65.89*	2.594	*65.89*	2.594	*65.89*	3.094	*78.59*	3.094	*78.59*

NOTE: Dimensions given in inches / *mm* – Weights given in lb/ft / *Kg/m*

FOREWORD

This technical unit is written for internal use only, for Weatherford personnel. The information presented is the most accurate available as of the writing date and is not guaranteed. This information is subject to change without notice.

PRODUCT DESCRIPTION

The 'WRH' product is a wireline set, heavy-duty tubing retrievable bridge plug that is capable of holding differential pressure from above or below the tool. This tool can be used for isolating zones during acidizing, fracturing, testing and cementing operations, for casing pressure tests and for wellhead repair operations. The wireline set capability provides for precise depth control and for lubricated installation when wellhead pressure is present.

FEATURES

- ✓ Electric wireline set using industry standard setting equipment for precise depth control
- ✓ Balanced equalizing system opens prior to slip release to facilitate retrieval
- ✓ Retrieving tool allows for washing over the plug to the upper gauge ring
- ✓ Straight pull release mechanism for retrieval on tubing or endless tubing
- ✓ Safety release mechanism prevents complications when normal release cannot be achieved
- ✓ Short compact design for setting in short casing intervals and for easy lubrication while running under pressure
- ✓ Field proven element system
- ✓ Internal lock ring holds the initial setting force in the packing element system
- ✓ Pressure balanced design prevents any releasing actions while the tool is set

OPERATION

Running & Setting

The 'WRH' bridge plug is usually run on electric wireline and set on a Baker Wireline Pressure Setting Assembly (or equivalent). As with any wireline set tool, a gauge ring run should be made prior to setting the bridge plug to ensure clear passage of the tool. Additionally, hydraulic setting tools are available for running the plug on tubing or endless tubing.

The 4 1/2" tool is set on a #10 Baker setting tool and the 5 1/2" and 7" sizes are set on a #20 Baker setting tool. The completely assembled bridge plug must be connected to the setting tool using a 'WRK' wireline adapter kit. The following describes the procedure needed to connect the bridge plug to the setting tool:

1. The 'WRK' adapter bushing and 'WRK' adapter sleeve are slid over top the setting tool from the bottom.
2. The 'WRK' adjusting nut should then be made up onto the bottom of the setting tool and locked on with the set screws.
3. The 'WRK' crossover sub is also made up onto the bottom of the setting tool and locked with a set screw.
4. The shear stud on the 'WRH' bridge plug is screwed into the bottom of the 'WRK' crossover sub.
5. The 'WRK' adapter sleeve is pushed downwards and threaded onto the 'WRK' adjusting nut until it just touches the setting sleeve adapter on the bridge plug – then stop turning. ***(Important: Do NOT tighten the adapter sleeve as this will preload the shear screws and shear stud.)***
6. The 'WRK' adapter bushing is placed into the top of the 'WRK' adapter sleeve and both parts are locked in position with set screws.

The bridge plug is then run to setting depth and set by activating the setting tool.

Upon recovery of the setting tool and following the release of trapped pressure in the tool, confirm that all components are recovered and that the setting stud parted in the correct position. Any abnormalities must be recorded and considered for future operations.

In general, all retrievable tools should be set with a slow set charge. This is discussed in the Cardium Services Tech Units, Practices, Production Practices, "**TP06** - Using the Baker E-4 Setting Tool", page 2 "Charge Speed".

Releasing

The 'WRR' retrieving tool is used to release and retrieve the 'WRH' bridge plug. The retrieving tool is made up on the tubing string and run to setting depth. If sand or debris is present above the plug then fluid circulation should be used to clean out to the top of the plug. Circulation can be continued, if desired, after the retrieving tool has latched onto the plug. The retrieving tool will latch onto the plug by simply setting it down on the plug.

Open the equalizing sleeve by setting sufficient weight on the plug (based on the number of shear screws in the equalizing sleeve) to shift open the equalizing sleeve and to equalize any differential pressure. Sufficient time must be provided to allow for full equalization.

Following pressure equalization, 5,000 lbf (2,500 daN) tension will shift the fishing neck and unset the tool (unless an optional high shear release fishing neck is used – refer to Product Alert #1). The tool should be slowly raised 6 ft (2m) to completely unset all tool components and then be kept stationary to allow packing element relaxation. The tool can then be lowered past the setting depth to ensure that it has indeed been unset. The tool should not take weight if it has been properly unset and no debris is present around the tool. The bridge plug and retrieving tool can then be retrieved.

In the event that complications arise and the bridge plug cannot be unset, an emergency release is provided to allow the retrieving tool to be disengaged from the bridge plug. The emergency release is activated by pulling a 10,000-20,000 lbf (4,500-9,000 daN) on the work-string and rotating approximately five turns to the right at the tool. The retrieving tool can then be retrieved along with the safety sub and fishing neck off the bridge plug. Additional attempts to unset the plug must be made by using an overshot to latch onto the O.D. of the upper mandrel support.

If the bridge plug becomes stuck during retrieval, the operator may attempt to push the plug back down hole. When the retrieving tool is pushed against the released bridge plug, the retrieving tool collet is able to ride farther down the fish neck. The retrieving tool collet then re-latches under the bottom edge of the fish neck. The operator can apply tension and successfully retrieve the bridge plug with the retrieving tool in this position, but the retrieving tool collet and bridge plug fish neck may be damaged. These components will require inspection and possible replacement when the tools are redressed. Release from a stuck bridge plug may also be achieved by using the emergency release procedure. (***NOTE:*** *Do* ***NOT*** *exceed the maximum tension loads that are documented in Section 5 in regards to pulling on an unset – but stuck – tool.*)

The design of the bridge plug allows it to be retrieved with endless tubing or sandline. Additional considerations and equipment may be called for in those instances (ie. jars, weights, shear sub, etc.).

RUNNING CONSIDERATIONS

1. The tool must be retrieved and serviced before it can be reset in the well.
2. This tool is not recommended for installations where numerous pressure reversals are expected across the tool.
3. A gauge ring should be run prior to running and setting the bridge plug to ensure adequate running clearance.
4. Any equipment run below the tool must not interfere with pressure equalization when unsetting the tool. Equipment geometry must not interfere with the ID flow path or the equalization ports in the recorder sub at the bottom of the tool.
5. **GREAT CARE** is needed when the tool will be unset with pressure under the tool. The tool can prematurely release before pressure equalization has taken place if sufficient weight is not present above the tool to counteract the pressure below the tool. This could result in dangerous conditions due to uncontrolled equipment release! This consideration should always be made on shallow depth installations and for installations where retrieval on wireline, sandline or endless tubing is attempted.

6. Equipment handling and transportation must be done in a controlled manner to prevent compromising of tool functionality. This is especially important for tools which have been dressed with low shear values and improper handling could result in premature shearing before the equipment is run (i.e. reduced equalizing sleeve shear values). Equipment should always be secured during transport to prevent impact loading of equipment components. Third party transportation services must always be instructed on appropriate handling precautions (i.e. transport companies, hotshot companies, wireline companies, etc).
7. Awareness and caution must be exercised when releasing this tool after it has been set between perforated intervals where cross flow may occur. The presence of cross flow may complicate pressure equalization and could lead to unexpected tool actions. If unusual conditions are noted during release then provide additional time for equalization to occur and proceed with caution. High tensile loads should be avoided as they could introduce additional complications and/or equipment damage.
8. Setting speed should always be recorded in the job log whenever possible. This is always a concern on wireline set tools. The setting speed can be controlled if a hydraulic setting tool is used.
9. Avoid introducing right hand rotation into the work string during recovery efforts to prevent inadvertent activation of the emergency release.
10. The use of a flow control seating nipple above the WRR retrieving tool is recommended at all times. The seating nipple must be separated from the retrieving tool by a pup joint to facilitate running a plug into it when needed and to prevent any interference with the parted setting stud on the top of the bridge plug. The seating nipple may be needed in situations where well bore pressure is present after unsetting the bridge plug and snubbing operations are needed.

RELATED PRODUCTS

HYF HYdraulic setting tool (diFferential style)

WGR Wireline Gauge Ring

WRK ‘WRh’ bridge plug wireline adapter Kit

WRR ‘WRh’ bridge plug Retrieving tool

E-4 Wireline Pressure Setting Assembly and Baker Hughes C Firing Heads

Product Families H43702, H43720, and H43721

Table of Contents

1 Introduction 6
2 Description 6
3 Features and Benefits 7
4 Engineering Tables and Information 7
Table 1: Specification Guide 7
Accessory Equipment 7
Required Accessory Equipment 7
Igniters 7
Power Charge 8
Firing Head 8
Table 2: E-4 Wireline Pressure Setting Assembly Accessory Equipment, Size 05 8
Table 3: E-4 Wireline Pressure Setting Assembly Accessory Equipment, Size 10 8
Table 4: E-4 Wireline Pressure Setting Assembly Accessory Equipment, Size 20 9
5 HSE&S 9
6 Preservation of Product 10
Storage Recommendations 10
7 Inspection 10
E-4 W.L.P.S.A. Critical Dimensions for Periodic Inspection 10
Figure 1: Drawing 361-271-00, Size 05 10

Revision History					
Rev.	**DCR**	**Amendment Detail**	**Reviewer**	**Approver**	**Effective Date**
C		Updates throughout document	E. Dobies	W. LaBove	5 May 2014
D	RDR-1019	Updates throughout document	E. Dobies	W. LaBove	3 Nov 2014
E	—	Updates throughout document	E. Dobies	W. LaBove	6 Nov 2014
F	—	No Technical Change Revised Disclaimer	—	—	26 Aug 2015

Figure 2: Drawing 361-039-00P01, Size 10 11
Figure 3: Drawing 361-04800P01, Size 20 11
E-4 W.L.P.S.A. Inspection Gauges 12
Figure 4: Drawing 207-723 12
E-4 W.L.P.S.A. Field Inspection Gauges (Product Family H43790) 12
Figure 5: Drawing 207-799 12
Lexbar Rok-it Inspection Gauges 13
Figure 6: Drawing 753-453-1 13
Making Absolute And Relative Measurements With Your Mitutoyo Dial Caliper 13
For Relative Measurements 13
How To Read The Caliper 13
Table 5: Effect of Slides Edge Position on Caliper Reading 13
Dial Range is 0.2 in. Reading 0-100-100. 14
Care And Maintenance Of Your Dial Caliper 14
To readjust the tool 14
Adjusting Tool 15
Figure 7: Drawing 101-583 15
Radio Silence 16
Running in Extreme Temperatures 16
General Information 16
Products of Combustion 16
8 Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly, Size 05 16
Running Procedures 16
E-4 W.L.P.S.A. Middle Cylinder Oil level Line 17
Figure 8: Drawing 361-138-00-1, Size 05 17
Table 6: E-4 W.L.P.S.A. Middle Cylinder Oil-level Line Based on Well Temperature, Size 05 . 17
9 Baker Hughes C Firing Head, Size 05 19
Operation Running Procedures 19
10 Disassembly Instructions 19
Baker Hughes C Firing Head (Material H437210500), Size 05 19
11 Assembly Instructions 20
Baker Hughes C Firing Head, Size 05 20
C Firing Head Inspection of Firing Pin Location 20
Figure 9: Drawing 36113900_1, Size 05 20
12 Assembly and Dimensional Information 22
C Firing Head (Material H437210500) 22
Figure 10: Assembly and Dimensional Data Drawing 155-579-00-3B, Size 05 22

Dimensional Data, Size 05 23
Parts List, Size 05 23
13 Redress Kits 24
C Firing Head Redress Kit (Material H035687600) 24
Figure 11: Assembly Drawing 356-876-00, Size 05 24
Redress Kit, Size 05 24
14 Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 10 25
E-4 W.L.P.S.A. Upper Cylinder Oil Level 25
Figure 12: Drawing 361-138-00-2, Size 10 25
Table 7: E-4 W.L.P.S.A. Upper Cylinder Oil Level Based on Well Temperature, Size 10 25
15 Baker Hughes C Firing Head, Size 10 27
Operation 27
Running Procedures 27
16 Disassembly Instructions 27
Baker Hughes C Firing Head (Material H437201000), Size 10 27
17 Assembly Instructions 28
Baker Hughes C Firing Head, Size 10 28
C Firing Head Inspection of Firing Pin 29
Figure 13: Drawing 36113900_2, Size 10 29
18 Assembly and Dimensional Information 30
C Firing Head (Material H437201000) 30
Figure 14: Assembly Drawing 390-484-00-3B, Size 10 30
Dimensional Data, Size 10 31
Parts List, Size 10 31
19 Redress Kits 32
C Firing Head Redress Kit (Material H035687700) 32
Figure 15: Assembly Drawing 356-877-00, Size 10 32
Redress Kit, Size 10 32
E-4 W.L.P.S.A. Cylinder Oil Level, Size 20 33
Figure 16: Drawing 361-138-00-3 33
Table 8: E-4 W.L.P.S.A. Cylinder Oil Level Based on Well Temperature, Size 20 33
20 Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 20 33
21 Baker Hughes C Firing Head, Size 20 35
Operation 35
Running Procedures 35
22 Disassembly Instructions 36
Baker Hughes C Firing Head (Material H437202000), Size 20 36

23 Assembly Instructions 36
Baker Hughes C Firing Head, Size 20 36
24 Assembly and Dimensional Information 38
C Firing Head (Material H437202000) 38
Figure 17: Assembly and Dimensional Drawing 390-484-00-3B, Size 20 38
Dimensional Data, Size 20 39
Parts List, Size 20 39
25 Redress Kits 40
C Firing Head Redress Kit (Material H035687800) 40
Figure 18: Assembly Drawing 356-878-00, Size 20 40
Redress Kit, Size 20 41
26 E-4 Wireline Pressure Setting Assembly, Size 05 41
Operation 41
Running Procedures 41
27 Disassembly Instructions 42
E-4 Wireline Pressure Setting Assembly, Size 05 42
Phase I and Phase II Bleed-off Procedures for Wireline Pressure Setting Assembly, Size 05 42
Phase I Bleed-off Procedure, Size 05 42
Phase II Bleed-off Procedure, Size 05 44
Depiction of Phase I and II Bleed-off Procedures 46
Figure 19: Drawing 468451, Size 05 46
Disassembling the E-4 Wireline Pressure Setting Assembly, Size 05 47
28 Assembly Instructions 48
E-4 Wireline Pressure Setting Assembly, Size 05 48
29 Assembly and Dimensional Information 50
E-4 Wireline Pressure Setting Assembly (Material H4370205E4RT) 50
Figure 20: Assembly and Dimensional Data Drawing 390-979-00P02, Size 05 50
E-4 Wireline Pressure Setting Assembly (Material H4370205E4RT) 51
Parts List, Size 05 51
30 E-4 Wireline Pressure Setting Assembly, Size 10 52
Operation 52
Running Procedures 52
31 Disassembly Instructions 52
E-4 Wireline Pressure Setting Assembly, Size 10 52
Phase I and Phase II Bleed-off Procedures for Wireline Pressure Setting Assembly, Size 10 53
Phase I Bleed-off Procedure, Size 10 53
Phase II Bleed-off Procedure, Size 10 57
Depiction of Phase I and II Bleed-off Procedures 59
Figure 21: Drawing 468449, Size 10 59

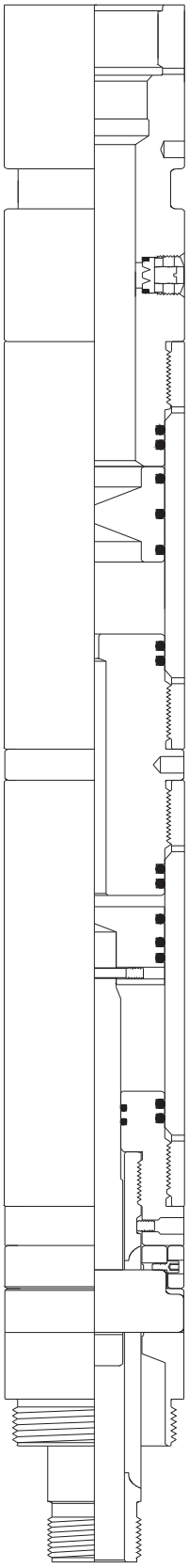
Disassembling the E-4 Wireline Pressure Setting Assembly, Size 10 60
32 Assembly Instructions 61
E-4 Wireline Pressure Setting Assembly, Size 10 61
33 Assembly and Dimensional Information 63
E-4 Wireline Pressure Setting Assembly 63
Figure 22: Assembly Drawing 390-427-0P03, Size 10 63
E-4 Wireline Pressure Setting Assembly (Material H4370210E4RT) 64
Parts List, Size 10 64
E-4 Wireline Pressure Setting Assembly, Size 20 64
Operation 64
Running Procedures 65
34 Disassembly Instructions 65
E-4 Wireline Pressure Setting Assembly, Size 20 65
Phase I and Phase II Bleed-off Procedures for Wireline Pressure Setting Assembly, Size 20 65
Phase I Bleed-off Procedure, Size 20 66
Phase II Bleed-off Procedure, Size 20 69
Depiction of Phase I and II Bleed-off Procedures 71
Figure 23: Drawing 46845, Size 20 71
Disassembling the E-4 Wireline Pressure Setting Assembly, Size 20 72
35 Assembly Instructions 72
E-4 Wireline Pressure Setting Assembly, Size 20 72
36 Assembly and Dimensional Information 75
E-4 Wireline Pressure Setting Assembly (Material H4370220E4RT) 75
Figure 24: Assembly and Dimensional Drawing 390-426-00-3, Size 20 75
Parts List, Size 20 76

1 Introduction

The E-4™ wireline pressure setting assembly (W.L.P.S.A.) is a device in which the products of combustion are utilized for the gradual development of force through pressure. This motive force operates the various working parts of the W.L.P.S.A. in a proper sequence to ensure the successful setting of Baker Hughes bridge plugs, retainer production packers, cement retainers, and other products.

2 Description

The pressure required is built up through the burning of a slow-set power charge (Product Family H43766), or a standard power charge, (Product Family H43764), which was originally known as a high-temperature power charge. For specifics on all power charges and igniters refer to Slow-Set Power Charge, Standard Power Charge, Secondary Igniter, BP-3S and BP-5S Igniter (Product Families H43766, H43764, H43743, and H43744),and Unit 4190 under Service Tools/Remedial Systems. The setting pressure is confined to the proper area of the setting tool through the use of O-ring seals. It is of extreme importance that all O-rings be maintained in perfect condition and replaced after each use. The E-4 W.L.P.S.A. incorporates a piercing disk bleeder system to provide a safe, easy method of bleeding off trapped pressure before disassembling the W.L.P.S.A. after it has been run. The manual bleeder valve for size 05, 10, and 20 is obsolete. It has been replaced by the piercing disk bleeder system.



Drawing 390-426-00-3

3 Features and Benefits

- Used to set Baker Hughes bridge plugs, cement retainers, and production packers on electric wireline
  - Risk aversion on equipment compatibility.
- Used in conjunction with a casing collar locator for correlation of exact setting depth
  - Accurate equipment placing.
- Uses the advantage of the fast running capability of wireline
  - Wellsite cost savings.
- Proven design has been the industry standard for many years
  - Reliable well sight performance.
- Sizes available for setting inside 2-3/8-in. tubing up to the largest casing
  - Available for all well program sizes.

4 Engineering Tables and Information

Table 1: Specification Guide

Description	Size				
	05	10		20	
		Standard	Heavy Duty	Standard	Heavy Duty
Maximum hydrostatic pressure (psi) at setting depth	27,000	15,000	30,000	15,000	25,000
Maximum setting force (lb)*	10,000	35,000		55,000	
Maximum operating temperature (°F)	400				
Maximum outside diameter (in.)	1.718	2.750	3.250	3.800	4.125
Length (less firing head)	74.16	63.80		74.84	
Length (with firing head)	81.84	72.21	72.21	83.59	83.59

*The force output of the E-4 wireline pressure setting assembly is a function of well conditions, and the characteristics of the device that is being set. The E-4 W.L.P.S.A. will generate sufficient force to set standard Baker Hughes bridge plugs, packers and other products under specified conditions. Other manufacturers devices should be tested before attempting to set with the E-4 W.L.P.S.A.
It is imperative that the specification guides for the various tools set with the E-4 W.L.P.S.A. be followed strictly in regard to the size E-4 W.L.P.S.A. used to set the various sizes of the tools.

Accessory Equipment

Required Accessory Equipment

Igniters

The E-4 W.L.P.S.A. is designed to operate with either a BP-3S (Material H437442200) or a BP-5S (Material H437444200), primary igniter and a secondary igniter (Material H437431000). Refer to the Baker Hughes Slow-Set Power Charge, Standard Power Charge, Secondary Igniter, BP-3S and

BP-5S Igniter (Product Families H43766, H43764, H43743, and H43744) Unit 4190 under Service Tools/Remedial Systems.

Power Charge

The E-4 W.L.P.S.A. is designed to operate with a standard power charge (Material H437641500) for the size 05 and either a standard power charge (Material H437642113 for size 10; Material H437643223 for size 20) or slow set power charge (Material H437660010 for size 10; Material H437660020 for size 20). Refer to Baker Hughes Slow-Set Power Charge, Standard Power Charge, Secondary Igniter, BP-3S and BP-5S Igniter (Product Families H43766, H43764, H43743, and H43744), Unit 4190 under Service Tools/Remedial Systems for further information

Firing Head

The E-4 W.L.P.S.A. utilizes a firing head which connects the wireline pressure setting assembly to the cable head or collar locator on the electric line and provides a means of electrically igniting the power charge, through the igniter, and a secondary igniter.

The C™ firing head (Material H437210500) is used on a size 05 E-4 W.L.P.S.A. The Baker Hughes firing heads (Materials H437201000, and H437202000) are used on the size 10 and 20 E-4 W.L.P.S.A. respectively.

The firing heads are manufactured with the top end blank, for threading, so that it can be machined to fit the operator's cable head or collar locator.

Table 2: E-4 Wireline Pressure Setting Assembly Accessory Equipment, Size 05

Refer to Drawing 390-979-00P02.

Item	Description	Qty. Req'd	Size (in.) and Material
27	Spanner Wrench	1	H016418100
28	Bleeder Wrench Assembly	1	H039098700
28A	Bleeder Housing	1	H036115800
28B	Hex Socket Set Screw	2	HWWG51H0S0 (1/2–13×3/4 lg)
28C	Piercing Screw	1	H036224000

Table 3: E-4 Wireline Pressure Setting Assembly Accessory Equipment, Size 10

Refer to Drawing 390-427-00P03.

Item	Description	Qty. Req'd	Material
24	Spanner Wrench	1	H012421900
25	Bleeder Wrench	1	H039047500
26	Anchor Bolt	1	H038101200
27	Disk Retainer Socket	1	H038100500

Table 4: E-4 Wireline Pressure Setting Assembly Accessory Equipment, Size 20

Refer to Drawing 390-426-00-3.

Item	Description	Qty. Req'd	Size (in.) and Material
21	Spanner Wrench	1	H012059700
22	Bleeder Wrench	1	H039047500
26	Anchor Bolt	1	H038101200
27	Disk Retainer Socket	1	H038100500

5 HSE&S

Read, understand and follow all Baker Hughes instructions and specifications in this unit while assembling, disassembling, maintaining or repairing this equipment. Failure to do so may result in property damage, serious injury or fatality.

⚠ WARNING

After the firing head and wireline pressure setting assembly (W.L.P.S.A) have been run and fired; high pressure gas will be trapped inside the tools. This high pressure gas must be bled off before beginning disassembly. Failure to comply with the following bleed-off guidelines may result in serious bodily injury:

- Do not perform the bleed-off procedures while the W.L.P.S.A. is suspended in the air by the wireline.
- Wear safety glasses, gloves, long sleeves, and hearing protection while bleeding pressure off of the W.L.P.S.A.
- Establish a restricted area for bleeding the setting tool, and post **Danger** placards around the area.
- All non-essential personnel must remain clear of the restricted area until the W.L.P.S.A. has been completely bled off.
- Ensure that the vent holes are pointed away from all personnel and are pointing in the downwind direction.
- Always bleed the W.L.P.S.A. in a well-ventilated area.

6 Preservation of Product

Storage Recommendations

Store setting tools in a cool, dry place.

7 Inspection

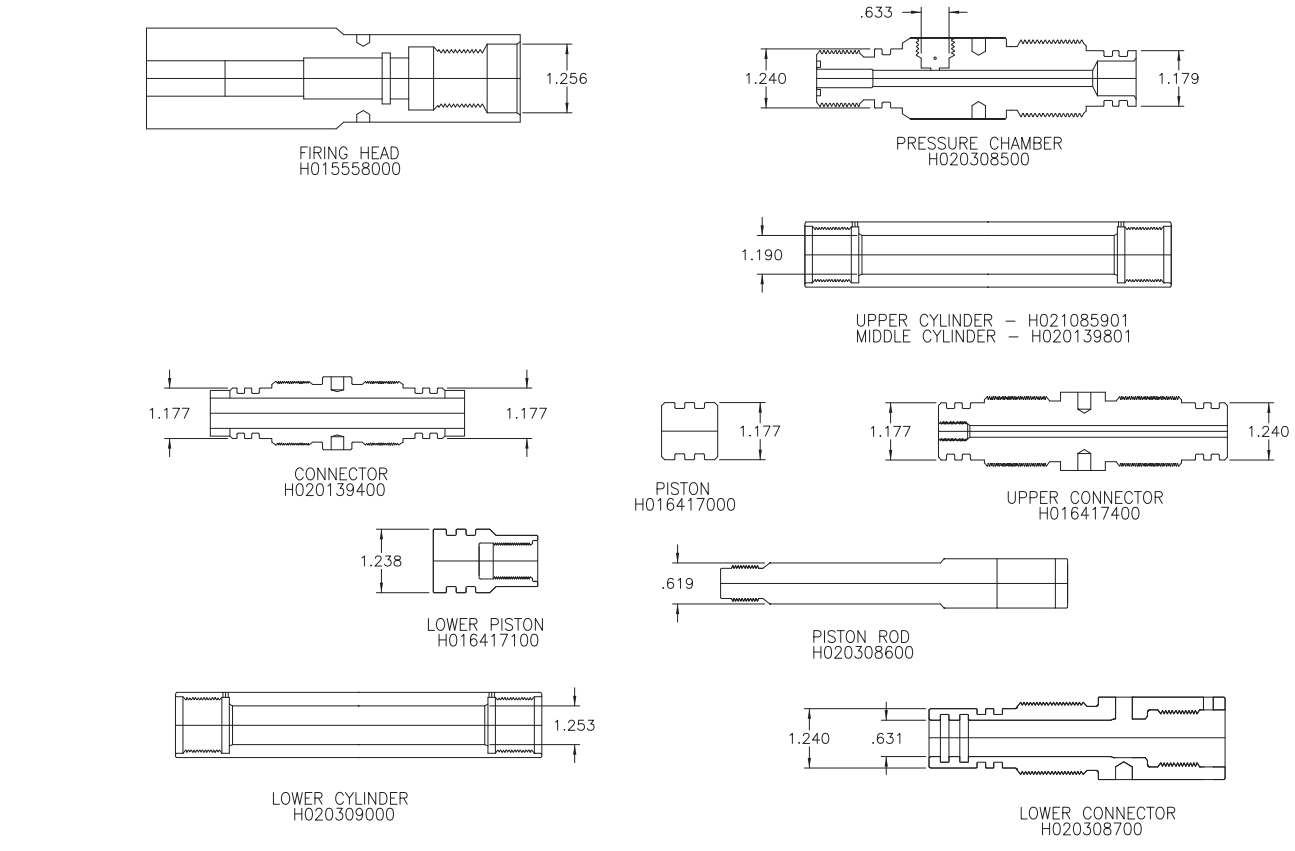
The Baker Hughes E-4 wireline pressure setting assembly should be inspected periodically to replace any parts that have become worn (out of tolerance) due to continuous usage. When maximum or minimum acceptable diameters are exceeded on any part, the part should be replaced.

For critical inspection dimensions,

- Refer to Fig. 1, Size 05.
- Refer to Fig. 2, Size 10.
- Refer to Fig. 3, Size 20.

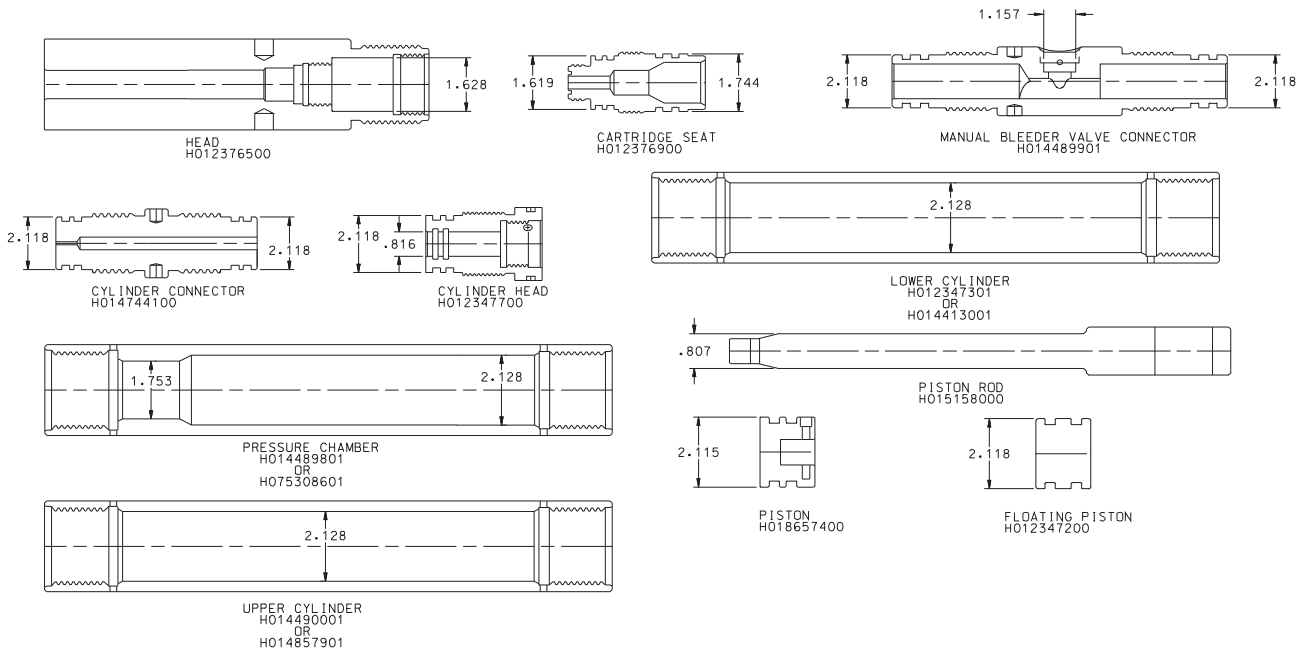
E-4 W.L.P.S.A. Critical Dimensions for Periodic Inspection

Figure 1: Drawing 361-271-00, Size 05



E-4 W.L.P.S.A. Critical Dimensions for Periodic Inspection

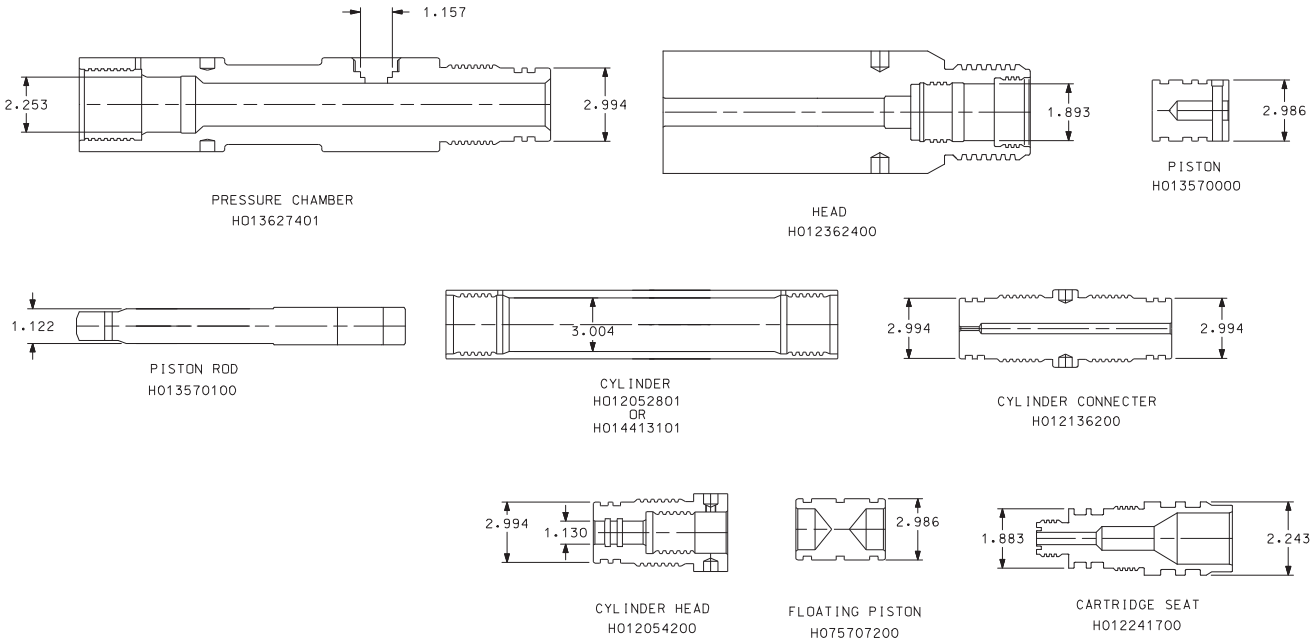
Figure 2: Drawing 361-039-00P01, Size 10



1

E-4 W.L.P.S.A. Critical Dimensions for Periodic Inspection

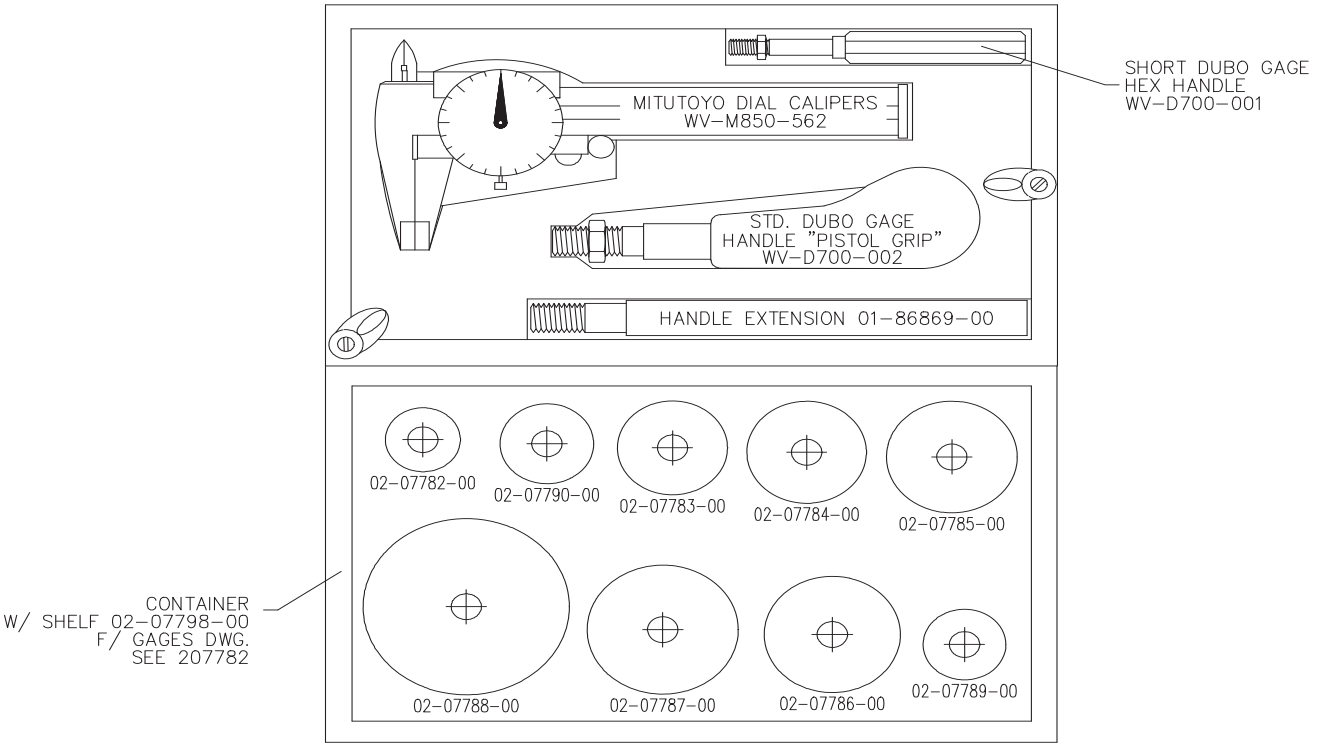
Figure 3: Drawing 361-04800P01, Size 20



1 ALL DIMENSIONS SHOWN ARE MAXIMUM ACCEPTABLE FOR INSIDE DIAMETERS AND MINIMUM ACCEPTABLE FOR OUTSIDE DIAMETERS.

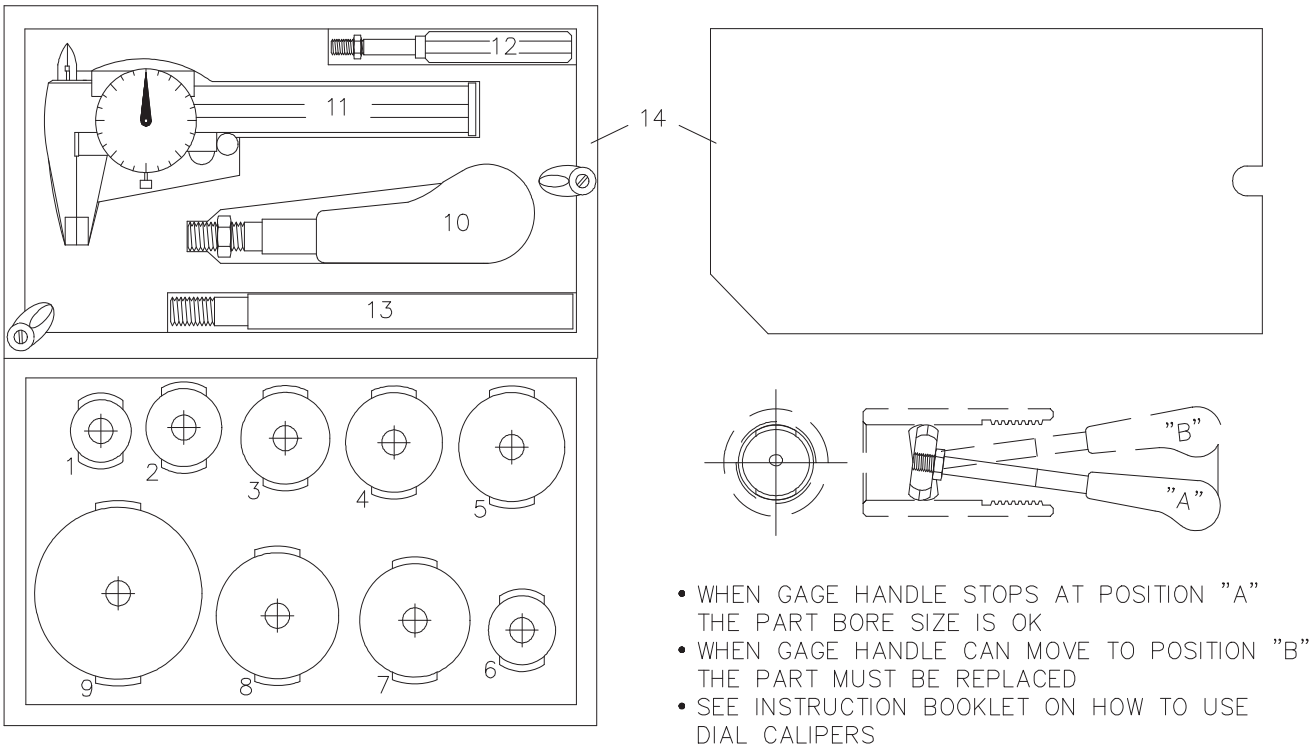
E-4 W.L.P.S.A. Inspection Gauges

Figure 4: Drawing 207-723



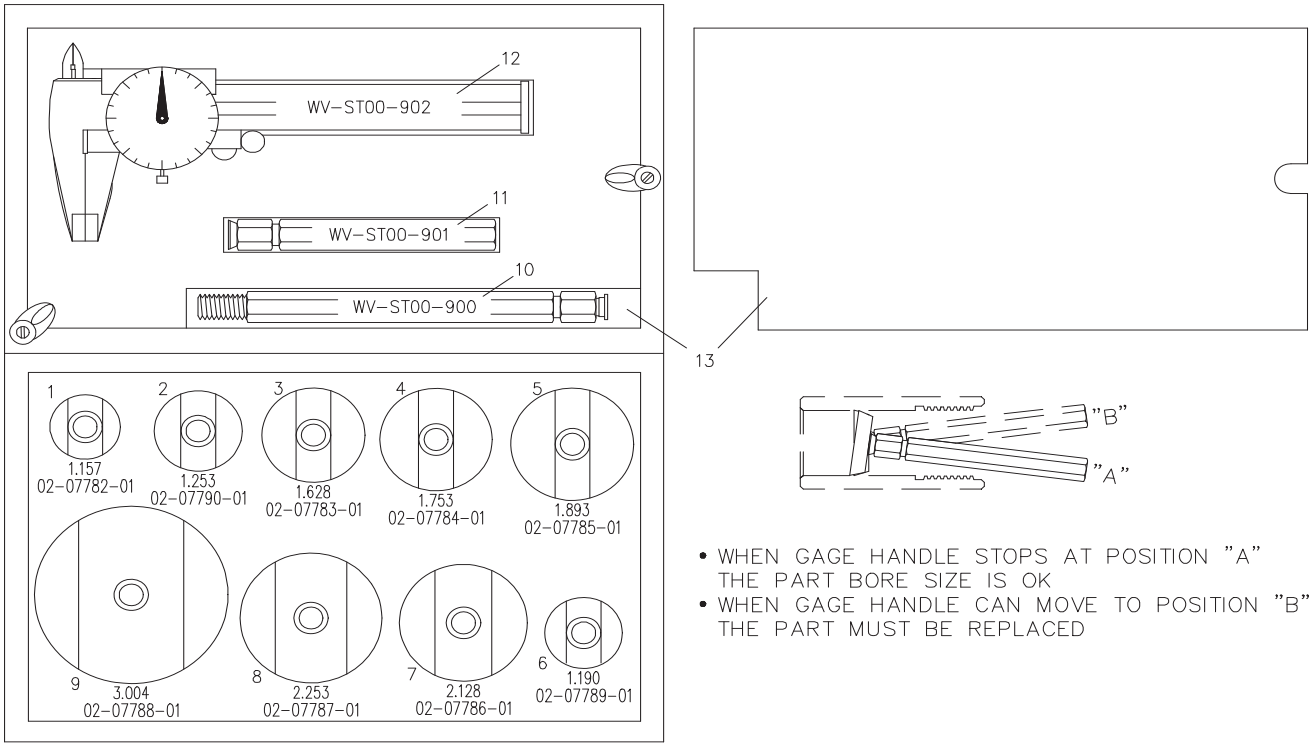
E-4 W.L.P.S.A. Field Inspection Gauges (Product Family H43790)

Figure 5: Drawing 207-799



Lexbar Rok-it Inspection Gauges

Figure 6: Drawing 753-453-1



The following are parts of the inspection kits not shown in Figs. 4–6:

- Instructions on the use and care of dial clippers.
- Critical dimensions for inspection, refer to Drawing 361-271-00 (Fig. 1), Drawing 361-039 (Fig. 2), and Drawing 361-039 (Fig. 3).
- Instructions on gauging parts, refer to Drawing 207-799(Fig. 5).

Making Absolute And Relative Measurements With Your Mitutoyo Dial Caliper

Mitutoyo dial calipers may be used for absolute measurement in the same manner as you would use an ordinary caliper.

For Relative Measurements

First measure the workpiece to be used as a master.

With the dial at this measurement, loosen the bezel screw and set the dial to zero without disturbing the pointer. Comparative measurements and variations are now rapidly read on the dial.

How To Read The Caliper

Refer to Drawing 101-583.

Table 5: Effect of Slides Edge Position on Caliper Reading

If The Slide's Edge is Between 1.2 in. and 1.3 in.	(in.)
Blade reading (take the lower figure)	1.2

Table 5: Effect of Slides Edge Position on Caliper Reading

If The Slide's Edge is Between 1.2 in. and 1.3 in.	(in.)
Dial reading (0.001 in.×46)	0.046
Dial Caliper reading	1.246

Dial Range is 0.2 in. Reading 0-100-100.

Revolution counter counts at each 0.1 in. up to 1 in. and then starts again at zero. When the pointer rests at red (black) half of the dial, the counter reading should be made on red (black) figure, and both the dial and counter readings should be added to the blade reading.

This color-coding helps eliminate reading errors.

Care And Maintenance Of Your Dial Caliper

Keep the jaws, the main scale, rack and the slide free from dust, chips and oil. Before using your tool be sure that when the jaws are closed, the dia pointer is at zero. It it is not, loosen the bezel holding screw and set the dial face to a zero indication.

In the event the pointer rests at more than 10 divisions from the vertical the tool can be easily readjusted in the following fashion except 505-646, 505-637 and 505-644, which should be returned to the maker for repair.

To readjust the tool

Step	Action
1.	Clean the rack and slide thoroughly.
2.	Open the caliper slide up 1–2 in. (40–50 mm).
3.	Holding the adjusting tool in the left hand, back the pointer off 10 divisions on the dial. Insert the adjusting tool between the rack and pinion (refer to Fig. 5 within Drawing 101-583) (Fig. 9).
4.	Hold the tool still and slowly move the main slide closed until the pinion rests upon the adjuster. The pointer must be within 4 divisions form zero with the English dial (refer to Fig. 6 within Drawing 101-583) (Fig. 9).
5.	Adjuster Assembly No. 101583.
6.	Release the adjusting tool. Be sure the pointer remains within 4 divisions of zero as the slide is moved slowly left. When the reference mark on the slide lines up with one of the even numbered graduations on the main scale pull out the adjusting tool. When the tool is removed the pointer should be a zero (refer to Fig. 7 within Drawing 101-583) (Fig. 9).
7.	Check the tool with the jaws closed before next measurement. **Note:** If movements of dial and a slider become unsmooth, return the dial calipers to the maker for repair.

Adjusting Tool

Figure 7: Drawing 101-583

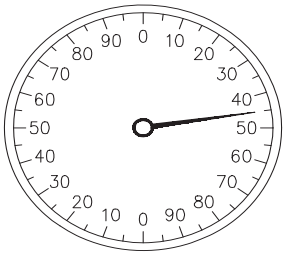


FIG. 3 & 4

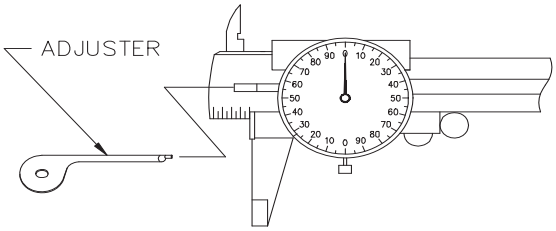


FIG. 5

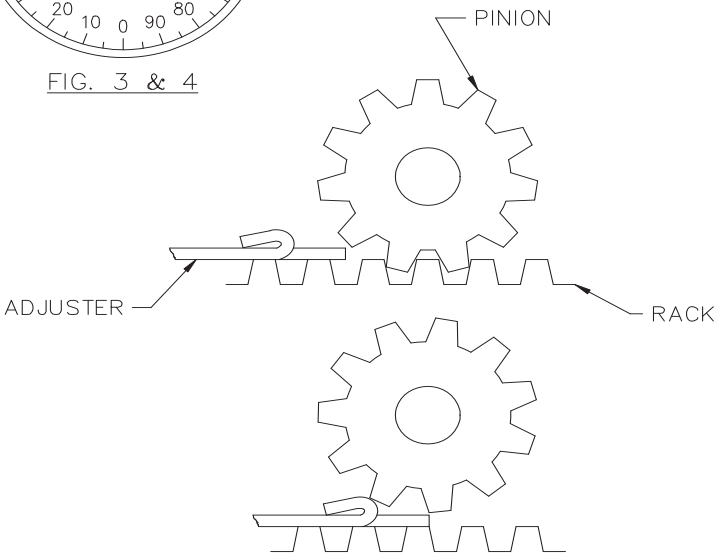


FIG. 6

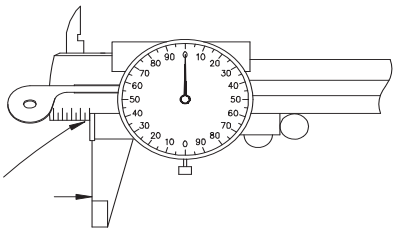


FIG. 7

Radio Silence

It is normal practice to shut down all radio and radar transmitters in the immediate vicinity while setting up and running the E-4 W.L.P.S.A. Tests have shown that it is difficult, but not impossible to set off the W.L.P.S.A. with radio or radar transmissions. Radio silence should be maintained unless an on-site evaluation of radio frequency energy indicates that it is safe to do otherwise.

Running in Extreme Temperatures

When running in temperatures expected to be in excess of 350°F, it is suggested that the gauge ring, wireline feeler and junk catcher be run on the firing head with an igniter in place. After the run, check the firing head for leaks and high-temperature firing of the igniter. If the Igniter has been fired by high well temperatures, it will be impossible to run the W.L.P.S.A. to the setting depth without danger of premature setting. If any fluid is found inside the firing head, all parts must be dried, sealing surfaces examined and all O-rings inspected and replaced. It is very important that all new O-rings be used when the W.L.P.S.A. is run, as fluid around the pin would prevent the firing head from operating. Do not reuse the igniter! Discard and use a new igniter.

It is a good idea to find the setting depth on the gauge ring run and flag the wireline at setting depth. Then run in the hole as fast as possible for the tools being run and fire the setting tool as soon as the flag is reached and the wireline has quit oscillating. This will minimize the temperature that the power charge and Igniters will heat up to before being fired.

General Information

Products of Combustion

The E-4 W.L.P.S.A. should never be bled off in an enclosed area. In case of emergency, the products of combustion are: Carbon monoxide/ hydrogen/water/nitrogen/methane/potassium chloride/ strontium oxide/oxides of nitrogen–both nitrous and nitric/carbon/nitrogen based hydrocarbons/ unburned asphalt/ acetic fraction and paraffin.

The above information is provided for use in administering medical attention only.

8 Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly, Size 05

Running Procedures

Step	Action
1.	Remove the Pressure Chamber (7) from the Upper Cylinder (9) and set aside.
2.	Unscrew the upper half of tool between the Middle Cylinder (12) and Upper Connector (14) from lower half and set on clean surface with Middle Cylinder up.
3.	Use aluminum tube, dowel rod, or broomstick to check that the Piston (11) is completely bottomed out against the Connector (10).

Step	Action
4.	Determine the proper middle cylinder oil-level line using a Baker Hughes oil-level gauge (refer to Fig. 10). The appropriate oil-level line depends on the well temperature at setting depth (refer to Table 6).

E-4 W.L.P.S.A. Middle Cylinder Oil level Line

Figure 8: Drawing 361-138-00-1, Size 05

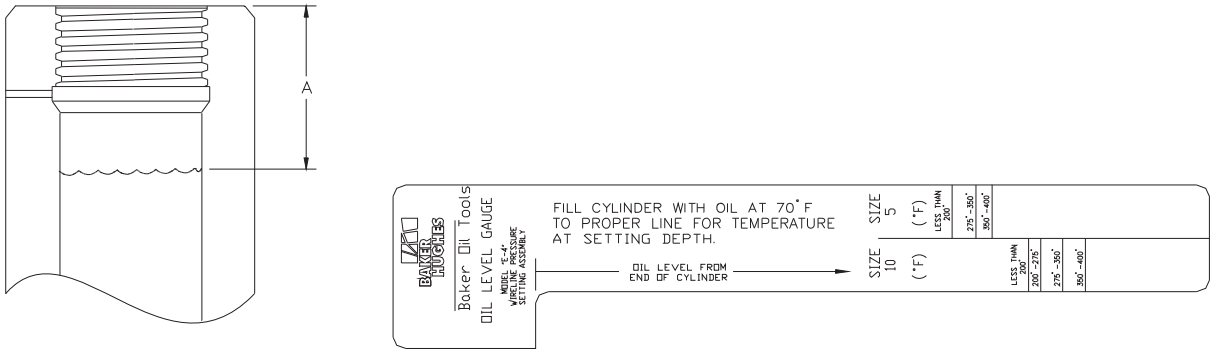


Table 6: E-4 W.L.P.S.A. Middle Cylinder Oil-level Line Based on Well Temperature, Size 05

Refer to Drawing 361-138-00-1.

Well Temperature (°F)	Dimension A (in.)*
	Size 05
200 or less	3-1/4
201–275	
276–350	3-1/2
351–400	3-5/8

*Dimension A is the distance from the end of the cylinder to the oil level.

5.	Fill Middle Cylinder (12) with clean oil (S.A.E. 10W-40 weight oil) to the proper level. Use oil level gauge to check oil level from end of Middle Cylinder.
6.	Pick up the lower portion of the W.L.P.S.A. and thread into the Middle Cylinder (12) and tighten the connection.
7.	Use the proper size screwdriver to loosen and back out the Retainer (4).
8.	Check that the bleeder disk is in place and thread the Retainer (4) back in place (this is a left-hand thread) and tighten.
9.	Clean any grease from the inside diameter (ID) of the Pressure Chamber (7) that may have accumulated there when the piercing disk was assembled. Grease left in this area can prevent the igniter from igniting the secondary igniter.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>10.</td><td>Please refer to the Baker Hughes Slow-Set Power Charge, Standard Power Charge, Secondary Igniter, BP-3S and BP-5S igniter (Product Families. H43766, H43764, H43743, and H43744), Unit 4190 under Service Tools/ Remedial Systems for the proper selection of power charges and igniters.</td></tr>
<tr><td>11.</td><td>Install a secondary igniter (Material H437431000) into the bottom end of the Pressure Chamber (7) and use the Truarc® [Truarc is a registered trademark of Waldes Truarc, Inc. Waldes Truarc is a division of Rotor Clip Company, Inc.] ring provided to retain the secondary. Notice that no groove is provided for the Truarc ring to snap into. The ring is held in place by friction alone and is blown out when the igniter fires.</td></tr>
<tr><td>12.</td><td>Install a BP-3S (Material H437442200) or BP-5S (Material H437444200) primary igniter into the top of the Pressure Chamber (7) and retain with the Protector Cap (1). Be sure that the O-ring (2) is in place between the igniter and the Pressure Chamber.</td></tr>
<tr><td>13.</td><td>Remove the plastic cap from a power charge (Material H437640500) and place the power charge into the bore of the Upper Cylinder (11) with the open end of the power charge facing the open end of the Upper Cylinder. Install the Pressure Chamber (7) into the Upper Cylinder (9) and tighten.
<table>
<tr><td>  </td><td>⚠ WARNING
Never install more than 1 power charge into any W.L.P.S.A. even if it will fit
Additional power charges will cause excessive pressure to build up in the setting tool and may cause it to burst which could result in injury or property damage.
• Never install more than 1 power charge into any W.L.P.S.A.
• Coveralls, gloves, safety glasses, ear protection, hard hat, safety shoes, and breathing protection</td></tr>
</table></td></tr>
<tr><td>14.</td><td>Use an ohmmeter to check the firing head (Material H437210500) for electrical continuity (should read near zero ohm resistance) from the Connector (10) to the Firing Pin (5). Check for shorting (should read infinite ohms) from the Firing Pin to the Head (1).</td></tr>
<tr><td>15.</td><td>Install the firing head onto the cable head or collar locator that it will be run on. Use a ruler to depress the Firing Pin (5) as far as possible and make note of the distance from the end of the firing pin to the end of the Head (1) as shown on Drawing 361-139-00.1.
<table>
<tr><td>NOTICE</td><td>If this dimension is less than 2-1/8 in., the firing pin will exert too much force on the igniter and will damage it and may cause the igniter to leak or misfire.</td></tr>
</table></td></tr>
<tr><td>16.</td><td>Make up the wireline adapter kit and the product to be set to the W.L.P.S.A. Refer to the unit of the specific product being set for assembly instructions.</td></tr>
<tr><td>17.</td><td>Remove the Protector Cap (1) and thread the firing head to the W.L.P.S.A. This connection will not shoulder up and will leave a gap a little wider than a nickel when tight. The gap is necessary because of the face seal on the O-ring (2) between the igniter and the Pressure Chamber (9).</td></tr>
</table>

Step	Action
18.	Remove the firing head from the collar locator or cable head and use a safety meter to check the resistance from the Firing Head Connector (2) to the Head (1). This checks the resistance of the igniter and confirms that the firing head and igniter are installed correctly. Thread the firing head back up to the collar locator or cable head.
19.	Pick up the tools, check zero and run in the hole at a speed no higher than 300 ft/min, being careful to slow down when approaching the fluid level. Continue running several feet past setting depth if possible. Check odometer and weight indicator and pick up slowly to setting depth.
20.	Fire igniter.
21.	Depending on depth, well fluid and other conditions as many as three (3) distinct impulses can be felt manually on the electric line or observed on the weight indicator as the tools set and shear off.
22.	Wait about 1 minute after the last weight indicator bobble to be sure that the tool is set. Then if possible slack off several feet and watch the weight indicator for a drop to indicate that the tool has set. **Note:** With some tools slacking off will re-engage the wireline adapter kit and could cause you to hang up and not be able to pull free. Pick up slowly and note the setting depth by the weight increase remembering that the W.L.P.S.A. has increased about one 1ft in length due to stroking out.
23.	Retrieve the tools at a rate no higher than 300 ft/min. A much slower rate should be used if there is any doubt about the tool being sheared off.

9 Baker Hughes C Firing Head, Size 05

Operation Running Procedures

Refer to Section 10: Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 05

10 Disassembly Instructions

Baker Hughes C Firing Head (Material H437210500), Size 05

Refer to Drawing 155-579-00-3A.

Step	Action
1.	Use a small screwdriver or pick to remove Retaining Ring (7).
2.	Use a wooden dowel or similar tool to push Connector (2), Insulating Sleeve (3), Spring (4), Firing Pin (5) and Pin Insulator (6) out of bottom end of Head (1).
3.	Clean and inspect all parts for wear or damage. Replace as necessary.

11 Assembly Instructions

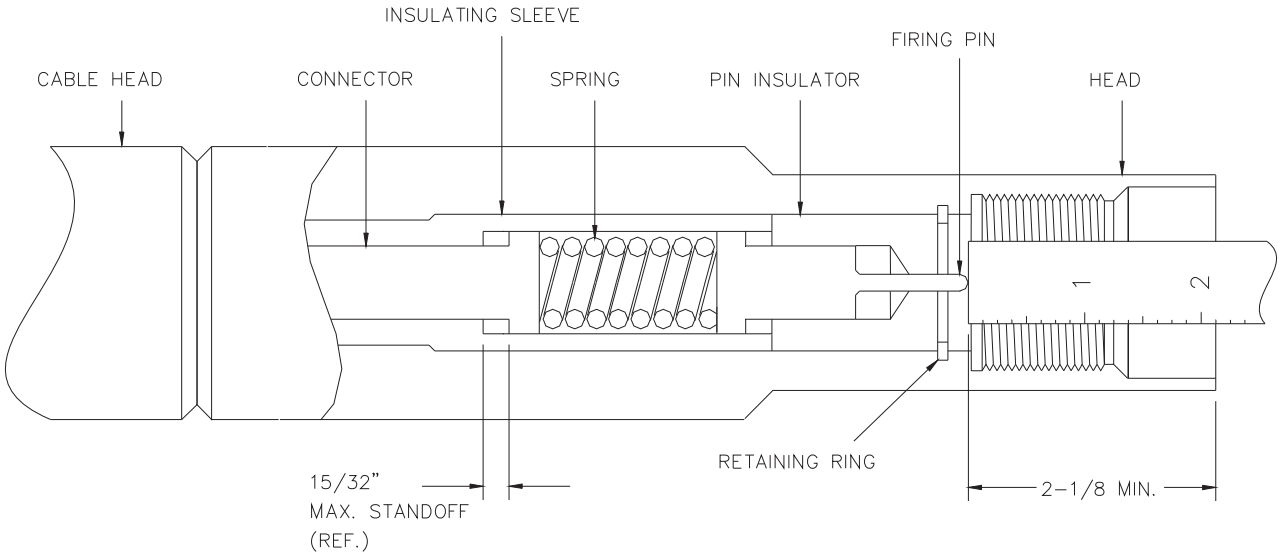
Baker Hughes C Firing Head, Size 05

Refer to Drawing 155-579-00-3B.

Step	Action
1.	Lightly sand both ends of Connector (2), Spring (4), and Firing Pin (5) with a piece of fine sandpaper to remove surface film and provide a good electrical connection between these mating parts.
2.	Insert Connector (2) into the Insulating Sleeve (3) so that the head of the Connector shoulders against the inside of the Insulating Sleeve.
3.	Place Spring (4) inside of Insulating Sleeve (3), touching the Connector (2).
4.	Insert these parts into Head (1) so that Insulating Sleeve (3) shoulders inside Head.
5.	Insert Firing Pin (5) into Pin Insulator (6) until it shoulders.
6.	Place these parts into Head (1) and install the Retaining Ring (7) until it snaps into the groove securing all internal parts.
7.	Use ohmmeter to check the circuit between Connector (2) and Firing Pin (5). The resistance should be near zero. Also check between Firing Pin and Head (1). The resistance should be infinite. If either readings are incorrect, disassemble and inspect all parts for damage and replace as necessary.

C Firing Head Inspection of Firing Pin Location

Figure 9: Drawing 36113900_1, Size 05



When the pressure chamber is made up into a C firing head, the firing pin will be slightly depressed into the firing head. If space is not provided for this movement, the firing pin or igniter will be damaged as the tool is assembled. If the igniter is damaged it could cause pressure to leak into the cable head.

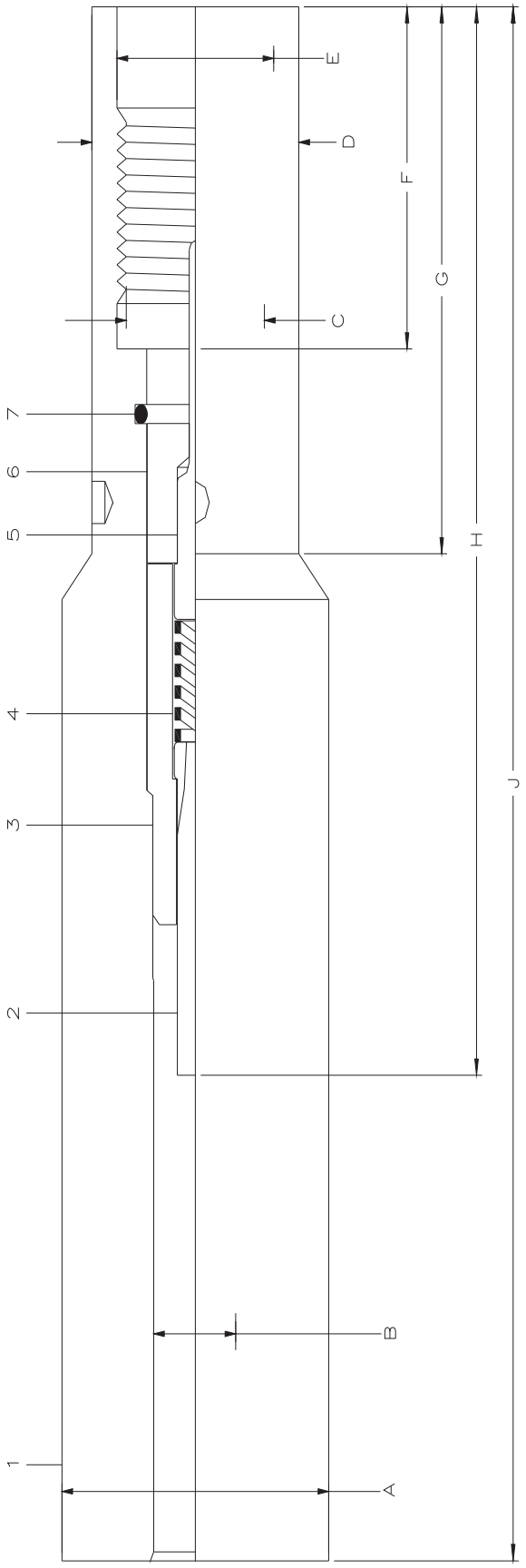
To ensure that the firing head was assembled correctly,

Step	Action
1.	Make up C firing head into cable head or collar locator.
2.	Depress firing pin with a ruler.
3.	Measure distance from bottom of firing pin to end of firing head. Distance should be greater than the minimum dimension shown above.
4.	If distance is less then 2-1/8 in., shorten firing pin to suit. **Note:** It is possible that, due to an unfavorable tolerance build-up, the firing pin will not protrude far enough to contact the igniter. In this event, cut 1/8in. off the top end of the pin insulator.

12 Assembly and Dimensional Information

C Firing Head (Material H437210500)

Figure 10: Assembly and Dimensional Data Drawing 155-579-00-3B, Size 05



C Firing Head (Material H437210500)

Dimensional Data, Size 05

Refer to Drawing 155-579-00-3B.

Dimensions	Size (in.)
A*	1.687
B	0.687
C	0.977
D	1.500
E	1.250
F	2.03
G	3.00
H	7.00
J	9.50

*This OD may be turned down to a minimum of 1.500, but no further.

Parts List, Size 05

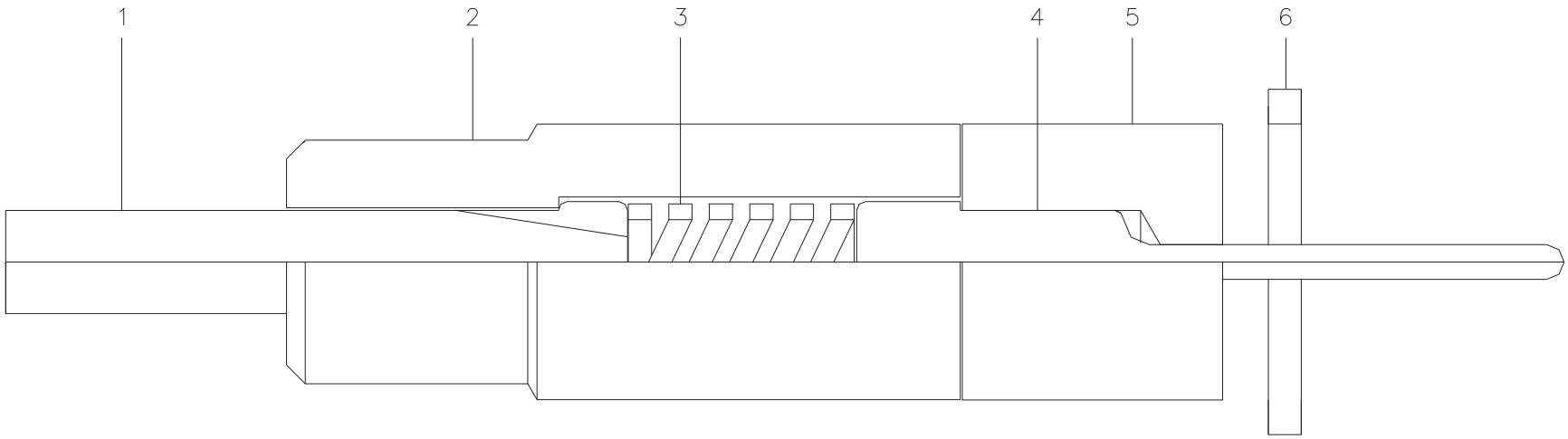
Refer to Drawing 155-579-00-3B.

Item	Description	Qty. Req'd	Material
1	Head	1	H015558000
2	Connector	1	H012362600
3	Insulating Sleeve	1	H018437800
4	Spring	1	H012253800
5	Firing Pin	1	H012254100
6	Pin Insulator	1	H018437900
7	Retaining Ring	1	H015012400

13 Redress Kits

C Firing Head Redress Kit (Material H035687600)

Figure 11: Assembly Drawing 356-876-00, Size 05



C Firing Head

Redress Kit, Size 05

Refer to Drawing 356-876-00.

Item	Description	Qty. Req'd	Size (in.) and Material
1	Connector	1	H012362600
2	Insulating Sleeve	1	H018437800
3	Spring	1	H012253800
4	Firing Pin	1	H012254100
5	Pin Insulator	1	H018437900
6	Retaining Ring	1	H015012400

14 Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 10

Refer to Drawing 390-427-00P03.

Step	Action
1.	Unscrew the upper half of tool between the Upper Cylinder (5) and Cylinder Connector (6) from lower half and set on clean surface with Upper Cylinder up.
2.	Use aluminum tube, dowel rod, or broomstick to check that the Piston (4) is completely bottomed out against the Manual Bleeder Valve Connector (3).
3.	Determine the proper upper cylinder oil-level line using a Baker Hughes oil-level gauge (refer to Fig. 14). The appropriate oil-level line depends on the well temperature at setting depth (refer to Table 8).

E-4 W.L.P.S.A. Upper Cylinder Oil Level

Figure 12: Drawing 361-138-00-2, Size 10

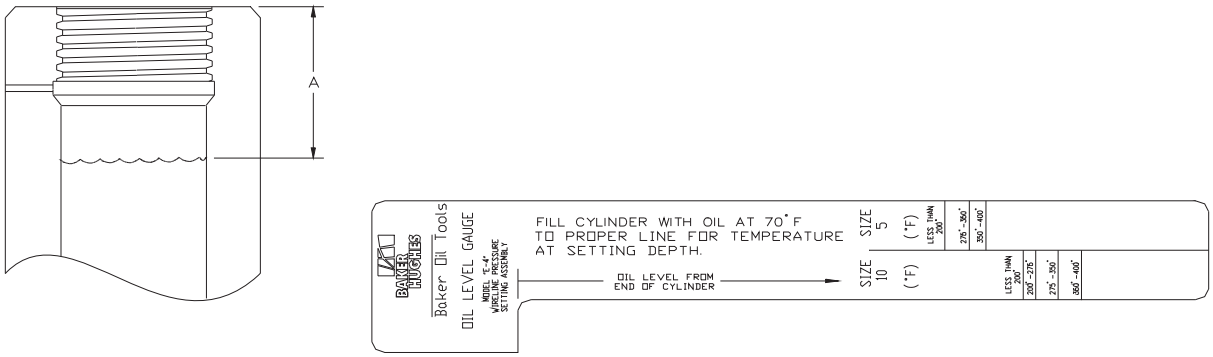


Table 7: E-4 W.L.P.S.A. Upper Cylinder Oil Level Based on Well Temperature, Size 10

Refer to Drawing 361-138-00-2.

Well Temperature (°F)	Dimension A (in.)*
	Size 10
200 or less	4
201–275	4-1/8
276–350	4-3/8
351–400	4-5/8

*Dimension A is the distance from the end of the cylinder to the oil level.

4.	Fill Upper Cylinder (5) with clean oil (S.A.E. 10W-40 weight oil) to the proper level. Use oil level gauge to check oil level from end of Upper Cylinder.
5.	Pick up the lower portion of the W.L.P.S.A. and thread into the Upper Cylinder (5) and tighten the connection.
6.	Use the anchor bolt (Material H038101200) and Disk Retainer Socket (Material H038100500) to back out the Disk Retainer (22).

Step	Action
7.	Place the anchor bolt inside the disk retainer socket. Use an Allen wrench to tighten the left-hand anchor bolt into the Disk Retainer (22) and use a 3/4-in. drive torque wrench to release the Disk Retainer (22).
8.	Check that the bleeder disk is in place and thread the Disk Retainer (22) back in place.
9.	Place the anchor bolt inside the disk retainer socket. Use an Allen wrench to tighten the left-hand anchor bolt into the Disk Retainer (22) and use a 3/4-in.drive torque wrench to tighten the Disk Retainer to 70 ft/lb. Remove the anchor bolt and disk retainer socket.
10.	Thread the Filler Screw (23) into the Disk Retainer (22). This screw prevents debris from collecting in the thread of the Disk Retainer which would make using the Bleeder Wrench (25) for bleeding off pressure difficult.
11.	Please refer to the Slow-Set Power Charge, Standard Power Charge, Secondary Igniter, BP-3S and BP-5S igniter (Product Families H43766, H43764, H43743, and H43744) Unit 4190 under Service Tools/Remedial Systems for the proper selection of power charges and igniters.
12.	On the firing head (Drawing 390-484-00.3), remove the Cartridge Seat (13) from the Head (1). Notice that this is a left-hand thread.
13.	Install a secondary igniter (Material H437431000) into the bottom end of the cartridge seat and use the *Truarc* ring provided to retain the secondary igniter. Notice that no groove is provided for the *Truarc* ring to snap into. The ring is held in place by friction and is blown out on top of the power charge when the primary igniter fires.
14.	Install a BP-3S (Material H437442200) or BP-5S (Material H437444200) primary igniter into the top of the Cartridge Seat (13).
15.	Thread the cartridge seat cap to retain the primary igniter in place. Be sure that the O-ring (9) is in place between the primary igniter and the Cartridge Seat (13).
16.	Use an ohmmeter to check the firing head for electrical continuity (should read near zero ohm resistance) from the Connector (2) to the Firing Pin (5). Check for shorting (should read infinite ohms) from the Firing Pin to the Head (1).
17.	Install the firing head onto the cable head or collar locator that will be run on. Use a ruler to depress the Firing Pin (5) as far as possible and make note of the distance from the end of the Firing Pin to the end of the Head (1) as shown on Drawing 361-139-00.2. *NOTICE* — If this dimension is less than 2-3/8 in. the firing pin will exert too much force on the igniter and will damage it and may cause the igniter to leak or misfire.
18.	Thread the wireline adapter kit and the product to be set to the W.L.P.S.A. Refer to the unit of the specific product being set for assembly instructions.
19.	Remove the plastic cap from the power charge (Material H437660010 or H437642113) and place the power charge into the Pressure Chamber (1) with the open end of the power charge facing the open end of the Pressure Chamber.
20.	Remove the firing head from the collar locator or cable head.
21.	Install and tighten the Cartridge Seat (13) into the Head (1).

Step	Action
22.	Thread and tighten the firing head into the Pressure Chamber (1).
23.	Use a safety meter to check the resistance from the Firing Head Connector (2) to the Head (1). This checks the resistance of the igniter which should be 2.5-5 ohms for a BP-3S igniter and confirms that the firing head and igniter are installed correctly. Thread firing head back up to the collar locator or cable head.
24.	Pick up the tools, check zero and run in the hole at a speed no higher than 300 ft/min, being careful to slow down when approaching the fluid level. Continue running several feet past setting depth if possible. Check odometer and weight indicator and pick up slowly to setting depth.
25.	Fire primary igniter.
26.	Depending on depth, well fluid and other conditions as many as three [3] distinct impulses can be felt manually on the electric line or observed on the weight indicator as the tools set and shear off.
27.	Wait about 1 minute after the last weight indicator bobble to be sure that the tool is set. Then if possible slack off several feet and watch the weight indicator for a drop to indicate that the tool has set. With some tools slacking off will re-engage the wireline adapter kit and could cause you to hang up and not be able to pull free. Pick up slowly and note the setting depth by the weight increase, remembering that the W.L.P.S.A. has increased about 1 ft in length due to stroking out.
28.	Retrieve the tools at a rate no higher than 300 ft/min. A much slower rate should be used if there is any doubt about the tool being sheared off.

15 Baker Hughes C Firing Head, Size 10

Operation

Running Procedures

Refer to Section 12: Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 10.

16 Disassembly Instructions

Baker Hughes C Firing Head (Material H437201000), Size 10

Refer to Drawing 390-484-00.3.

Step	Action
1.	Remove Cartridge Seat (13) from Head (1). This is a left-hand thread.
2.	Remove Cartridge Seat Cap (8) from Cartridge Seat (13).
3.	Remove and discard Igniter (10) and O-rings (9, 11, and 12). Clean Power Charge residue from Cartridge Seat (13).
4.	Use Lock Ring Wrench (14) to remove Locking Ring (7).
5.	Use a wooden dowel or similar tool to push Connector (2), Insulating Sleeve (3), Spring (4), Firing Pin (5) and Pin Insulator (6) out of lower end of Head (1).

Step	Action
6.	Clean and inspect all parts for wear and damage. Replace as necessary.

17 Assembly Instructions

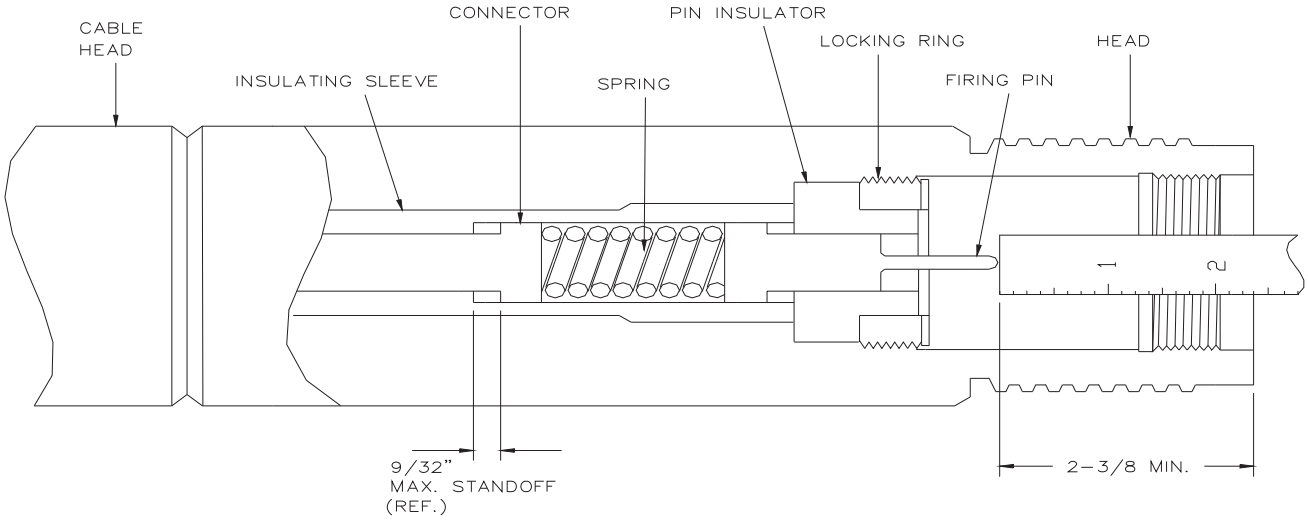
Baker Hughes C Firing Head, Size 10

Refer to Drawing 390-484-00-3A.

Step	Action
1.	Lightly sand both ends of Connector (2), Spring (4) and Firing Pin (5) with a piece of fine sandpaper to remove surface film and provide a good electrical connection between these mating parts.
2.	Insert Connector (2) into the Insulating Sleeve (3) so that the head of the Connector shoulders against the inside of the Insulation Sleeve.
3.	Place Spring (4) inside of Insulating Sleeve (3), touching the Connector (2).
4.	Insert these parts into Head (1) so that Insulating Sleeve (3) shoulders inside Head.
5.	Insert Firing Pin (5) into Pin Insulator (6) until it shoulders.
6.	Place these parts into Head (1) so that Firing Pin (5) contacts Spring (4).
7.	Use Lock Ring Wrench (14), screw Locking Ring (7) into Head (1) until it forces Pin Insulator (6) to shoulder on the Head. Do not over-tighten.
8.	Use ohmmeter to check the circuit between Connector (2) and Firing Pin (5). The resistance should be near zero. Also check between the Firing Pin and Head (1). The resistance should be infinite. If either readings are incorrect, disassemble and inspect all parts for damage and replace as necessary.
9.	Lubricate O-rings (9, 11, and 12) and install on Cartridge Seat (13).
10.	Insert secondary igniter into bottom end of Cartridge Seat (13) and retain with *Truarc* ring supplied with igniter. The *Truarc* ring does not fit into a groove, but is held by frictional contact alone.
11.	Insert Igniter (10) into the top end of the Cartridge Seat (13) and secure with Cartridge Seat Cap (8). Wrench tight Cartridge Seat Cap to ensure a seal on O-ring (9) between igniter and cartridge seat.
12.	Install Cartridge Seat (13) into Head (1) Wrench **Note:** The connection between the Cartridge Seat and the Head is a shouldered left-hand thread. It is very important that this connection be made up securely, otherwise the Cartridge Seat may back off when the firing head is screwed into the electric line adapter of the feeler and junk catcher or the pressure chamber of the W.L.P.S.A.

C Firing Head Inspection of Firing Pin

Figure 13: Drawing 36113900_2, Size 10



When a cartridge seat is made up into the firing head, the firing pin will be slightly depressed into the firing head. If space is not provided for this movement, the firing pin or igniter will be damaged as the tool is assembled. If the igniter is damaged, it could cause pressure to leak into the cable head or cause the igniter to misfire.

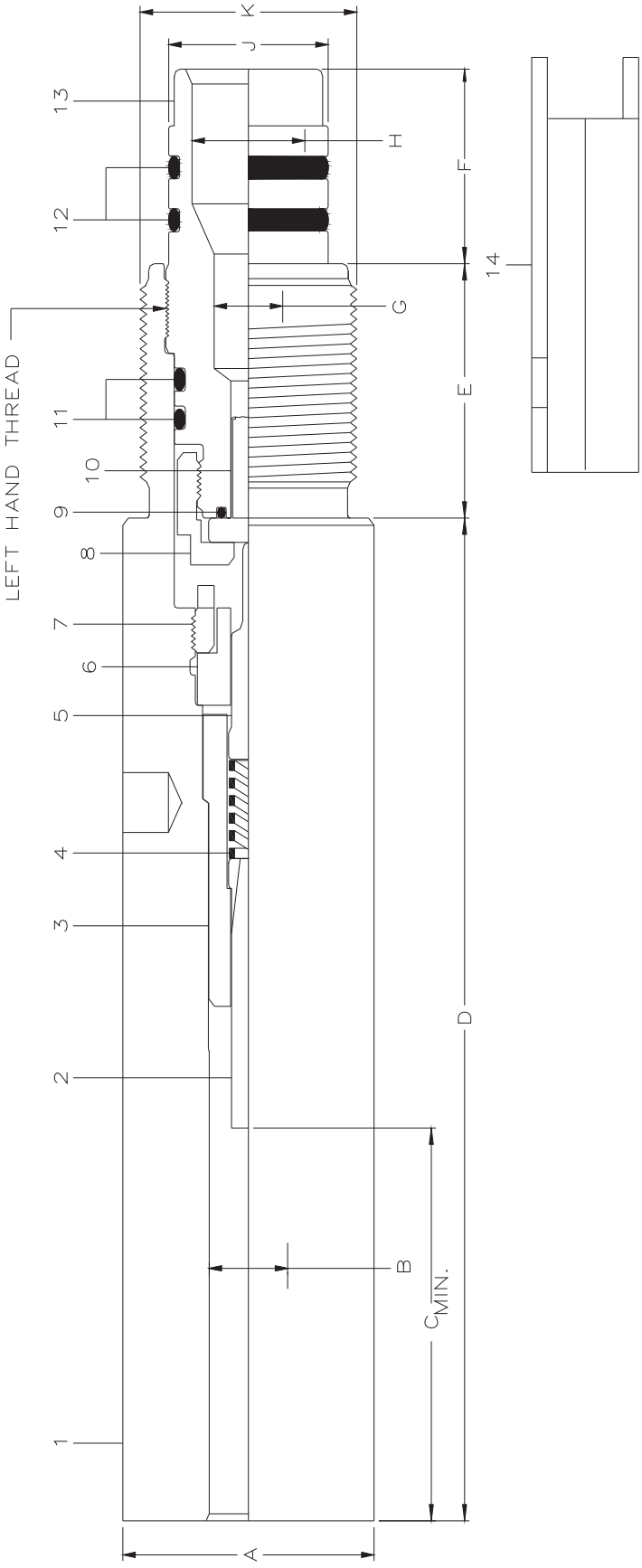
To ensure that the firing head was assembled correctly,

Step	Action
1.	Thread firing head, less cartridge seat, into cable head or collar locator.
2.	Depress firing pin with a ruler.
3.	Measure distance from bottom of firing pin to end of firing head. Distance should be greater than the minimum dimension shown on drawing.
4.	If distance is less than 2-3/8 in., shorten firing pin to suit.

18 Assembly and Dimensional Information

C Firing Head (Material H437201000)

Figure 14: Assembly Drawing 390-484-00-3B, Size 10



C Firing Head (Material H437201000)

Dimensional Data, Size 10

Refer to Drawing 390-484-00-3B.

Dimensions	Size (in.)
A	2.75
B	0.875
C	3.375
D	8.38
E	2.13
F	1.63
G	0.75
H	1.25
J	1.747
K	2.375

Parts List, Size 10

Refer to Drawing 390-484-00-3B.

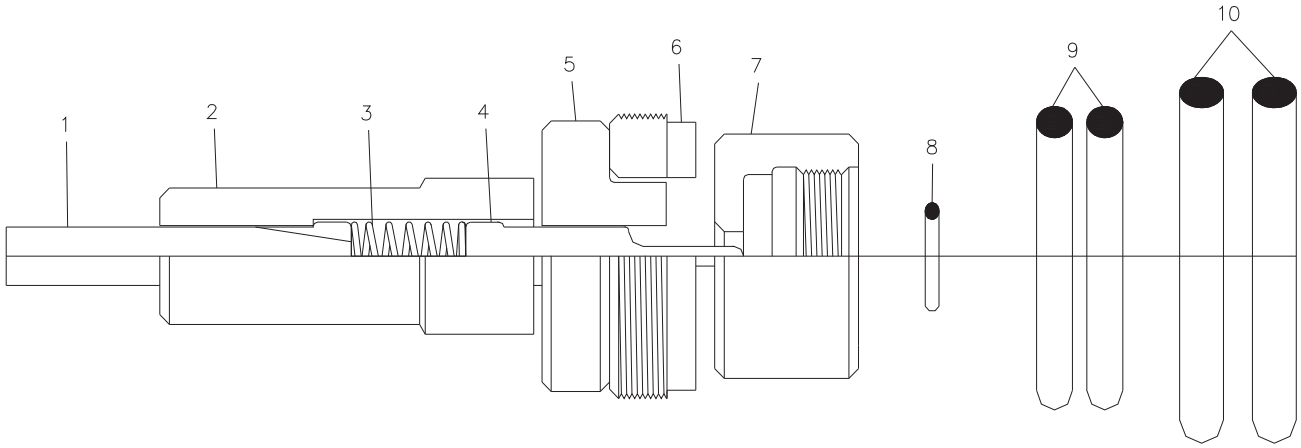
Item	Description	Qty. Req'd	Material
1	Head	1	H012376500
2	Connector	1	H012362600
3	Insulating Sleeve	1	H018435000
4	Spring	1	H012253800
5	Firing Pin	1	H012254100
6	Pin Insulator	1	H018435100
7	Locking Ring	1	H012376700RT
8	Cartridge Seat Cap	1	H012376800
9	O-ring	1	HWWB112H40
10	BP-3S Igniter* or BP-5S Igniter *	1	H437442200 or H437440001
11	O-ring	2	HWWB220H40
12	O-ring	2	HWWB222H40
13	Cartridge Seat	1	H012376900
14	Lock Ring Wrench*	1	H075214600

* When ordered only.

19 Redress Kits

C Firing Head Redress Kit (Material H035687700)

Figure 15: Assembly Drawing 356-877-00, Size 10



C Firing Head

Redress Kit, Size 10

Item	Description	Qty. Req'd	Size and Material
			Size 10
			H035687700
1	Connector	1	H012362600
2	Insulating Sleeve	1	H018435000
3	Spring	1	H012253800
4	Firing Pin	1	H012254100
5	Pin Insulator	1	H018435100
6	Locking Ring	1	H012376700RT
7	Cartridge Seat Cap	1	H012376800
8	O-ring	1	HWWB112H40
9	O-ring	2	HWWB220H40
10	O-ring	2	HWWB222H40

20 Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 20

Refer to Drawing 390-426-00-3.

Step	Action
1.	Unscrew the upper half of tool between the Cylinder (4) and Cylinder Connector (5) from lower half and set on clean surface with Cylinder up.
2.	Use aluminum tube, dowel rod, or broomstick to check that the Piston (3) is completely bottomed out against the Pressure Chamber (1).
3.	Determine proper cylinder oil-level line using a Baker Hughes oil-level gauge (refer to Fig. 18). The appropriate oil-level line depends on the well temperature at setting depth (refer to Table 10).

E-4 W.L.P.S.A. Cylinder Oil Level, Size 20

Figure 16: Drawing 361-138-00-3

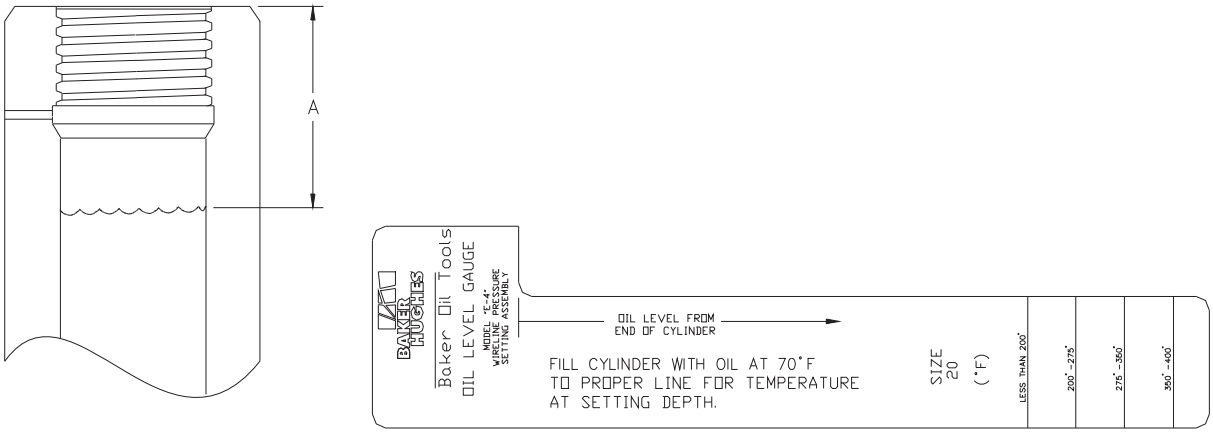


Table 8: E-4 W.L.P.S.A. Cylinder Oil Level Based on Well Temperature, Size 20

Refer to Drawing 361-138-00-3.

Well Temperature (°F)	Dimension A (in.)*
	Size 20
200 or less	4
201–275	4-1/2
276–350	5
351–400	5-1/2

*Dimension A is the distance from the end of the cylinder to the oil level.

4.	Fill Cylinder (4) with clean oil (S.A.E. 10W-40 weight oil) to the proper level. Use oil level gauge to check oil level from end of upper cylinder.
5.	Pick up the lower portion of the W.L.P.S.A. and thread into the Cylinder (4) and tighten the connection.

Step	Action
6.	Use the anchor bolt (Material H0838101200) and Disk Retainer Socket (Material H038100500) to back out the disk retainer.
7.	Place the anchor bolt inside the disk retainer socket. Use an Allen wrench to tighten the left-hand anchor bolt into the Disk Retainer (19) and use a 3/4-in. drive torque wrench to release the Disk Retainer (19).
8.	Check that the bleeder disk is in place and thread the Disk Retainer (19) back in place.
9.	Place the anchor bolt inside the disk retainer socket. Use an Allen wrench to tighten the left-hand anchor bolt into the Disk Retainer (19) and use a 3/4-in. drive torque wrench to tighten the Disk Retainer (19) to 70 ft/lb. Remove the anchor bolt and disk retainer socket.
10.	Thread the Filler Screw (20) into the Disk Retainer (19). This screw prevents debris from collecting in the thread of the Disk Retainer which would make using the Bleeder Wrench (22) for bleeding off pressure difficult.
11.	Please refer to the Baker Slow-Set Power Charge, Standard Power Charge, Secondary Igniter, BP-3S and BP-5S igniter (Product Families H43766, H43764, H43743, and H43744), Unit 4190 under Service Tools/Remedial Systems for the proper selection of power charges and igniters.
12.	On the firing head (Drawing 390-484-00.3), remove the Cartridge Seat (13) from the Head (1). Note that this is a left-hand thread.
13.	Install a secondary igniter (Material H437431000) into the bottom end of the Cartridge Seat (13) and use the *Truarc* ring provided to retain the secondary igniter. Notice that no groove is provided for the *Truarc* ring to snap into. The ring is held in place by friction and is blown out on top of the power charge when the primary igniter fires.
14.	Install a BP-3S (Material H437442200) or BP-5S (Material H437444200) primary igniter into the top of the Cartridge Seat (13).
15.	Thread the cartridge seat cap to retain the primary igniter in place. Be sure that the O-ring (9) is in place between the primary igniter and the Cartridge Seat (13).
16.	Use an ohmmeter to check the firing head for electrical continuity (should read near 0 ohm resistance) from the Connector (2) to the Firing Pin (5). Check for shorting (should read infinite ohms) from the Firing Pin to the Head (1).
17.	Install the firing head onto the cable head or collar locator that will be run on. Use a ruler to depress the Firing Pin (5) as far as possible and make note of the distance from the end of the Firing Pin to the end of the Head (1) as shown on Drawing 361-139-00.3. *NOTICE* — If this dimension is less than 2-3/8 in. the firing pin will exert too much force on the igniter and will damage it and may cause the igniter to leak or misfire.
18.	Thread the wireline adapter kit and the product to be set to the W.L.P.S.A. Refer to the unit of the specific product being set for assembly instructions.
19.	Remove the plastic cap from the power charge (Materials H437660020 or H437643223) and place the power charge into the Pressure Chamber (1) with the open end of the power charge facing the open end of the Pressure Chamber.

Step	Action
20.	Remove the firing head from the collar locator or cable head.
21.	Install and tighten the Cartridge Seat (13) into the Head (1).
22.	Thread and tighten the firing head into the Pressure Chamber (1).
23.	Use a safety meter to check the resistance from the Firing Head Connector (2) to the Head (1). This checks the resistance of the igniter which should be 2.5-5 ohms for a BP-3S igniter and confirms that the firing head and igniter are installed correctly. Thread firing head back up to the collar locator or cable head.
24.	Pick up the tools, check zero and run in the hole at a speed no higher than 300 ft/min, being careful to slow down when approaching the fluid level. Continue running several feet past setting depth if possible. Check odometer and weight indicator and pick up slowly to setting depth.
25.	Fire primary igniter.
26.	Depending on depth, well fluid and other conditions as many as three distinct impulses can be felt manually on the electric line or observed on the weight indicator as the tools set and shear off.
27.	Wait about 1 minute after the last weight indicator bobble to be sure that the tool is set. Then if possible slack off several feet and watch the weight indicator for a drop to indicate that the tool has set. With some tools slacking off will re-engage the wireline adapter kit and could cause you to hang up and not be able to pull free. Pick up slowly and note the setting depth by the weight increase, remembering that the W.L.P.S.A. has increased about 1 ft in length due to stroking out.
28.	Retrieve the tools at a rate no higher than 300 ft/min. A much slower rate should be used if there is any doubt about the tool being sheared off.

21 Baker Hughes C Firing Head, Size 20

Operation

Running Procedures

Refer to Section 14: Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 20.

22 Disassembly Instructions

Baker Hughes C Firing Head (Material H437202000), Size 20

Refer to Drawing 390-484-00.3.

Step	Action
1.	Remove Cartridge Seat (13) from Head (1). Left-hand thread.
2.	Remove Cartridge Seat Cap (8) from Cartridge Seat (13).
3.	Remove and discard Igniter (10) and O-rings (9, 11 and 12). Clean power charge residue from Cartridge Seat (13).
4.	Use Lock Ring Wrench (14) to remove Locking Ring (7).
5.	Use a wooden dowel or similar tool to push Connector (2), Insulating Sleeve (3), Spring (4), Firing Pin (5) and Pin Insulator (6) out of lower end of Head (1).
6.	Clean and inspect all parts for wear and damage. Replace as necessary.

23 Assembly Instructions

Baker Hughes C Firing Head, Size 20

Refer to Drawing 390-484-00-3A.

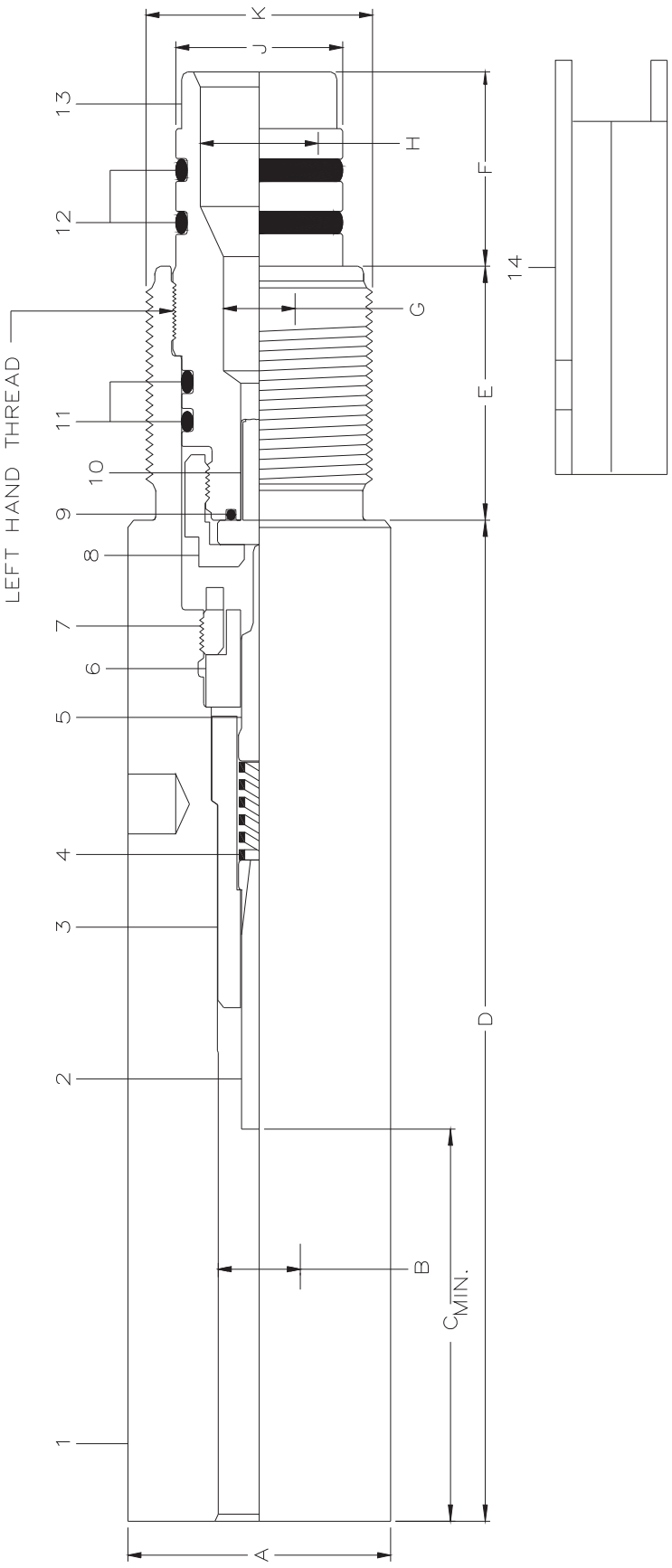
Step	Action
1.	Lightly sand both ends of Connector (2), Spring (4) and Firing Pin (5) with a piece of fine sandpaper to remove surface film and provide a good electrical connection between these mating parts.
2.	Insert Connector (2) into the Insulating Sleeve (3) so that the head of the Connector shoulders against the inside of the Insulation Sleeve.
3.	Place Spring (4) inside of Insulating Sleeve (3), touching the Connector (2).
4.	Insert these parts into Head (1) so that Insulating Sleeve (3) shoulders inside Head.
5.	Insert Firing Pin (5) into Pin Insulator (6) until it shoulders.
6.	Place these parts into Head (1) so that Firing Pin (5) contacts Spring (4).
7.	Use Lock Ring Wrench (14), screw Locking Ring (7) into Head (1) until it forces Pin Insulator (6) to shoulder on the Head. Do not over tighten.
8.	Use ohmmeter to check the circuit between Connector (2) and Firing Pin (5). The resistance should be near zero. Also check between the Firing Pin and Head (1). The resistance should be infinite. If either reading is incorrect, disassemble and inspect all parts for damage and replace as necessary.
9.	Lubricate O-rings (9, 11, and 12) and install on Cartridge Seat (13).
10.	Insert secondary igniter into bottom end of Cartridge Seat (13) and retain with *Truarc* ring supplied with igniter. The *Truarc* ring does not fit into a groove, but is held by frictional contact alone.

Step	Action
11.	Insert Igniter (10) into the top end of the Cartridge Seat (13) and secure with Cartridge Seat Cap (8). Wrench tight Cartridge Seat Cap to ensure a seal on O-Ring (9) between igniter and cartridge seat.
12.	Install Cartridge Seat (13) into Head (1) Wrench. **Note:** The connection between the Cartridge Seat and the Head (1) is a shouldered left-hand thread. It is very important that this connection be made up securely, otherwise the Cartridge Seat may back off when the firing head is screwed into the electric line adapter of the feeler and junk catcher or the pressure chamber of the W.L.P.S.A.

24 Assembly and Dimensional Information

C Firing Head (Material H437202000)

Figure 17: Assembly and Dimensional Drawing 390-484-00-3B, Size 20



C Firing Head (Material H437202000)

Dimensional Data, Size 20

Refer to Drawing 390-484-00-3B.

Dimensions	Size 20 (in.)
A	3.835
B	0.875
C	4.000
D	8.44
E	2.56
F	1.69
G	0.75
H	1.625
J	2.246
K	2.875

Parts List, Size 20

Refer to Drawing 390-484-00-3B.

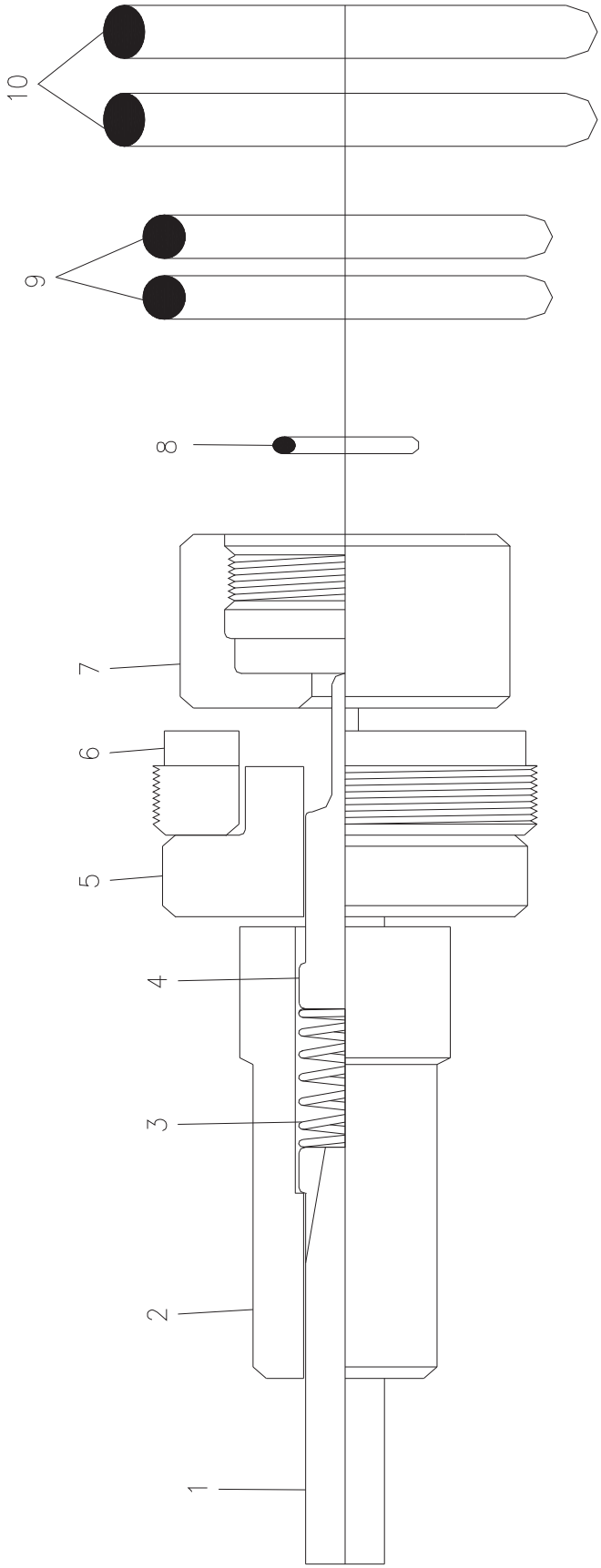
Item	Description	Qty. Req'd	Size and Material
			Size 20
1	Head	1	H012362400
2	Connector	1	H012362600
3	Insulating Sleeve	1	H018435000
4	Spring	1	H012253800
5	Firing Pin	1	H012254100
6	Pin Insulator	1	H018435200
7	Locking Ring	1	H012254300
8	Cartridge Seat Cap	1	H012376800
9	O-ring	1	HWWB112H40
10	BP-3S Igniter* or BP-5S Igniter*	1	H437442200 or H437440001
11	O-ring	2	HWWB325H40
12	O-ring	2	HWWB328H40
13	Cartridge Seat	1	H012241700
14	Lock Ring Wrench*	1	H075214600

* When ordered only.

25 Redress Kits

C Firing Head Redress Kit (Material H035687800)

Figure 18: Assembly Drawing 356-878-00, Size 20



C Firing Heads

Redress Kit, Size 20

Refer to Drawing 356-878-00.

Item	Description	Qty. Req'd	Size and Material
			Size 20
			H035687800
1	Connector	1	H012362600
2	Insulating Sleeve	1	H018435000
3	Spring	1	H012253800
4	Firing Pin	1	H012254100
5	Pin Insulator	1	H018435200
6	Locking Ring	1	H012254300
7	Cartridge Seat Cap	1	H012376800
8	O-ring	1	HWWB112H40
9	O-ring	2	HWWB325H40
10	O-ring	2	HWWB328H40

26 E-4 Wireline Pressure Setting Assembly, Size 05

Operation

Running Procedures

Refer to Section 10: Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 05

27 Disassembly Instructions

E-4 Wireline Pressure Setting Assembly, Size 05

You must complete the following Phase I and Phase II bleed-off procedures before beginning the disassembly.

Phase I and Phase II Bleed-off Procedures for Wireline Pressure Setting Assembly, Size 05

Phase I Bleed-off Procedure, Size 05

Step	Action
1.	Lay tools down, being careful not to damage the wireline adapter kit.
2.	Position the W.L.P.S.A. so that the bleeder disk system faces up.
3.	Locate the bleeder vent hole in the Pressure Chamber (7) next to the bleeder disk system. Make sure this vent hole is pointed away from all personnel and is pointing in the down wind direction. All personnel are required to stand on the side of the tool that is opposite from the vent hole. Verified by:_____
4.	Slide the Bleeder Wrench Assembly (28) over the W.L.P.S.A. The vent hole in the Pressure Chamber (7) must be aligned with the open side of the Bleeder Wrench Housing (28A).
5.	Align the Piercing Screw (28C) with the hole in the Retainer (4). Hand-tighten Piercing Screw until it makes contact with the Piercing Disk (5).
6.	Secure the Bleeder Wrench Assembly (28) to the W.L.P.S.A. with two 1/2–13 Hex Socket Set Screws (28B).

Step	Action
7.	Slowly thread (right-hand thread) the Piercing Screw (28C) into the bleeder wrench until the Piercing Disk (5) is punctured.  **⚠ WARNING** Ensure personnel are not leaning over the Bleeder Wrench Assembly (28) **Could result in serious bodily injury or even death** • Wear standard PPE including a hard hat, as well as ear and eye protection  **⚠ WARNING** Keep hands away from the vent hole at all times **Could result in serious bodily injury or even death** • Wear standard PPE including a hard hat, as well as ear and eye protection
8.	When the tool starts to bleed off, make an additional 1 turn and then stop. Do not screw the Piercing Screw (28C) in tight because it can seal against the Piercing Disk (5) and prevent bleeding.
9.	Do not turn the Piercing Screw (28C) to the left until the tool is completely bled off. If pressure has been completely bled off, remove Bleeder Disk Assembly (28).  If the Piercing Disk (5) was not punctured and the pressure was not released, do not remove the Piercing Screw (28c).

Step	Action
10.	Clean any debris from the vent hole in the top end of the Pressure Chamber (1).
11.	Position vent hole in the Upper Cylinder (9) away from personnel.
12.	Scribe a line between the Bleeder Wrench Assembly (28) and Upper Cylinder (9).
13.	Hold back up on the Upper Cylinder (9) and slowly unscrew the Pressure Chamber (7) by turning on the Bleeder Wrench Assembly (28) a maximum of 11-1/2 turns from the Upper Cylinder (9).
14.	Do not back the Pressure Chamber (7) off more than 11-1/2 turns.
15.	Allow a sufficient amount of time to release the pressure.
16.	Thread the Pressure Chamber (1) back into the Upper Cylinder (9).
17.	Clean any debris from the vent hole in the bottom end of the Upper Cylinder (9).
18.	Position vent hole in the Upper Cylinder (9) away from personnel.
19.	Scribe a line across the thread connection between the Upper Cylinder (9) and Connector (10).
20.	Hold back up on the Upper Cylinder (9) and slowly unscrew the Connector (10) a maximum of 11-1/2 turns from the Upper Cylinder (9)
21.	Do not back off the Connector (10) more than 11-1/2 turns.
22.	Allow a sufficient amount of time to release the pressure.
23.	Thread the Connector (10) back into the Upper Cylinder (9).
24.	All trapped pressure should be bled off from the Upper section of the W.L.P.S.A. Slowly remove the Bleeder Wrench Assembly (28) from the Pressure Chamber (7) if it was not removed in step 9 of Phase I.
25.	Proceed to Phase II.

Phase II Bleed-off Procedure, Size 05

Before transporting or disassembly is started, the Phase II Bleed-off procedure must be followed to verify that no additional pressure is trapped in the lower section of the W.L.P.S.A.

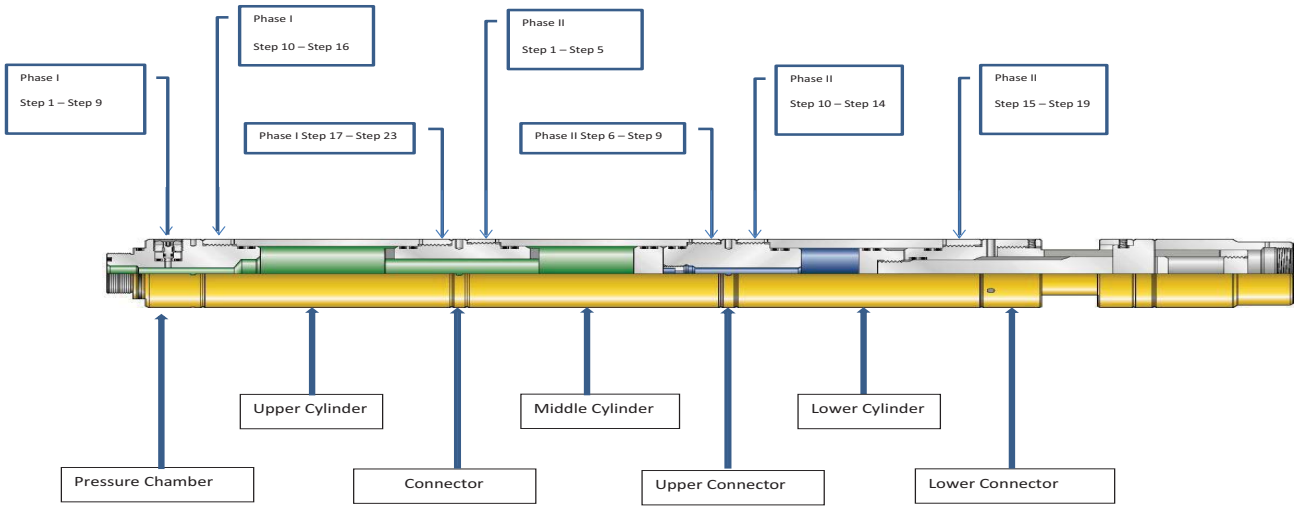
Step	Action
1.	Place the W.L.P.S.A. in a vise on the Middle Cylinder (12) and secure in place with the vent holes in the Middle Cylinder positioned so the pressure will bleed away from personnel.
2.	Clean any debris from the vent hole in the upper end of the Middle Cylinder (12).
3.	Scribe a line across the thread connection between the Connector (10) and Middle Cylinder (12).

Step	Action
4.	Slowly unscrew the Connector (10) a maximum of 11-1/2 turns from the Middle Cylinder (12). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A.
5.	Do not back the Connector (10) off more than 11-1/2 turns. Once pressure has bled off, thread Connector (10) back into the Middle Cylinder (12).
6.	Clean any debris from the vent hole in the bottom end of the Middle Cylinder (12).
7.	Scribe a line across the thread connection between the Upper Connector (14) and Middle Cylinder (12).
8.	Slowly unscrew the Upper Connector (14) a maximum of 11-1/2 turns from the Middle Cylinder (12). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A.
9.	Do not back the Upper Connector (14) off more than 11-1/2] turns. Once pressure has bled off, thread Upper Connector back into the Middle Cylinder (12).
10.	Reposition the W.L.P.S.A. in the vise on the Lower Cylinder (15) and secure in place with the vent holes in the Lower Cylinder positioned so the pressure will bleed away from personnel.
11.	Clean any debris from the vent hole in the Upper end of the Lower Cylinder (15).
12.	Scribe a line across the thread connection between the Lower Cylinder (15) and Upper Connector (14).
13.	Slowly unscrew the Upper Connector (14) a maximum of 11-1/2 turns from the Lower Cylinder (15). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A.
14.	Do not back the Upper Connector (14) off more than 11-1/2 turns. Once pressure has bled off, thread Upper Connector back into the Lower Cylinder (15).
15.	Clean any debris from the vent hole in the bottom end of the Lower Cylinder (15). Position vent hole in the Lower Cylinder so the pressure will discharge away from personnel.
16.	Scribe a line across the thread connection between the Lower Cylinder (15) and Lower Connector (19).
17.	Slowly unscrew the Lower Connector (19) a maximum of 13 turns from the Lower Cylinder (15). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A.
18.	Do not back the Lower Connector (19) off more than 13 turns. Allow a sufficient amount of time to release the pressure. Once pressure has bled off, thread the Lower Connector back into the Lower Cylinder (15).

Step	Action
19.	**Note:** The W.L.P.S.A. is now ready for transport or disassembly since all pressure has been bled from it. Contact Baker Hughes Engineering if any difficulties were encountered in Phase I or Phase II of the procedure. Once the wireline pressure setting assembly has been returned to the warehouse, the warehouse personnel are required to perform Phase I and Phase II of the bleed-off procedure again to ensure all trapped pressure has been bled out of the W.L.P.S.A. prior to disassembly.

Depiction of Phase I and II Bleed-off Procedures

Figure 19: Drawing 468451, Size 05



Disassembling the E-4 Wireline Pressure Setting Assembly, Size 05

Refer to Drawing 390-979-00P02.

Step	Action
1.	Unscrew and remove firing head.
2.	Remove adapter kit from W.L.P.S.A.
3.	Use an appropriate size screwdriver to remove Retainer (4), This is a left-hand thread.
4.	Remove the Piercing Disk (5).
5.	Remove Pressure Chamber (7).
6.	Remove Upper Cylinder (9).
7.	Using an aluminum tube, dowel rod, or broomstick, push burnt power charge from the Upper Cylinder (9).
8.	Unscrew and remove Connector (10).
9.	Place container under tool to catch oil and remove Middle Cylinder (12).
10.	Use an aluminum tube, dowel rod, or broomstick to push the Piston (11) out the lower end of the Middle Cylinder (12).
11.	Unscrew Upper Connector (14) from Lower Cylinder (15), catch and discard all oil from tool properly.
12.	Remove Set Screw (22) and slide Link Retaining Ring (21) up off of Cross Link Sleeve (24).
13.	Remove Cross Link (23), Cross Link Sleeve (24), and Link Retaining Ring (21).
14.	Remove Set Screw (20) and unscrew Setting Mandrel (25) from Lower Connector (19).
15.	Unscrew Lower Connector (19) from Lower Cylinder (15) and remove along with Lower Piston (16) and Piston Rod (17).
16.	Unscrew Lower Piston (16) from Piston Rod (17) and slide Piston Rod out of Lower Connector (19).
17.	Remove and discard all O-rings (2, 3, 6, 8, and 18).
18.	Clean and inspect all parts for wear or damage. **Note:** For field clean up following the use of the W.L.P.S.A. go through step 10. Clean parts thoroughly and reassemble them hand tight without o-rings as soon as possible. The tool should be completely disassembled, thoroughly cleaned and inspected before being reassembled and run again.

28 Assembly Instructions

E-4 Wireline Pressure Setting Assembly, Size 05

Refer to Drawing 390-979-00P02.

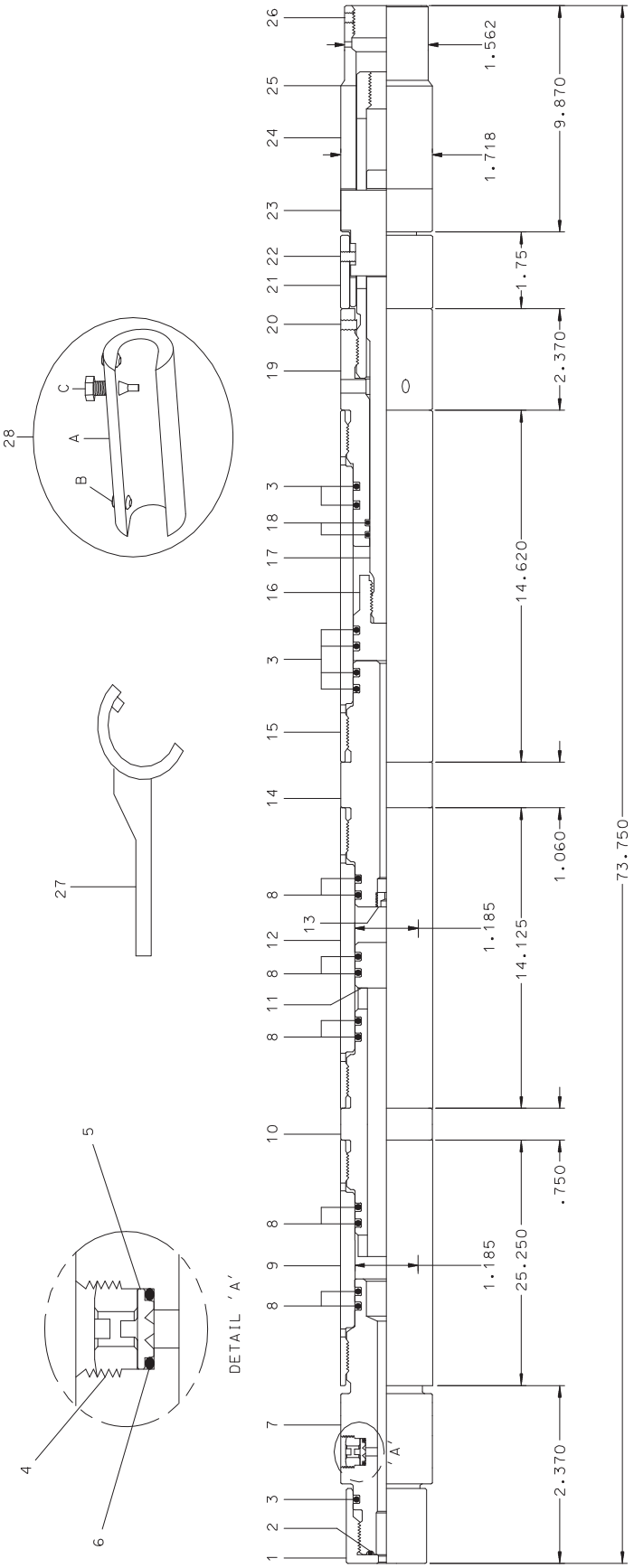
Step	Action
1.	Place Cross Link Sleeve (24) into vise.
2.	Lubricate Cross Link Sleeve (24) and Setting Mandrel (25) with downhole grease and slide Setting Mandrel into Cross Link Sleeve. **Note:** Pin thread of Setting Mandrel must be positioned toward top of tool.
3.	Lubricate Piston Rod (17) and slide into Setting Mandrel (25). Align slot in Piston Rod with slots in Cross Link Sleeve (24) and Setting Mandrel.
4.	Insert Cross Link (23) into slots.
5.	Slide Link Retaining Ring (21) over Cross Link (23) until it shoulders on Cross Link Sleeve (24).
6.	Thread Set Screw (22) into Link Retaining Ring (21).
7.	Lubricate and install internal and external O-rings (18 and 3) onto Lower Connector (19).
8.	Thread Lower Connector (19) onto Setting Mandrel (25).
9.	Lubricate and assemble O-rings (3) onto Lower Piston (16) and thread onto Piston Rod (17).
10.	Push Lower Connector (19) against Link Retaining Ring (21) and slide Lower Cylinder (15) over Lower Piston and thread onto Lower Connector.
11.	Lubricate and assemble O-rings (3 and 8) onto Upper Connector (14) and thread into Lower Cylinder (15). **Note:** Make sure Bean (13) in Upper Connector is positioned toward top of tool and that the Bean is made up tight into Upper Connector.
12.	Remove assembly from vise, set aside and place Middle Cylinder (12) in vise.
13.	Lubricate and assemble O-rings (8) on Piston (11) place Piston into top end of Middle Cylinder (12).
14.	Lubricate and assemble O-rings (8) onto Connector (10) and thread Connector into the top end of the Middle Cylinder (12).
15.	Thread Upper Cylinder (9) onto Connector (10).
16.	Lubricate and assemble O-rings (3 and 8) onto Pressure Chamber (7) and thread Pressure Chamber into Upper Cylinder (9).
17.	Place O-ring (2) onto Pressure Chamber (7).
18.	Thread Protector Cap (1) onto Pressure Chamber (7) to prevent damage to O-rings and threads on Pressure Chamber.
19.	Lubricate and install O-ring (6) into Pressure Chamber (7)

Step	Action
20.	Install Piercing Disk (5) into Pressure Chamber (7) being careful not pinch the O-ring (6).
21.	Thread Retainer (4) into Pressure Chamber (7) to secure Piercing Disk (5) in place. **Note:** Thread on Retainer and Pressure Chamber where Retainer screws in is left-hand.
22.	Unscrew the upper half of tool between the Middle Cylinder (12) and Upper Connector (14) from lower half and set on Protector Cap (1) with Middle Cylinder up. Use aluminum tube, dowel rod, or broomstick to push Piston (11) down until it contacts the Connector (10).
23.	Determine proper line on a Baker Hughes oil level gauge or use chart below for your well temperature at setting depth. Fill Middle Cylinder (12) with clean oil (S.A.E. 10W-40 weight oil) to the proper level. Use oil level gauge to check oil level from end of Middle Cylinder. **Note:** If tool is to be stored prior to its use, oil should not be filled into Middle Cylinder (14) until it is taken out of storage. Mark **No Oil In Tool** on OD.
24.	Thread upper half of tool onto lower half at the Middle Cylinder (12) and Upper Connector (14) threaded connection. Place tool back in vise and tighten all thread connections. **Note:** Check the gap between the Cross Link Sleeve (24) and Lower Connector (19). If a gap is present proceed to step 25.
25.	With tool in vise, carefully break connection between the Middle Cylinder (12) and Upper Connector (14) threaded connection until past the O-ring seal (if oil is in tool it may run out of connection). Remove tool from vise and repeat step 23 above. Then while performing step 24, slowly thread the connection back together while tapping up on Cross Link Sleeve (24) to remove any air trapped between the Piston (16) and oil in Middle Cylinder until O-rings mounted on Upper Connector contacts with sealing area on the inside diameter of the Middle Cylinder. Proceed to tighten to makeup torque.

29 Assembly and Dimensional Information

E-4 Wireline Pressure Setting Assembly (Material H4370205E4RT)

Figure 20: Assembly and Dimensional Data Drawing 390-979-00P02, Size 05



E-4 Wireline Pressure Setting Assembly (Material H4370205E4RT)

Parts List, Size 05

Refer to Drawing 390-979-00P02.

Item	Description	Qty. Req'd	Size (in.) and Material
1	Protector Cap	1	H015506500
2	O-ring*	1	HWWB112H40
3	O-ring*	7	HWWB214H40
4	Retainer	1	H035763600
5	Piercing Disk*	1	H036216100
6	O-ring*	1	HWWB111H40
7	Pressure Chamber	1	H020308500RT
8	O-ring*	10	HWWB213H40
9	Upper Cylinder	1	H021085901RT
10	Connector	1	H020139400RT
11	Piston	1	H016417000RT
12	Middle Cylinder	1	H020139801RT
13	Bean	1	H016416900
14	Upper Connector	1	H016417400RT
15	Lower Cylinder	1	H020309000RT
16	Lower Piston	1	H016417100RT
17	Piston Rod	1	H020308600RT
18	O-ring*	2	HWWB114H40
19	Lower Connector	1	H020308700RT
20	Hex Socket Set Screw	1	HWWG5180B1 (1/4–20×5/16 lg)
21	Link Retaining Ring	1	H020309200
22	Hex Socket Set Screw	2	HWWG518080 (1/4–20×1/4 lg)
23	Cross Link	1	H020308900RT
24	Cross Link Sleeve	1	H020309100
25	Setting Mandrel	1	H020308800RT
26	Hex Socket Set Screw	1	HWWG518060 (1/4–20×3/16 lg)

*O-ring kit (Material H036115200) consists of Items 2, 3, 5, 6, 8 and 18 when ordered only.
*Disk kit (Material H036115100) consists of items 5 and 6 when ordered only.

E-4 Wireline Pressure Setting Assembly (Material H4370205E4RT)

Parts List, Size 05 (Continued)

Refer to Drawing 390-979-00P02.

Item	Description	Qty. Req'd	Size (in.) and Material
27	Spanner Wrench	1	H016418100
28	Bleeder Wrench Assembly	1	H039098700
28A	Bleeder Housing	1	H036115800
28B	Hex Socket Set Screw	2	HWWG51H0S0 (1/2–13×3/4 lg)
28C	Piercing Screw	1	H036224000

*O-ring kit (Material H036115200) consists of Items 2, 3, 5, 6, 8 and 18 when ordered only.
*Disk kit (Material H036115100) consists of items 5 and 6 when ordered only.

30 E-4 Wireline Pressure Setting Assembly, Size 10

Operation

Running Procedures

Refer to Section 12: Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 10.

31 Disassembly Instructions

E-4 Wireline Pressure Setting Assembly, Size 10

You must complete the following Phase I and Phase II bleed-off procedures before beginning the disassembly.

Phase I and Phase II Bleed-off Procedures for Wireline Pressure Setting Assembly, Size 10

Click here to view the E-4 Wireline Pressure Setting Assembly (size 10) phase I and phase II bleed-off procedure animation.

NOTICE	Bleed-off procedure is only valid when using a Baker Hughes firing head, size 10 E-4 Wireline Pressure Setting Assembly, primary igniter, secondary igniter and power charge. for all other manufacturer's equipment, consult manufacturer.

DANGER

Pressure is trapped in the W.L.P.S.A. after being removed from the wellbore

Trapped pressure not fully released will create a projectile

- Use bleed-off procedures starting with the Phase I Bleed-off Procedure
- Wear standard PPE including a hard hat, as well as ear and eye protection

Phase I Bleed-off Procedure, Size 10

Step	Action
1.	Lay tools down, being careful not to damage the wireline adapter kit.
2.	Position the W.L.P.S.A. so that the bleeder disk system faces up.
3.	Locate the bleeder vent hole in the Manual Bleeder Valve Connector (3) next to the bleeder disk system. Make sure this vent hole is pointed away from all personnel and is pointing in the down wind direction. All personnel are required to stand on the side of the tool that is opposite from the vent hole. **Verified by:**_____.

Step	Action
4.	Carefully remove the Filler Screw (23), left-hand thread. Watch the Disk Retainer (22) while removing the Filler Screw to make sure the Disk Retainer does not rotate.

⚠ WARNING

Loosening the Disk Retainer while removing the Filler Screw

Could result in serious bodily injury or even death

- If the Filler Screw cannot be removed without loosening the Disk Retainer, proceed to step 10 of Phase I
- Wear standard PPE including a hard hat, as well as ear and eye protection

Verified by:_____.

Step	Action
5.	Slowly thread (left-hand thread) the Bleeder Wrench (25) into the Disk Retainer (22).  **⚠ WARNING** Ensure personnel are not leaning over the Bleeder Wrench (25) **Could result in serious bodily injury or even death** • Wear standard PPE including a hard hat, as well as ear and eye protection  **⚠ WARNING** Keep hands away from the vent hole at all times **Could result in serious bodily injury or even death** • Wear standard PPE including a hard hat, as well as ear and eye protection **Verified by:**_____.
6.	Once the Bleeder Wrench (25) makes contact with the Piercing Disk (21), continue threading the Bleeder Wrench into the Disk Retainer (22) slowly. Do not make full rotations of the Bleeder Wrench, instead alternate 1/4 turn left, 1/4 turn right-hand rotation and increasing each oscillation by a 1/4 turn, until the Piercing Disk is punctured. **Verified by:**_____.
7.	When the tool starts to bleed off, make an additional 1/2 turn to the left and then back off 1/4 of a turn. Do not screw the Bleeder Wrench (22) in tight because it can seal against the Piercing Disk (21) and prevent bleeding. **Verified by:**_____.

Step	Action
8.	Once the Bleeder Wrench (25) is bottomed out, carefully turn it to the right 1/4 turn, watching to be sure that the Disk Retainer (22) does not rotate.
9.	If the Disk Retainer (22) rotates, turn it to the left, hand tight. If the pressure has been released, remove the Bleeder Wrench (25).  **⚠ WARNING** If the Piercing Disk (21) was not punctured and the pressure was not released, do not remove the Bleeder Wrench (25) **Could result in serious bodily injury or even death** • Wear standard PPE including a hard hat, as well as ear and eye protection **Verified by:**_____.
10.	Clean any debris from the vent hole in the top end of the Pressure Chamber (1).
11.	Position vent hole in the Pressure Chamber (1) away from personnel.
12.	Scribe a line across the thread connection between the Baker Hughes firing head and Pressure Chamber (1).
13.	Hold back up on the Pressure Chamber (1) and slowly unscrew the firing head a maximum of 6 turns from the Pressure Chamber. **Verified by:**_____.
14.	Do not back the firing head off more than 6 turns. **Verified by:**_____.
15.	Allow a sufficient amount of time to release the pressure.
16.	Thread the firing head back into the Pressure Chamber (1). Make sure the Bleeder Wrench (25) is in its original position from step 8 of Phase I.
17.	Clean any debris from the vent hole in the top end of the Upper Cylinder (5).
18.	Position vent hole in the Upper Cylinder (5) away from personnel.
19.	Scribe a line across the thread connection between the Manual Bleeder Valve Connector (3) and Upper Cylinder (5).

Step	Action
20.	Hold back up on the Upper Cylinder (5) and slowly unscrew the Manual Bleeder Valve Connector (3) a maximum of 8 turns from the Upper Cylinder (5). **Verified by:**_____.
21.	Do not back off the Manual Bleeder Valve Connector (3) more than 8 turns. **Verified by:**_____.
22.	Allow a sufficient amount of time to release the pressure.
23.	Thread the Manual Bleeder Valve Connector (3) back into the Upper Cylinder (5).
24.	All trapped pressure should be bled off from the Upper section of the W.L.P.S.A. Slowly remove the Bleeder Wrench (22) from the Disk Retainer (19) if it was not removed in step 9 of Phase I.
25.	Proceed to Phase II. **Verified by:**_____.

Phase II Bleed-off Procedure, Size 10

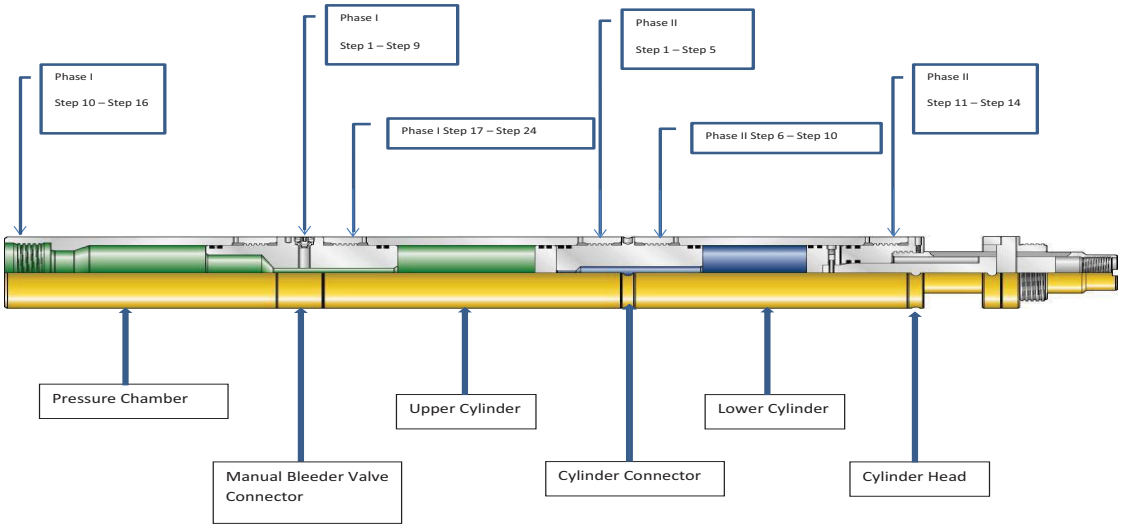
Before transporting or disassembly is started, the Phase II Bleed-off procedure must be followed to verify that no additional pressure is trapped in the lower section of the W.L.P.S.A.

Step	Action
1.	Place the W.L.P.S.A. in a vise on the Upper Cylinder (5) and secure in place with the vent holes in the Upper Cylinder positioned so the pressure will bleed away from personnel.
2.	Clean any debris from the vent hole in the bottom end of the Upper Cylinder (5).
3.	Scribe a line across the thread connection between the Cylinder Connector (6) and Upper Cylinder (5).
4.	Slowly unscrew the Cylinder Connector (6) a maximum of 7 turns from the Upper Cylinder (5). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A. **Verified by:**_____.
5.	Do not back the Cylinder Connector (6) off more than 7 turns. Once pressure has bled off, thread Cylinder Connector back into the Upper Cylinder (5). **Verified by:**_____.
6.	Reposition the W.L.P.S.A. in the vise on the Lower Cylinder (7) and secure in place with the vent holes in the Lower Cylinder positioned so the pressure will bleed away from personnel.

Step	Action
7.	Clean any debris from the vent hole in the Upper end of the Lower Cylinder (7).
8.	Scribe a line across the thread connection between the Lower Cylinder (7) and Cylinder Connector (6).
9.	Slowly unscrew the Cylinder Connector (6) a maximum of 7 turns from the Lower Cylinder (7). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A. **Verified by:**_____.
10.	Do not back the Cylinder Connector (6) off more than 7 turns. Once pressure has bled off, thread Cylinder Connector back into the Lower Cylinder (7). **Verified by:**_____.
11.	Clean any debris from the vent hole in the bottom end of the Lower Cylinder (7). Position vent hole in the Lower Cylinder so the pressure will discharge away from personnel.
12.	Scribe a line across the thread connection between the Lower Cylinder (7) and Cylinder Head (12).
13.	Slowly unscrew the Cylinder Head (12) a maximum of 7 turns from the Lower Cylinder (7). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A. **Verified by:**_____.
14.	Do not back the Cylinder Head (12) off more than 7 turns. Allow a sufficient amount of time to release the pressure. Once pressure has bled off, thread the Cylinder Head back into the Lower Cylinder (7). **Verified by:**_____.
15.	**Note:** The W.L.P.S.A. is now ready for transport or disassembly since all pressure has been bled from it. Contact Baker Hughes engineering if any difficulties were encountered in Phase I or Phase II of the procedure. Once the wireline pressure setting assembly has been returned to the warehouse, the warehouse personnel are required to perform Phase I and Phase II of the bleed-off procedure again to ensure all trapped pressure has been bled out of the W.L.P.S.A. prior to disassembly.
16.	Verify that you have viewed the E-4 Wireline Pressure Setting Assembly (size 10) phase I and phase II bleed-off procedure animation. **Verified by:**_____.

Depiction of Phase I and II Bleed-off Procedures

Figure 21: Drawing 468449, Size 10



Disassembling the E-4 Wireline Pressure Setting Assembly, Size 10

Refer to Drawing 390-427-00.1.

Click here to view the E-4 Wireline Pressure Setting Assembly (size 10) disassembly procedure animation.

Step	Action
1.	Use the anchor bolt and disk retaining bolt to remove Disk Retainer (22)This is a left-hand thread.
2.	Use the screw extractor portion of the Bleeder Wrench (29) to remove the punctured Piercing Disk (21).
3.	Remove Pressure Chamber (1).
4.	Remove Manual Bleeder Valve Connector (3).
5.	Remove Upper Cylinder (5).
6.	Using an aluminum tube, dowel rod, or broomstick, push burnt power charge from Upper Cylinder (5).
7.	Push Floating Piston (4) out of lower end of Upper Cylinder (5).
8.	Remove Set Screw (15) and slide Link Retaining Ring (14) up off of Cross Link Sleeve (18).
9.	Remove Cross Link (16).
10.	Remove Cross Link Sleeve (18) and Link Retaining Ring (14).
11.	Remove Set Screw (13) and remove Setting Mandrel (19).
12.	Unscrew Cylinder Head (12) and remove along with Piston (8) and Piston Rod (17). Catch and discard oil from tool.
13.	Remove Set Screw (9) from Piston (8).
14.	Remove Retaining Pin (10) and separate Piston (8) from Piston Rod (17).
15.	Pull Piston Rod (17) from lower end of Cylinder Head (12).
16.	Remove Cylinder Connector (6).
17.	Remove and discard all O-rings (2, 11, 20, and 21).
18.	Clean and inspect all parts for wear or damage. **Note:** For field clean up following the use of the W.L.P.S.A. go through step 12. Clean parts thoroughly and reassemble them hand tight without o-rings as soon as possible. **The tool should be completely disassembled, thoroughly cleaned and inspected before being reassembled and run again**.
19.	Verify that you have viewed the E-4 Wireline Pressure Setting Assembly (size 10) disassembly procedure animation. **Verified by:**_____.

32 Assembly Instructions

E-4 Wireline Pressure Setting Assembly, Size 10

Refer to Drawing 390-427-00P03.

Click here to view the E-4 Wireline Pressure Setting Assembly (size 10) assembly procedure animation.

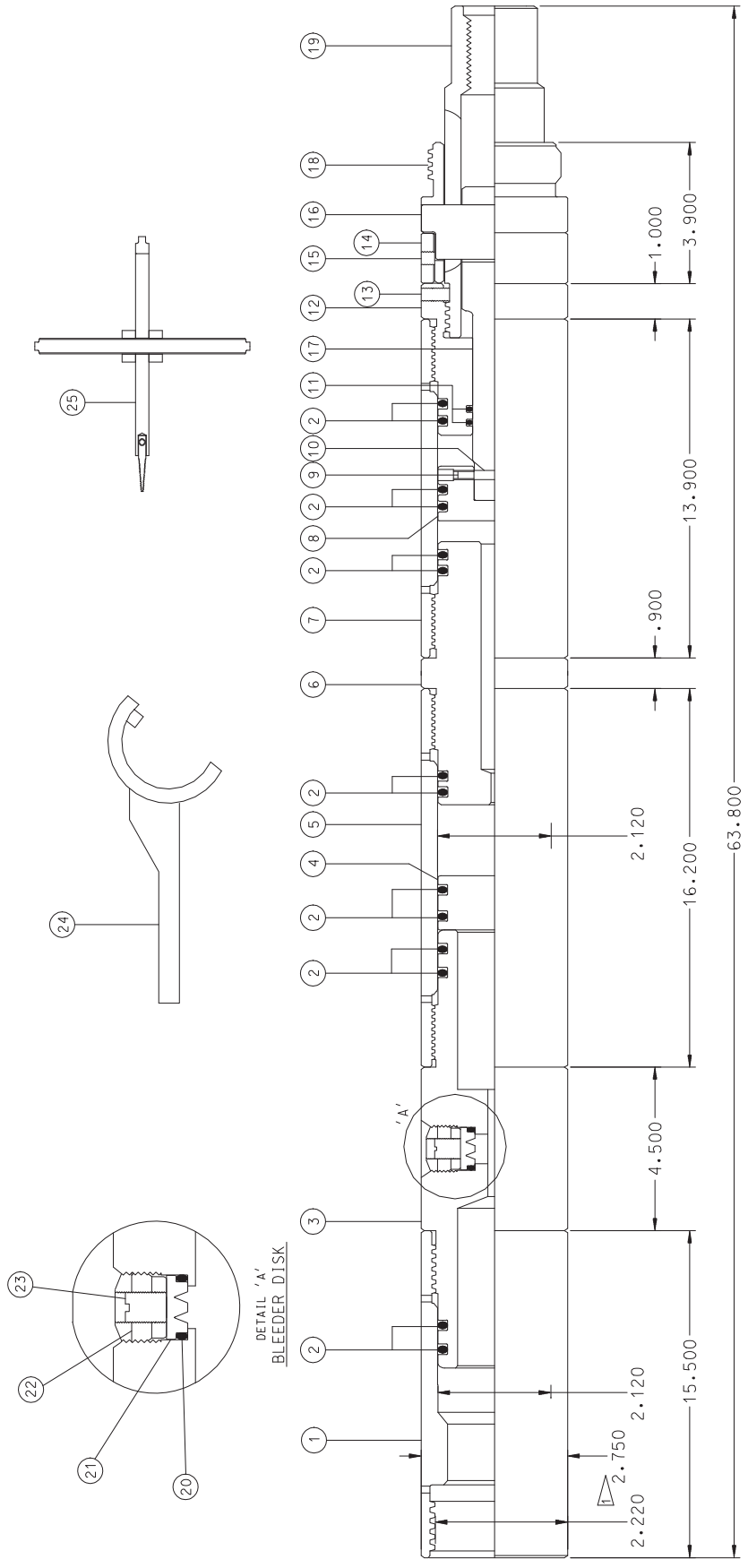
Step	Action
1.	Place Cross Link Sleeve (18) into vise.
2.	Lubricate Cross Link Sleeve (18) and Setting Mandrel (19) with downhole grease and slide Setting Mandrel into Cross Link Sleeve. **Note:** Pin thread of Setting Mandrel must be positioned toward top of tool.
3.	Lubricate Piston Rod (17) and slide into Setting Mandrel (19). Align slot in Piston Rod with slots in Cross Link Sleeve (18) and Setting Mandrel.
4.	Insert Cross Link (16) into slots.
5.	Slide Link Retaining Ring (14) over Cross Link Sleeve (18) and Cross Link (16) until it shoulders on Cross Link Sleeve.
6.	Thread Set Screw (15) into Link Retaining Ring (14), making sure to align Set Screw hole with indention on Cross Link Sleeve (18).
7.	Lubricate and install internal and external O-rings (2 and 11) onto Cylinder Head (12).
8.	Thread Setting Mandrel (19) into Cylinder Head (12) and thread Set Screw (13) into Cylinder Head.
9.	Lubricate and assemble O-rings (2) onto Piston (8) and connect to Piston Rod (17) with Retaining Pin (10) and Set Screw (9).
10.	Push Cylinder Head (12) against Cross Link Sleeve (18), lubricate Piston (8), and slide Lower Cylinder (7) over Piston and thread onto Cylinder Head.
11.	Assemble O-ring (2) on Cylinder Connector (6) and thread into Lower Cylinder (7).
12.	Remove assembly from vise, set aside and place Upper Cylinder (5) in vise.
13.	Lubricate and assemble O-rings (2) on Floating Piston (4) and place Floating Piston into top end of Upper Cylinder (5).
14.	Lubricate and assemble O-rings (2) onto Manual Bleeder Valve Connector (3) and thread the end of the Connector without the drill tip in the inside diameter (ID) into the Upper Cylinder (5).
15.	Thread Pressure Chamber (1) onto Manual Bleeder Valve Connector (3).
16.	Lubricate and install O-ring (20) into Manual Bleeder Valve Connector (3).
17.	Install Piercing Disk (21) into Manual Bleeder Valve Connector (3) being careful not to pinch O-ring (20).

Step	Action
18.	Thread Disk Retainer (22) into Manual Bleeder Valve Connector (3) to secure the Piercing Disk (21) in place. **Note:** Thread on Disk Retainer and Manual Bleeder Valve Connector where Disk Retainer threads in, is a left-hand thread. This is done by using the Anchor Bolt (Material H0838101200) and Disk Retainer Socket (Material H038100500).
19.	Place the anchor bolt inside the disk retainer socket.Use an Allen wrench to tighten the left-hand anchor bolt into the Disk Retainer and use a 3/4-in. drive torque wrench to tighten the Disk Retainer to 70ft–lb. Remove assembly tools to run.
20.	Thread Filler Screw (23) into Disk Retainer (4).
21.	Remove upper half of tool from vise and set on end with Upper Cylinder (5) up. Use aluminum tub, dowel rod, or broomstick to push Floating Piston (4) down until it contacts the Manual Bleeder Valve Connector (3).
22.	Determine proper line on a Baker Hughes oil level gauge or use the chart below for your well temperature at setting depth. Fill Upper Cylinder (5) with clean oil (S.A.E. 10W-40 weight oil) to the proper level. Use oil level gauge to check oil level from end of cylinder. **Note:** If tool is to be stored prior to its use, oil should not be put into Upper Cylinder until it is taken out of storage. Mark **No Oil In Tool** on OD.
23.	Thread lower half of tool onto upper half of tool. Place tool back in vise and tighten all thread connections. **Note:** Check the gap between the Cross Link Sleeve (18) and Cross Link (16). If a gap is present proceed to step 24.
24.	With tool in vise, carefully break connection between the Upper Cylinder (5) and Cylinder Connector(6) until past the O-ring seal (if oil is in tool it may run out of connection). Remove tool from vise and repeat step 22. Then while performing step 23, slowly thread the connection back together while tapping up on Cross Link Sleeve (18) to remove any air trapped between the Piston (8) and oil in Lower Cylinder (7) until O-rings mounted on Cylinder Connector contact with sealing area on Upper Cylinder. Proceed to tighten to torque.
25.	Verify that you have viewed the E-4 Wireline Pressure Setting Assembly (size 10) assembly procedure animation. **Verified by:**_____.

33 Assembly and Dimensional Information

E-4 Wireline Pressure Setting Assembly

Figure 22: Assembly Drawing 390-427-0P03, Size 10



E-4 Wireline Pressure Setting Assembly (Material H4370210E4RT)

Parts List, Size 10

Refer to Drawing 390-427-00P03.

Item	Description	Qty. Req'd	Size (in.) and Material
1	Pressure Chamber	1	H014489801RT or Heavy Duty H075308601RT*
2	O-ring*	14	HWWB327H40
3	Manual Bleeder Valve Connector	1	H014489901RT
4	Floating Piston	1	H012347200RT
5	Upper Cylinder	1	H014490001RT or Heavy Duty H014857901RT*
6	Cylinder Connector	1	H014744100RT
7	Lower Cylinder	1	H012347301RT or Heavy Duty H014413001RT*
8	Piston	1	H018657400RT
9	Hex Socket Set Screw	1	HWWG5180D6 (1/4–20×3/8 lg)
10	Retaining Pin	1	H018669000
11	O-ring*	2	HWWB211H40
12	Cylinder Head	1	H012347700RT
13	Hex Socket Set Screw	1	HWWG51D0H0 (3/8–16×1/2 lg)
14	Link Retaining Ring	1	H012347800
15	Hex Socket Set Screw	1	HWWG51D080 (3/8–16×1/4 lg)
16	Cross Link	1	H012347900RT
17	Piston Rod	1	H015158000RT
18	Cross Link Sleeve	1	H012377100RT
19	Setting Mandrel	1	H013636800RT
20	O-ring*	1	HWWB213H40
21	Piercing Disk*	1	H034386100
22	Disk Retainer	1	H035267300
23	Filler Screw*	1	H038254800
24	Spanner Wrench	1	H012421900
25	Bleeder Wrench	1	H039047500

*O-ring kit (Material H075343100) consists of items 2, 11, 20, and 21when ordered only.
*O-ring kit (Material H034468700) consists of items 2, 11, 20, 21 and O-rings for firing head when ordered only.
Disk kit (Material H034515800) consists of Items 20, and 21 when ordered only.

34 E-4 Wireline Pressure Setting Assembly, Size 20

Operation

Running Procedures

Refer to Section 14: Baker Hughes C Firing Head and E-4 Wireline Pressure Setting Assembly Running Procedures, Size 20

35 Disassembly Instructions

E-4 Wireline Pressure Setting Assembly, Size 20

You must complete the following Phase I and Phase II bleed-off procedures before beginning the disassembly.

Phase I and Phase II Bleed-off Procedures for Wireline Pressure Setting Assembly, Size 20

Click here to view the E-4 Wireline Pressure Setting Assembly (size 20) phase I and phase II bleed-off procedure animation.

NOTICE	Bleed-off procedure is only valid when using a Baker Hughes firing head, size 20 E-4 Wireline Pressure Setting Assembly, primary igniter, secondary igniter and power charge. for all other manufacturer's equipment, consult manufacturer.

DANGER

Pressure is trapped in the W.L.P.S.A. after being removed from the wellbore

Trapped pressure not fully released will create a projectile

- Use bleed-off procedures starting with the Phase I Bleed-off Procedure
- Wear standard PPE including a hard hat, as well as ear and eye protection

Phase I Bleed-off Procedure, Size 20

Step	Action
1.	Lay tools down, being careful not to damage the wireline adapter kit.
2.	Position the W.L.P.S.A. so that the bleeder disk system faces up.
3.	Locate the bleeder vent hole in the Pressure Chamber (1) next to the bleeder disk system. Make sure this vent hole is pointed away from all personnel and is pointing in the down wind direction. All personnel are required to stand on the side of the tool that is opposite from the vent hole. **Verified by:**_____.
4.	Carefully remove the Filler Screw (20), left-hand thread. Watch the Disk Retainer (19) while removing the Filler Screw (20) to make sure the Disk Retainer does not rotate.  **⚠ WARNING** Loosening the Disk Retainer while removing the Filler Screw **Could result in serious bodily injury or even death** • If the Filler Screw cannot be removed without loosening the Disk Retainer, proceed to step 11 of Phase I • Wear standard PPE including a hard hat, as well as ear and eye protection **Verified by:**_____.

Step	Action
5.	Slowly thread (left-hand thread) the Bleeder Wrench (22) into the Disk Retainer (19).  **⚠ WARNING** Ensure personnel are not leaning over the Bleeder Wrench **Could result in serious bodily injury or even death** • Wear standard PPE including a hard hat, as well as ear and eye protection  **⚠ WARNING** Keep hands away from the vent hole at all times **Could result in serious bodily injury or even death** • Wear standard PPE including a hard hat, as well as ear and eye protection **Verified by:**_____.
6.	Once the Bleeder Wrench (22) makes contact with the Piercing Disk (18), continue threading the Bleeder Wrench into the disk retainer slowly. Do not make full rotations of the Bleeder Wrench, instead alternate 1/4 turn left, 1/4 turn right-hand rotation and increasing each oscillation by a 1/4 turn, until the disk is punctured. **Verified by:**_____.

Step	Action
7.	When the tool starts to bleed off, make an additional 1/2 turn to the left and then back off 1/4 of a turn. Do not screw the Bleeder Wrench (22) in tight because it can seal against the piercing disk and prevent bleeding. **Verified by:**_____.
8.	Do not turn the Bleeder Wrench (22) to the right until the tool is completely bled off.
9.	Once the Bleeder Wrench (22) is bottomed out, carefully turn it to the right 1/4 turn, watching to be sure that the Disk Retainer (19) does not rotate. **Verified by:**_____.
10.	If the Disk Retainer (19) rotates, turn it to the left, hand tight. If the pressure has been released remove the Bleeder Wrench (22)  **⚠ WARNING** If the Piercing disk was not punctured and the pressure was not released, do not remove the Bleeder Wrench (22) **Could result in serious bodily injury or even death** • Ensure that the Piercing disk is punctured • Wear standard PPE including a hard hat, as well as ear and eye protection **Verified by:**_____.
11.	Clean any debris from the bleed hole in the top end of the Pressure Chamber (1).
12.	Position bleed hole in the Pressure Chamber (1) away from personnel.
13.	Scribe a line across the thread connection between the Baker Hughes firing head and Pressure Chamber (1).
14.	Hold back up on the Pressure Chamber (1) and slowly unscrew the firing head a maximum of seven [7] turns from the Pressure Chamber. **Verified by:**_____.
15.	Do not back the firing head off more than 7 turns. **Verified by:**_____.
16.	Allow a sufficient amount of time to release the pressure.

Step	Action
17.	Thread the firing head back into the Pressure Chamber (1). Make sure the Bleeder Wrench (22) is in its original position from step 9 of Phase I.
18.	Clean any debris from the vent hole in the top end of the Upper Cylinder (4).
19.	Scribe a line across the thread connection between the Pressure Chamber (1) and Upper Cylinder (4).
20.	Hold back up on the Upper Cylinder (4) and slowly unscrew the Pressure Chamber (1) a maximum of 6-1/2 turns from the Upper Cylinder **Verified by:**_____.
21.	Do not back off the Pressure Chamber (1) more than 6-1/2 turns. **Verified by:**_____.
22.	Allow a sufficient amount of time to release the pressure.
23.	Thread the Pressure Chamber (1) back into the Upper Cylinder (4).
24.	All trapped pressure should be bled off from the Upper section of the W.L.P.S.A. Slowly remove the Bleeder Wrench (22) from the Disk Retainer (19) if it was not removed in step 10 of Phase I.
25.	Proceed to Phase II. **Verified by:**_____.
26.	Verify that you have viewed the E-4 Wireline Pressure Setting Assembly (size 20) phase I and phase II bleed-off procedure animation. **Verified by:**_____.

Phase II Bleed-off Procedure, Size 20

Before transporting or disassembly is started, the Phase II Bleed-off procedure must be followed to verify that no additional pressure is trapped in the lower section of the W.L.P.S.A.

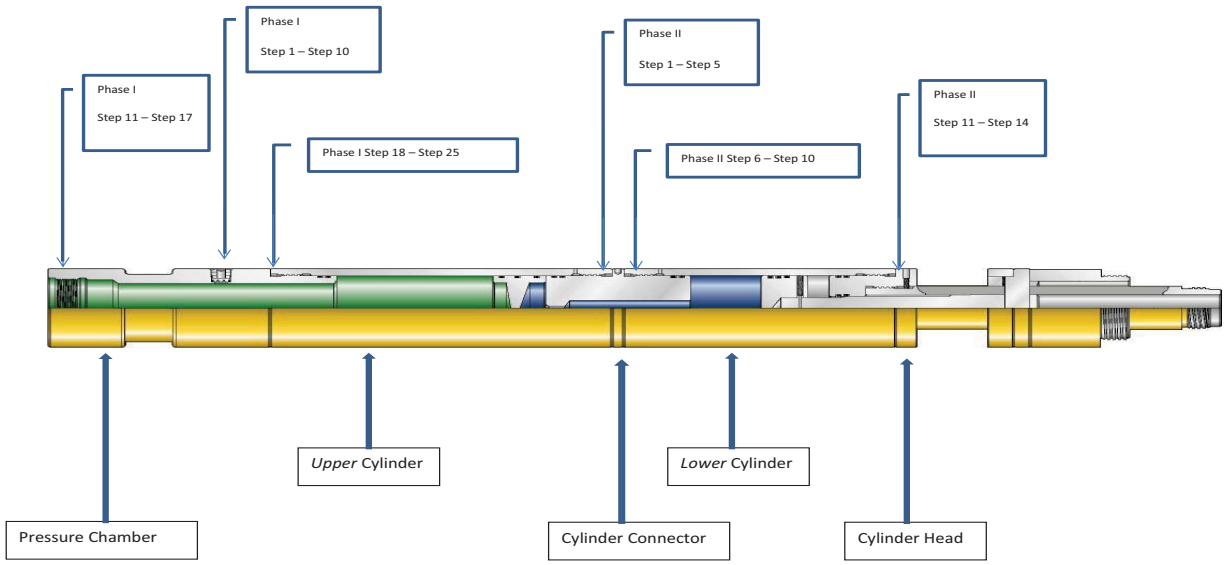
Step	Action
1.	Place the W.L.P.S.A. in a vise on the Upper Cylinder (4) and secure in place with the vent holes in the Upper Cylinder (4) positioned so the pressure will bleed away from personnel.
2.	Clean any debris from the vent hole in the bottom end of the Upper Cylinder (4).
3.	Scribe a line across the thread connection between the Cylinder Connector (5) and Upper Cylinder (4).

Step	Action
4.	Slowly unscrew the Cylinder Connector (5) a maximum of 6-1/2 turns from the Upper Cylinder (4). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A. **Verified by:**_____.
5.	Do not back the Cylinder Connector (5) off more than 6-1/2 turns. Once pressure has bled off, thread Cylinder Connector (5) back into the Upper Cylinder (4). **Verified by:**_____.
6.	Reposition the W.L.P.S.A. in the vise on the Lower Cylinder (4) and secure in place with the vent holes in the Lower Cylinder (4) positioned so the pressure will bleed away from personnel.
7.	Clean any debris from the vent hole in the Upper end of the Lower Cylinder (4).
8.	Scribe a line across the thread connection between the Lower Cylinder (4) and Cylinder Connector (5).
9.	Slowly unscrew the Cylinder Connector (5) a maximum of 6-1/2 turns from the Lower Cylinder (4). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A. **Verified by:**_____.
10.	Do not back the Cylinder Connector (5) off more than 6-1/2 turns. Once pressure has bled off, thread Cylinder Connector (5) back into the Lower Cylinder (4). **Verified by:**_____.
11.	Clean any debris from the vent hole in the bottom end of the Lower Cylinder (4). Position vent hole in the Lower Cylinder (4) so the pressure will discharge away from personnel.
12.	Scribe a line across the thread connection between the Lower Cylinder (4) and Cylinder Head (9).
13.	Slowly unscrew the Cylinder Head (9) a maximum of 6-1/2 turns from the Lower Cylinder (4). There could be a combination of oil and trapped gas being released. Therefore precautions should be taken to contain any fluids that may be released from the W.L.P.S.A. **Verified by:**_____.
14.	Do not back the Cylinder Head (9) off more than 6-1/2 turns. Allow a sufficient amount of time to release the pressure. Once pressure has bled off, thread the Cylinder Head (9) back into the Lower Cylinder (4). **Verified by:**_____.

Step	Action
15.	**Note:** The W.L.P.S.A. is now ready for transport or disassembly since all pressure has been bled from it. Contact Baker Hughes engineering if any difficulties were encountered in Phase I or Phase II of the procedure. Once the wireline pressure setting assembly has been returned to the warehouse the warehouse personnel are required to perform Phase I and Phase I of the bleed-off procedure again to ensure all trapped pressure has been bled out of the W.L.P.S.A. prior to disassembly.
16.	Verify that you have viewed the E-4 Wireline Pressure Setting Assembly (size 20) phase I and phase II bleed-off procedure animation. **Verified by:**_____.

Depiction of Phase I and II Bleed-off Procedures

Figure 23: Drawing 46845, Size 20



Disassembling the E-4 Wireline Pressure Setting Assembly, Size 20

Refer to Drawing 390-426-00.3.

Click here to view the E-4 Wireline Pressure Setting Assembly (size 20) disassembly procedure animation.

Step	Action
1.	Use the anchor bolt and disk retaining bolt to remove Disk Retainer (19, left-hand thread).
2.	Use the screw extractor portion of the Bleeder Wrench (22) to remove the punctured Piercing Disk (18).
3.	Remove Pressure Chamber (1)
4.	Remove Cylinder (4).
5.	Using an aluminum tube, dowel rod, or broomstick, push burnt power charge from Upper Cylinder (5).
6.	Push Floating Piston (3) out of lower end of Cylinder (4).
7.	Remove Cap Screw (11) and slide Link Retaining Ring (12) up off of Cross Link Sleeve (15).
8.	Remove Cross Link (13).
9.	Remove Cross Link Sleeve (15) and Link Retaining Ring (12).
10.	Remove Set Screw (10) and remove Setting Mandrel (16).
11.	Unscrew Cylinder Head (9) and remove along with Piston (6) and Piston Rod (14). Catch and discard oil from tool.
12.	Remove Retaining Pin (7) and separate Piston (6) from Piston Rod (14).
13.	Pull Piston Rod (14) from lower end of Cylinder Head (9).
14.	Remove Cylinder Connector (5).
15.	Remove and discard all O-rings (2, 8, and 17). Clean and inspect all parts for wear or damage. **Note:** For field cleanup following the use of the W.L.P.S.A. go through step 12. Clean parts thoroughly and reassemble them hand tight without o-rings as soon as possible. The tool should be completely disassembled, thoroughly cleaned and inspected before being reassembled and run again.

36 Assembly Instructions

E-4 Wireline Pressure Setting Assembly, Size 20

Refer to Drawing 390-426-00-3.

Click here to view the E-4 Wireline Pressure Setting Assembly (size 20) assembly procedure animation.

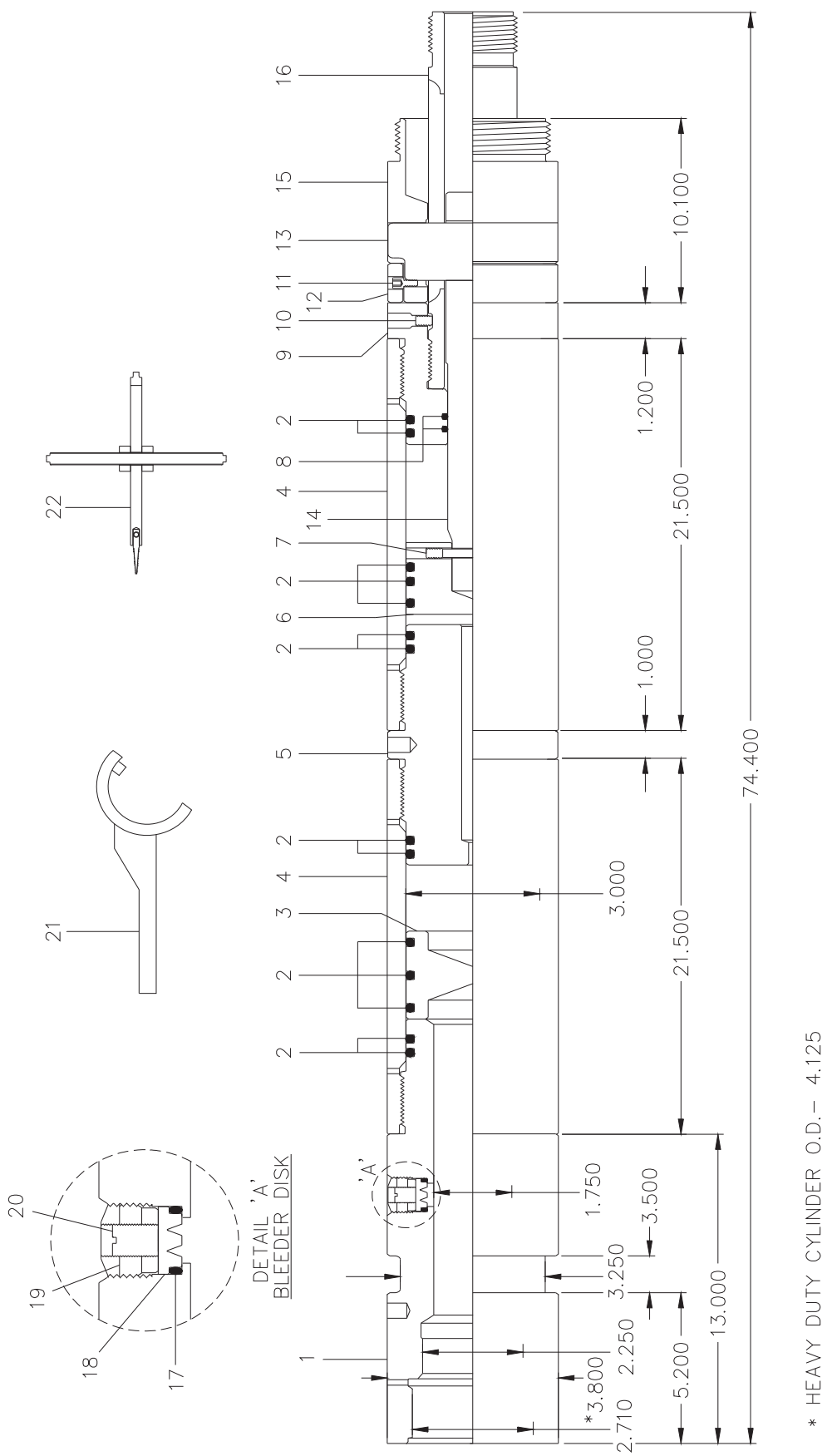
Step	Action
1.	Place Cross Link Sleeve (15) into vise.
2.	Lubricate Cross Link Sleeve (15) and Setting Mandrel (16) with downhole grease and slide Setting Mandrel in Cross Link Sleeve. **Note:** Pin thread of Setting Mandrel (16) must be positioned toward top of tool.
3.	Lubricate Piston Rod (14) and slide into Setting Mandrel (16). Align slot in Piston Rod with slots in Cross Link Sleeve (15) and Setting Mandrel.
4.	Insert Cross Link (13) into slots.
5.	Slide Link Retaining Ring (12) over Cross Link Sleeve (15) and Cross Link (13) until it shoulders on Cross Link Sleeve.
6.	Thread Cap Screw (11) into Link Retaining Ring (12).
7.	Lubricate and install internal and external O-rings (2 and 8) onto Cylinder Head (9).
8.	Thread Setting Mandrel (16) into Cylinder Head (9) and thread Set Screw (10) into Cylinder Head.
9.	Lubricate and assemble O-rings (2) onto Piston (6) and connect to Piston Rod (14) with Retaining Pin (7).
10.	Push Cylinder Head (9) against Cross Link Sleeve (15), lubricate Piston (6), and slide Cylinder (4) over Piston and thread onto Cylinder Head.
11.	Assemble O-ring (2) on Cylinder Connector (5) and thread into Cylinder (4).
12.	Remove assembly from vise, set aside and place Cylinder (4) in vise.
13.	Lubricate and assemble O-rings (2) on Floating Piston (3) and place Floating Piston into top end of Cylinder (4).
14.	Lubricate and assemble O-rings (2) onto Pressure Chamber (1) and thread into Cylinder (4).
15.	Lubricate and install O-ring (17) into Pressure Chamber (1).
16.	Install Piercing Disk (18) into Pressure Chamber (1) being careful not to pinch O-ring (17).
17.	Thread Disk Retainer (19) into Pressure Chamber (1) to secure the Piercing Disk (18) in place. **Note:** Thread on Disk Retainer (19) and Pressure Chamber (1) where Disk Retainer (19) threads in is a left-hand thread. This is done by using the anchor bolt (Material H038101200) and disk retainer socket (Material H038100500).
18.	Place the anchor bolt inside the disk retainer socket. Use and Allen wrench to tighten the left-hand anchor bolt into the Disk Retainer and use a 3/4-in drive torque wrench to tighten the Disk Retainer to 70ft-lb. Remove assembly tools to run.
19.	Thread Filler Screw (20) into Disk Retainer (19).

Step	Action
20.	Remove upper half of tool from vise and set on end with Cylinder (4) up. Use aluminum tub, dowel rod, or broomstick to push Floating Piston (3) down until it contacts the Pressure Chamber (1).
21.	Determine proper line on a Baker Hughes oil level gauge or use the chart below for your well temperature at setting depth. Fill Cylinder (4) with clean oil (S.A.E. 10W-40 weight oil) to the proper level. Use oil level gauge to check oil level from end of Cylinder. **Note:** If tool is to be stored prior to its use, oil should not be put into Cylinder (4) until it is taken out of storage. Mark No Oil In Tool on OD.
22.	Thread lower half of tool onto upper half of tool. Place tool back in vise and tighten all thread connections. **Note:** Check the gap between the Cross Link Sleeve (15) and Cross Link (13). If a gap is present proceed to step 23.
23.	With tool in vise, carefully break connection between the upper Cylinder (4) and Cylinder Connector (5) until past the O-ring seal (if oil is in tool it may run out connection). Remove tool from vise and repeat step 21. Then while performing step 22, slowly thread the connection back together while tapping up on Cross Link Sleeve (15) to remove any air trapped between the Piston (6) and oil in the lower Cylinder (4) until O-rings mounted in Cylinder Connector (5) contact with sealing area on upper Cylinder (4). Proceed to tighten to makeup torque.

37 Assembly and Dimensional Information

E-4 Wireline Pressure Setting Assembly (Material H4370220E4RT)

Figure 24: Assembly and Dimensional Drawing 390-426-00-3, Size 20



E-4 Wireline Pressure Setting Assembly (Material H4370220E4RT)

Parts List, Size 20

Item	Description	Qty. Req'd	Size (in.) and Material
1	Pressure Chamber	1	H013627401RT
2	O-ring	14	HWWB334H40
3	Floating Piston	1	H075707200RT
4	Cylinder	2	H012052801RT or Heavy Duty H014413101RT*
5	Cylinder Connector	1	H012136200RT
6	Piston	1	H013570000RT
7	Retaining Pin	1	H013345100
8	O-ring	2	HWWB216H40
9	Cylinder Head	1	H012054200RT
10	Hex Socket Set Screw	1	HWWG51D0H0 (3/8–16×1/2 lg)
11	Hex Socket Cap Screw	1	HWWG1180D0 (1/4–20×3/8 lg)
12	Link Retaining Ring	1	H012210700
13	Cross Link	1	H012052300RT
14	Piston Rod	1	H013570100RT
15	Cross Link Sleeve	1	H012211000RT
16	Setting Mandrel	1	H012174600RT
17	O-ring*	1	HWWB213H40
18	Piercing Disk*	1	H034386100
19	Disk Retainer	1	H035267300
20	Filler Screw	1	H038254800
21	Spanner Wrench	1	H012059700
22	Bleeder Wrench	1	H039047500

*O-ring kit (Material H075343200) consists of items 2,8,17, and 18 when ordered only.
*O-ring kit (Material H034468600) consists of items 2,8,17,18 and O-rings for firing head when ordered only.
*Disk kit (Material H034515800) consists of items 17, and 18 when ordered only.

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