SUPERIOR
Manufacturing & Hydraulics

TECHNICAL MANUAL

TOP DRIVE MAKE BREAK TOOL

covers

MODELS

TDMB2000-03

HEDS9750

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Broussard, Louisiana 70518
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Fax: (337) 837-8839
www.superior-manf.com

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Name: _____
Company: _____
Address: _____
Address: _____
City: _____ **State:** _____
Postal Code: _____ **Country:** _____
Telephone: _____ **Fax:** _____

Make/Break Model No.: _____ **Serial No.:** _____
Assembly Date: _____

CLINCHER® Make/Break Tool Technical Manual Registration Form

Name: _____
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CLINCHER® MAKE/BREAK TOOL

REVISION TABLE

Section	*Page*	*Date*	*Description*

CLINCHER® Make/Break Tool

HAZARD WARNING

Nomenclature used in this manual:

WARNING concerns an operating procedure or practice that, if not strictly observed, can result in injury to personnel or loss of life.

Caution concerns an operating procedure or practice that, if not strictly observed, can result in damage to or destruction of equipment.

Note concerns an operating procedure or practice that needs highlighting.

CLINCHER® Make/Break Tools are manufactured to provide a means of making up or breaking out high torque tubular connections between Varco TDS3, TDS4 & TDS5 Top Drives and their upper internal blowout preventer (IBOP) valves. This tool utilizes high pressure hydraulic fluid power which can cause the tool to move suddenly and with great force if it is not properly rigged up and operated. **CLINCHER®** Make/Break Tools contain rotating and reciprocating parts which can severely or fatally injure personnel who are operating, repairing, or near this equipment during its operation. **WARNING: Make/Break Tools are not to be operated by untrained personnel or personnel with diminished physical or mental capacity. No work of any type is to be carried out while the Make/Break Tool is connected to any hydraulic power unit.**

CLINCHER® Make/Break Tools are heavy tools. When lifted vertically, they should be suspended from a secure, high strength 5/8" IWRC minimum diameter wire cable with a 20.6 ton minimum breaking strength. The wire cable should be hung as close to the center of the wellbore as possible, without interfering with drilling equipment operation, to allow the tool to be readily swung into the working position. **WARNING: Users must insure the entire lifting system including cables, rig mounting points, lift cylinders, lifting brackets/bridles, winches, pulleys, counter weights, etc., are capable of handling the static weight of the tool PLUS any shock loads which may be seen during operation.**

A 2" IWRC minimum diameter wire cable with a 198 ton minimum or better breaking strength, should be attached at a 90 degree angle to the Make/Break Tool and at the same level to insure proper readout of optional external torque indicator. If optional external torque indicator is used, the rotary table must be unlocked and free to rotate. A SNUBBING LINE should always be attached to provide additional safety in the event of a rotary table lock slippage. **WARNING: Users must provide a means of safely controlling the Make/Break Tool movements in all directions when it is in use. Failure to account for its size, weight, movement and the amount of torque developed could result in personnel injury or death.**

CLINCHER® Make/Break Tools utilize high pressure hydraulic fluids. Portions of the tool, control valves, hydraulic lines and cylinders may contain high pressure fluid even when the power unit is de-energized and the fluid supply hoses are disconnected. During normal operation the temperature of the hydraulic fluids as well as hoses, piping, valves, etc., can rise to a level which can cause burns. **WARNING: Personal protective gear including safety glasses, face shields, protective gloves and protective clothing must be worn to guard against the hazards of high pressure fluids. Tight fitting clothing is required to prevent entanglement in rotating components. These tools should be serviced by thoroughly trained and qualified hydraulic technicians using procedures to safely insure hydraulic pressure is bled from these circuits.**

No attempt should be made to operate the **CLINCHER®** Make/Break Tool for any purpose other than which it is intended. This system is capable of generating very large torsional loads which if improperly applied or controlled, could result in damage to the tubular, to the tool or could possibly result in injury or death of personnel. Do not attempt to operate the unit without correct dies and the proper size tubular being in the tool.

HYDRAULIC PRODUCT SAFETY

WARNING: Valve lever (spool) may "stick" (not center) under certain conditions allowing the hydraulic equipment to continue to operate and could cause serious injury, death or equipment failure.

VALVE SAFETY: Read and follow instructions carefully. Failure to observe instructions and guidelines may cause serious injury, death or equipment failure. A sticking valve (spool bind) may be caused by one or more of the following factors:

DIRTY OIL: Oil must be filtered to a minimum of 25 microns. Filters should be changed regularly - spin-on types after 50 hours of initial use and then after every two hundred fifty hours of use. Use of a condition indicator is recommended. Consult your tractor or implement owner's manual for filtration and changing recommendations for internal systems.

OIL REQUIREMENTS: Premium quality anti-wear type oil with a viscosity between 100 and 200 SSU at operating temperatures. Certain synthetic oils may cause spool seals to swell and the valve to stick. If in doubt, call CROSS Engineering.

IMPROPER HOOK UP OR MOUNTING: Always use the proper size fittings. Hook up "in" & "out" as noted on the valve body. Do not overtorque pipe fittings. Mounting surfaces should be flat and care should be used when tightening mounting bolts. Over-tightened bolts can cause spool bind and casting breakage. When hooking a valve in series, always use a power beyond sleeve. Consult your tractor or implement manual to make sure you have the proper quick disconnect line connected to the inlet of the remote valve.

MISAPPLICATION: Always use the proper valve for the job. CONVERTA, CD, CS or CA valves should never be used for metered heavy load lifting - loaders or similar applications. Use an open center valve for open center applications and a closed center valve for closed applications. If in doubt, check with your tractor dealer. Contact CROSS if the valve allows the hydraulic equipment to creep excessively.

MAINTENANCE: Make sure all bolts are tightened and torqued to the recommended specification. Bent or broken parts should not be used. Replace immediately. Always use exact replacements. Always protect valve spool from paint overspray.

Faulty quick disconnects can cause high back pressures and sticking spools. Check quick disconnects periodically to make sure they are functioning properly. If valve spool does not center or appears to stick, do not use!

PUMPS & MOTORS SAFETY:

A relief or bypass in your hydraulic system is necessary to prevent pump from breakage due to overpressurization. Use correct fittings and proper oil as noted in the technical service manual packed with each unit. Change oil as recommended by your implement or tractor manufacturer.

CYLINDER SAFETY:

Check clevis clearances before, during and after extending the cylinder and before using the cylinder under pressure to avoid possible injury, or bent or broken rods caused by binding. Never operate a cylinder above recommended pressures. Never use a cylinder as a safety device when transporting equipment.

PINHOLE LEAKS:

If you observe a pinhole leak, discontinue use of the component. If oil has penetrated your skin or contacted your eye, seek medical attention immediately!

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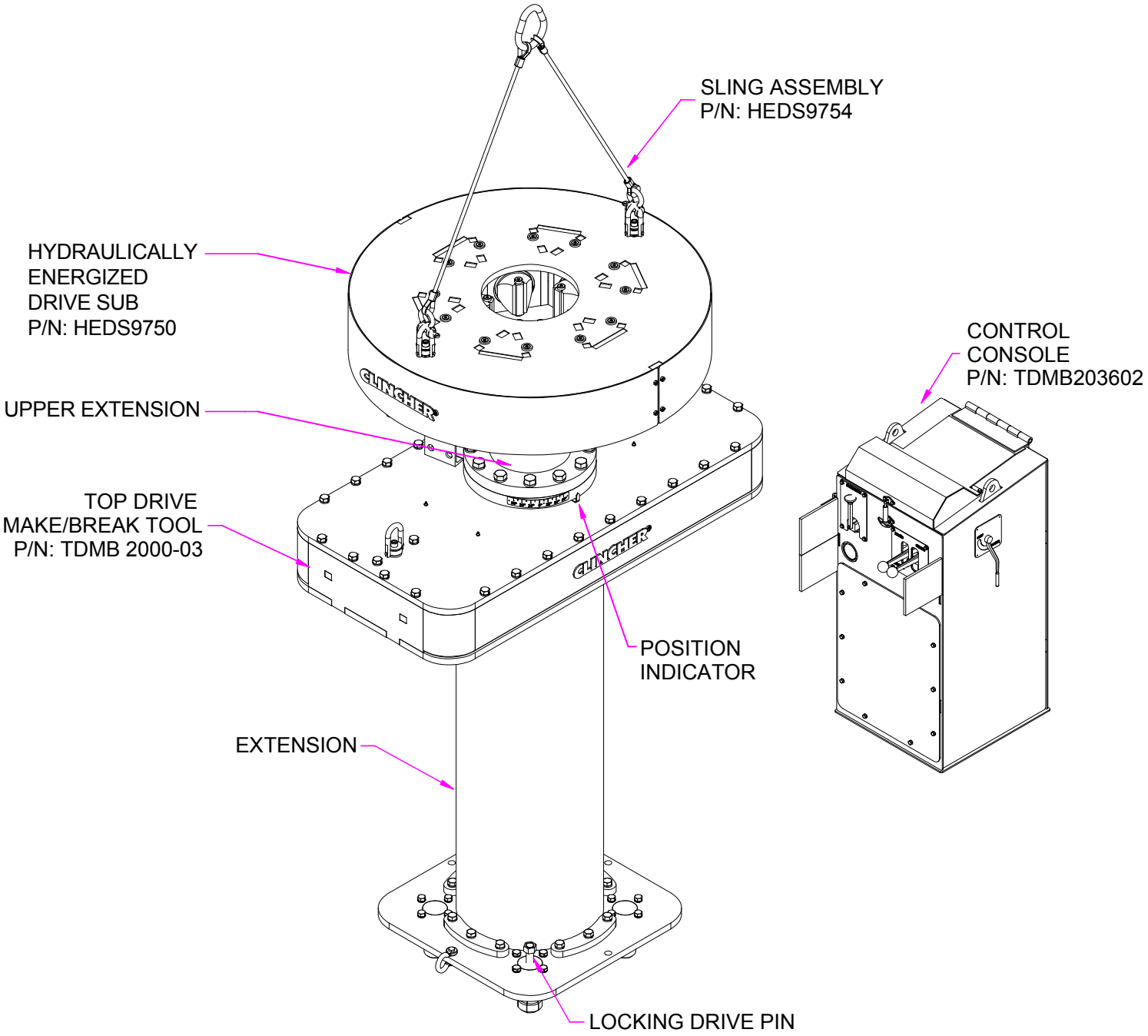

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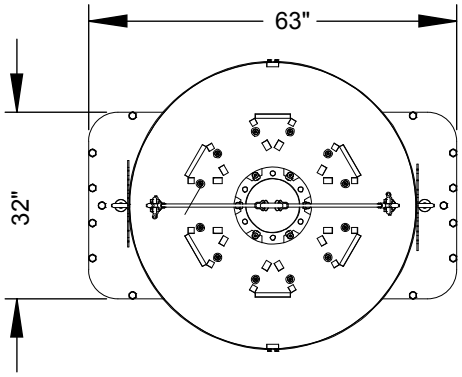
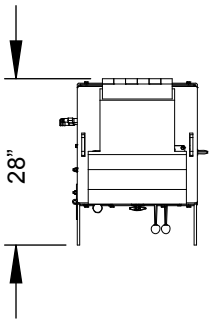
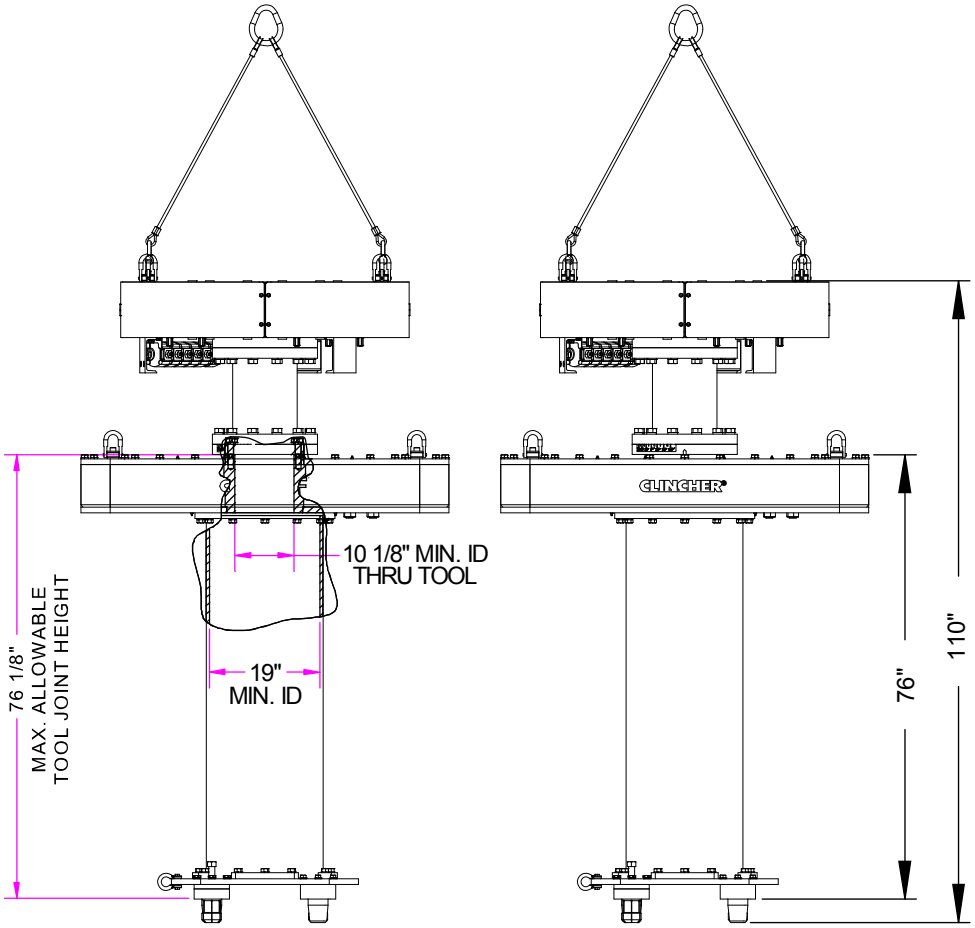
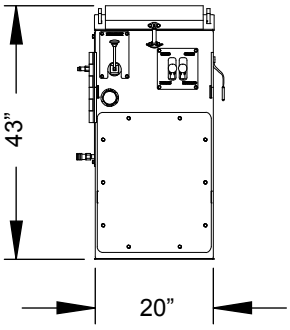




TOP VIEW





FRONT VIEW

DIMENSIONAL VIEWS

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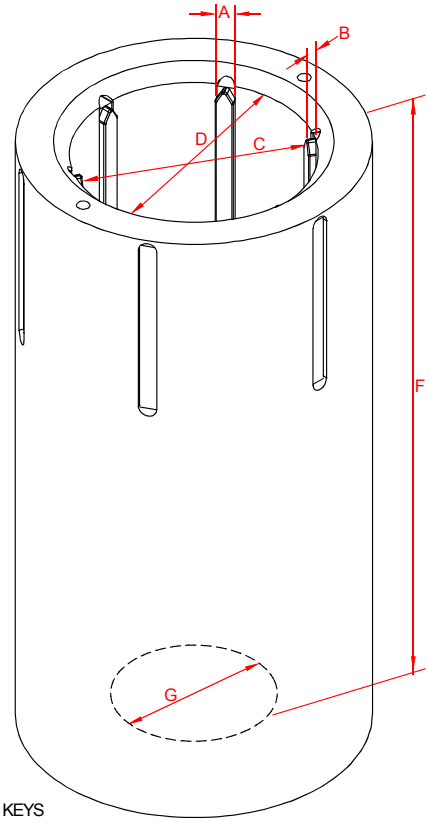
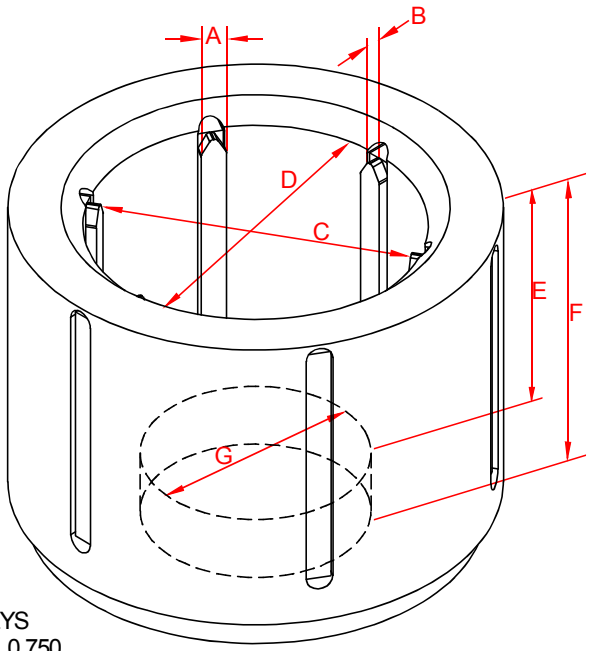


6 KEYS
A: 0.750
B: 0.313
C: 9.125
D: 9.750
F: 27.500
G: 6.531

PH85 EXTENDED DRIVE SUB

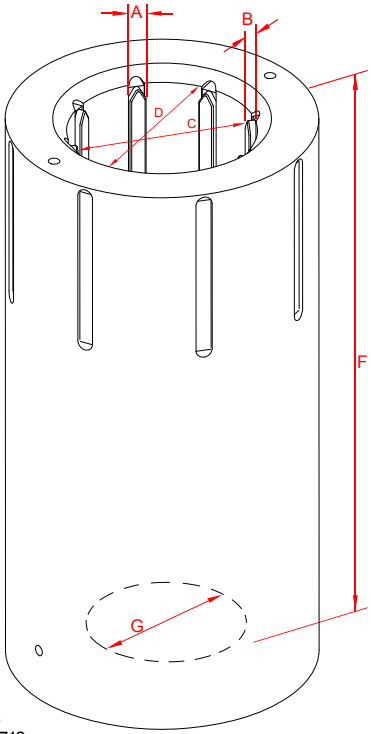
P/N: TDMB2065



6 KEYS
A: 0.750
B: 0.313
C: 9.125
D: 9.750
E: 8.500
F: 10.500
G: 6.531

PH85 STANDARD DRIVE SUB

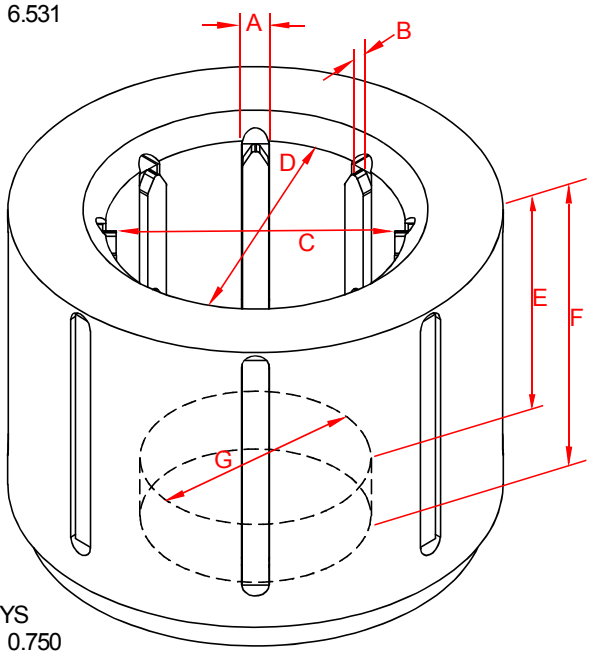
P/N: TDMB2017



8 KEYS
A: 0.712
B: 0.310
C: 7.875
D: 8.525
F: 27.500
G: 6.531

PH60 EXTENDED DRIVE SUB

P/N: TDMB2066



8 KEYS
A: 0.750
B: 0.325
C: 7.875
D: 8.525
E: 8.500
F: 10.500
G: 6.531

PH60 DRIVE SUB

P/N: TDMB2018

SPLINED DRIVE SUB DIMENSIONS

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SPECIFICATIONS

Makeup Torque [1]	165,000 ft.lbs. / 223,709.9 Nm
Breakout Torque [1]	165,000 ft.lbs. / 223,709.9 Nm
Maximum Operating Pressure	2,650 psi / 182.7 bar
Minimum ID through Make/Break Tool	10 1/8" / 25.7 cm
Upper Extension OD for compatibility with rig tongs	7 1/4" / 18.4 cm
Upper Extension OAL (approximate)	20 1/4" / 51.4 cm
Lower Extension ID to accommodate drill pipe tool joint suspended by rotary slips	19" / 48.26 cm
Drive Sub Maximum OD	14.0" / 35.6 cm
Drive Sub Minimum ID	6.65" / 16.9 cm
Standard Drive Sub OAL	10.5" / 26.7 cm
Extended Drive Sub OAL	27.5" / 69.9 cm
Overall Length Make/Break Tool	32 1/2" / XX cm
Overall Width Make/Break Tool	63" / XX cm
Standard Overall Height Make/Break Tool w/o Sling	106 7/8" / 271.5 cm
Extended Overall Height Make/Break Tool w/o Sling	115.11" / XX cm
Standard Weight (approximate)	3,540 lbs. / 1,605.7 kg
Extended Weight (approximate)	3,882 lbs. / 1,764.5 kg

[1] Torque ratings are based upon 2,650 psi operating pressure.

Standard Equipment:

- Handling sling
- Control console
- Hoses to connect control console to Make/Break Tool
- Hoses to connect control console to hydraulic power loop

DESCRIPTION and APPLICATION

The **CLINCHER®** RF (Rig Floor) Make/Break Tool is manufactured to service upper internal blow-out preventer valves associated with Varco TD3S, TD4S and TD5S top drives. This compact hydraulically operated tool generates a minimum of 110,000 ft/lbs of make-up torque and 130,000 ft/lbs of break-out torque when used with a 2000 psi hydraulic power supply (not included). Each cycle will generate 45 degrees of rotation.

The RF Make Break Tool's upper flanged hub allows a variety of accessories to be bolted in place to satisfy rig floor torquing needs. The bottom of the RF Make/Break Tool accepts pins which engage a 27 1/2" or 37 1/2" API Rotary Table Kelly Drive System per API 7K (other configurations upon request). The bottom is also flanged to accept a lower extension or accessories which are available to allow the bottom side to directly grip tubulars.

The RF Make/Break Tool is provided with an Upper Extension with flanged connections compatible for the tool and drive subs for Varco PH60 and PH85 Pipe Handlers' upper extension BOP valve. Approximate overall length is 20 1/4". The Extension OD of 7 1/4" is for compatibility with ring tongs. The drive sub maximum OD is 14", minimum ID is 6.65" and OAL is 10.5" or 27 1/2" for extended drive sub. Customer will need to specify if the RF Make/Break Tool is to be used with Varco PH60 or PH85 Pipe Handler.

The RF Make/Break Tool is provided with a Lower Extension with a flanged connection to raise the Make/Break Tool 54" above the Rotary Table. This extension offers a 19" ID to accommodate drillpipe tool joints suspended by rotary slips. Slip handles must be removed before landing Make/Break Tool and Extension.

The RF Make/Break Tool is provided with two torque drive subs and two lockdown drive subs. Lockdown drive subs feature **CLINCHER® GRIT FACE™** coating to engage sockets without requirement for modifications. Drive subs may be attached directly to the bottom of the RF Make/Break Tool or to the bottom of the RF Make/Break Lower Extension.

The RF Make/Break Tool is also provided with a separate free standing hydraulic control console. The console is provided with quick disconnects for supply, return and work circuits. It includes a directional control valve for make/break connections and includes a gauge which allows monitoring of make/break torques and pressures. An adjustable pressure control valve allows the operator to regulate the amount of make-up torque developed. This control system is set up for closed style pressure compensated hydraulic power systems with pressures up to 3,000 psi. Control valves for open hydraulic systems are available upon request.

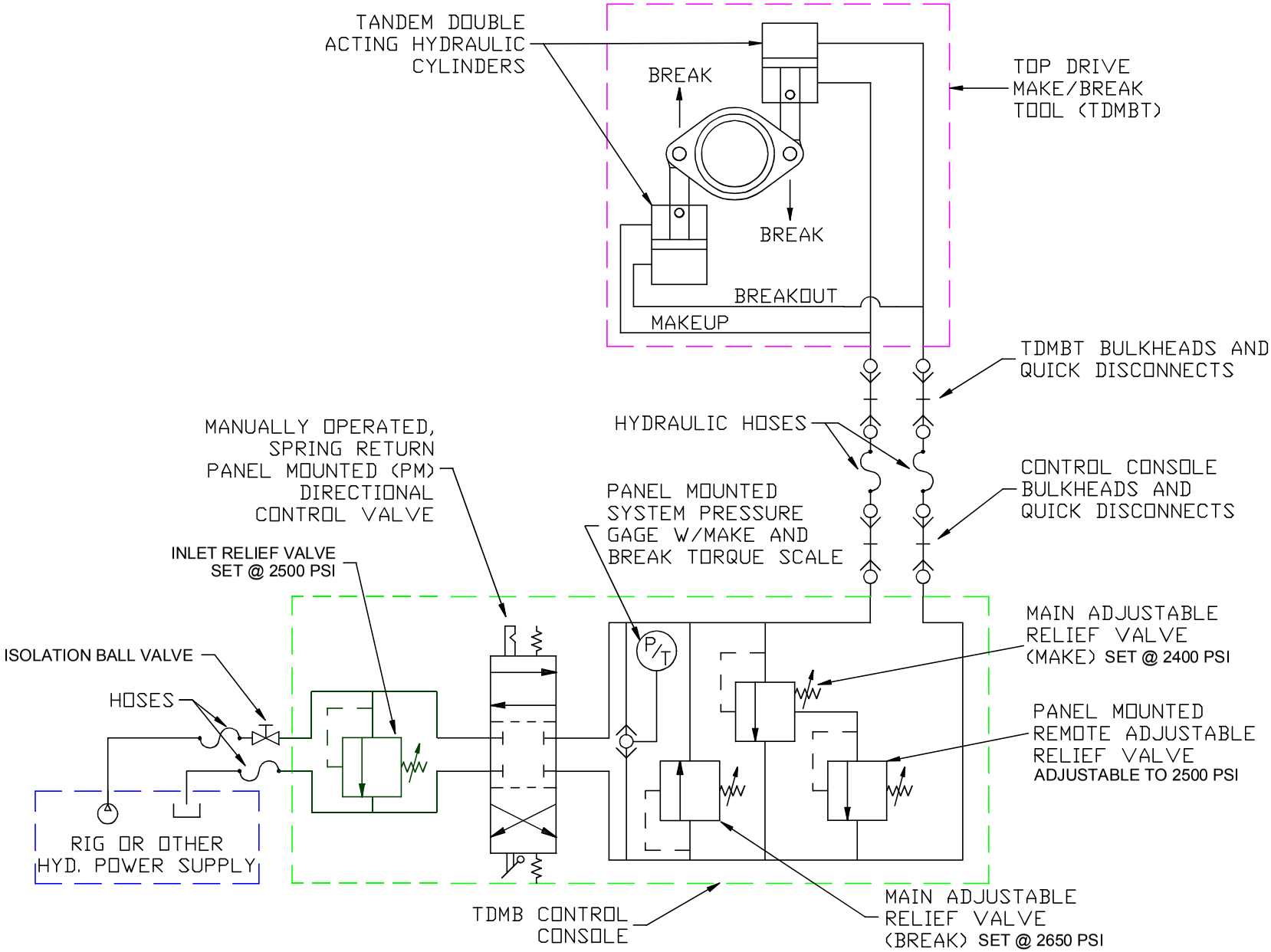
Original Top Drive Mounting System includes Haskel MAA gas booster, 3-way air valve, and air regulator to boost top drive braking force (installed by others). Brake intensifiers are available in two configurations; (1) remotely mounted on top drive or (2) attached to control console.

A Handling Sling with welded padeyes features two 1/2" 6x19 IWRC galvanized cables 48" long with swaged open socket on lower ends for pinning to two padeyes welded to the upper extension tube. The upper end of the cables are looped through a 1" sling link and feature galvanized thimbles with swaged retaining sleeves. Sling is proof tested and equipped with a metal tag.

Two 3/4" x 10' long two-wire hydraulic hoses with 2,500 psi working pressure are provided to connect control console to RF Make/Break Tool. These have a braided fabric protective cover to guard against abrasion. They are equipped with a 3/4" male NPT x 3/4" female JIC swivel hose ends.

Two 3/4" x 20' long standard two-wire hydraulic hoses with 2,500 psi working pressure are provided to connect control console to rig's hydraulic power loop. They are equipped with a 3/4" male NPT x 3/4" female JIC swivel hose ends.

An optional storage base incorporating the control console, pressure/torque gauge, torque control valve, and quick disconnects associated with hydraulic control console. This storage base is fabricated using 6"-17.25 PPF carbon steel S-beams and 1/2" flat plate. The plate contains openings for torque drive subs and lockdown drive subs. Hold downs are provided to lock RF Make/Break Tool to storage base during transit. Storage base features provisions for handling using forklift or four part sling (not included).



TOP DRIVE MAKE/BREAK TOOL
SIMPLIFIED HYDRAULIC SCHEMATIC

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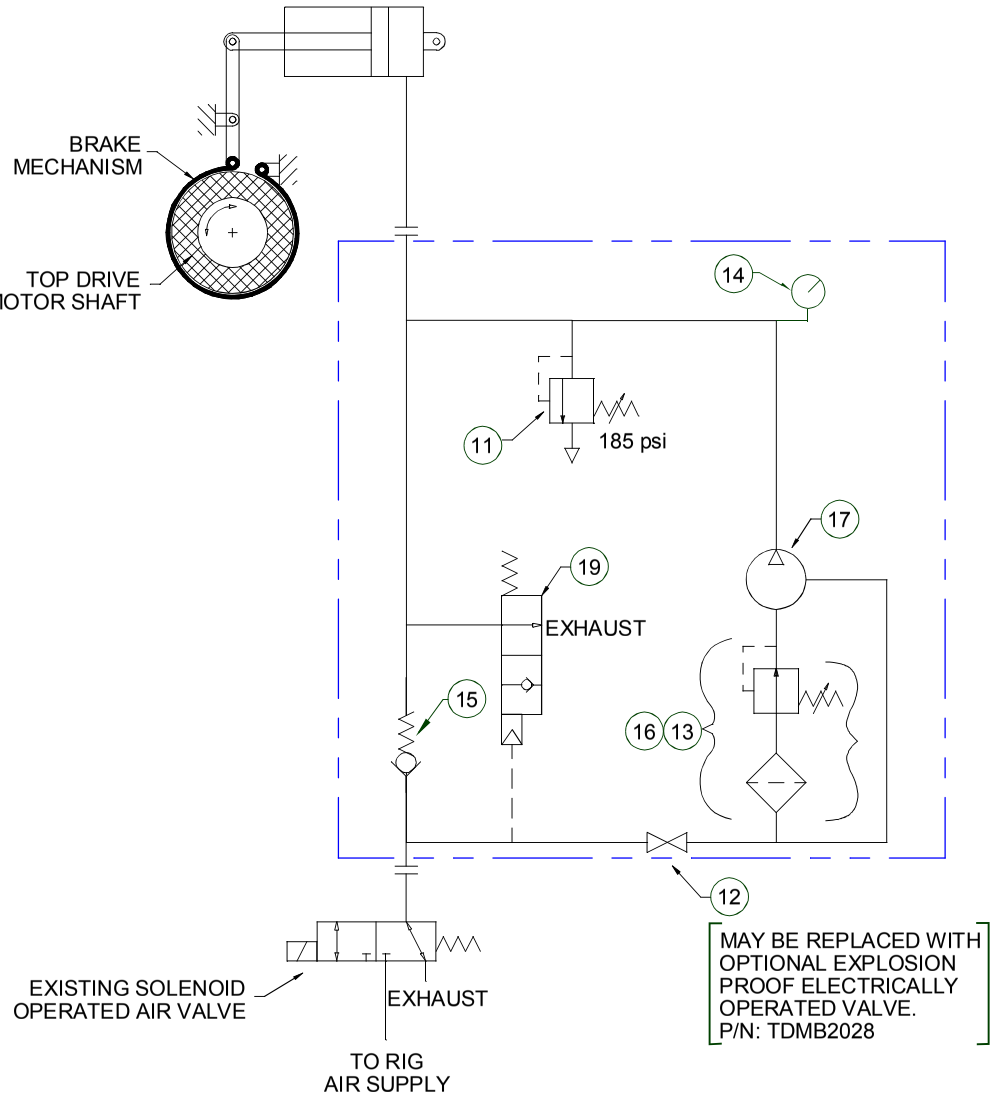

Item	Qty.	Part No.	Description
1	1	1/4 MRO	1/4" MALE RUN TEE
2	2	3/8 FF	3/8" MALE PIPE NIPPLE
3	2	3/8 MMS	MALE BRANCH TEE 3/8" MNPT X 3/8" FNPT
4	2	3/8 MRO	3/8" MALE RUN TEE
5	1	3/8 X 1/4 FG	3/8" NPT X 1/4" NPT EXPANDER/ADAPTER
6	2	3/8 X 1/4 PTR	3/8" NPT X 1/4" NPT PIPE THREAD REDUCER
7	1	4 FTX	MALE CONNECTOR 1/4" MJIC X 1/8" MNPT
8	1	4-4 FTX	1/4" MNPT X 1/4" MJIC STRAIGHT
9	2	6 FTX	1/4" MNPT X 3/8" MJIC MALE CONNECTOR
10	2	6-6 CTX	MALE ELBOW 3/8" MJIC X 3/8" MNPT
11	1	9889K19	AIR POP OFF VALVE 185 PSI, 1/4" NPT
12	1	1478	BALL VALVE BRASS, 3/8" FNPT
13	1	B18-02-FK00	AIR FILTER/ REGULATOR 1/4" NPT PORTS
14	1	BAC-600-25	GAUGE 600# 2 1/2" DIA BRASS
15	1	CM4554	3/8" CHECK VALVE
16	1	GPA-96-606	AIR FILTER MOUNTING BRACKET FOR WILKERSON B18-02-FK00
17	1	HAA31-2.5	GAS BOOSTER, 2.5:1 RATIO
18	1	TDMB1036-S1	AIR BOOSTER MOUNTING PLATE
19	1	TDMB1036-S2	2 POSITION / 4 WAY PILOTED AIR VALVE

TOP DRIVE MOUNTED BRAKE CYLINDER BOOSTER SCHEMATIC

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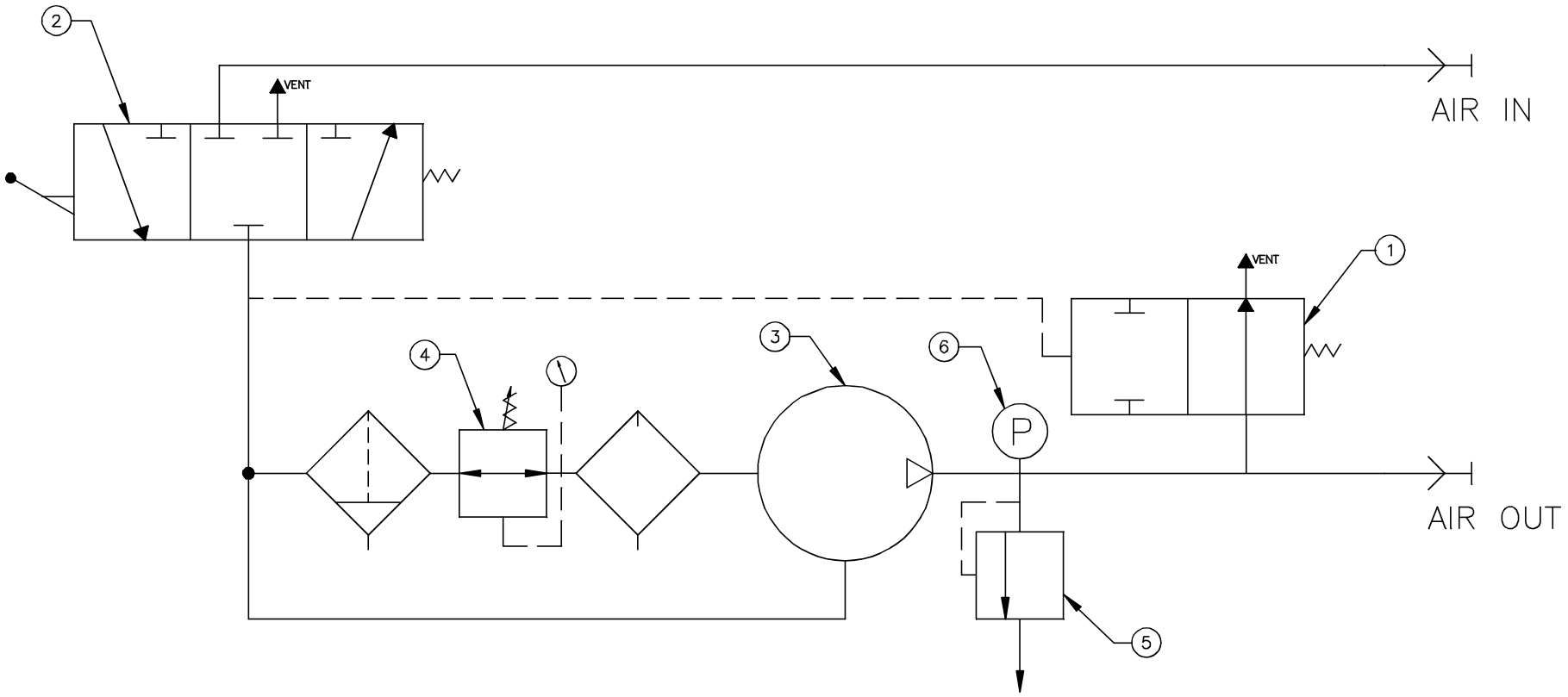
Item #	Qty.	Part Number	Part Description
1	1	PD4-20-0011	2-WAY, 2-POS, PILOT OPERATED VALVE
2	1	PD4-32-9802	3-WAY, 3-POS, LEVER OPERATED, TAPPED EXHAUST VALVE
3	1	HAA31-2.5	HASKEL AIR INTENSIFIER (2.5:1)
4	1	C18-03-FGGO	FILTER REGULATOR LUBRICATOR UNIT WITH AUTOMATIC DRAIN
5	1	9889K19	AIR POP-OFF VALVE (185 PSI)
6	1	BAC-600-25	PRESSURE GAUGE 600 PSI



CONSOLE MOUNTED
AIR INTENSIFIER SCHEMATIC

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ASSEMBLY TORQUE REQUIREMENTS

FASTENER LUBRICATION AND MAKE UP TORQUE REQUIREMENTS

Most bolts, nuts, and other threaded components are to be lubricated with Never-Seez or equivalent before assembly. Certain fasteners are to be assembled using permanent or removable Loctite as indicated in the assembly instructions. All tapered pipe threads are to be treated with a Teflon based pipe dope to assist in makeup and prevent leakage.

CAUTION: Do not use teflon tape. Improper application of teflon tape can cause joint failures. Teflon tape can release large particles which can plug small passages in hydraulic equipment.

All standard fasteners used in **CLINCHER®** products are to be GRADE 8 or better. DO NOT SUBSTITUTE lesser grades of fasteners. All fasteners are to be made up to the torque charted below. Failure to properly assemble these fasteners can result in their loss, product malfunction, and ultimately result in situations where personnel can be exposed to dangerous situations.

FASTENERS	
Size	***Torque***
5/8 - 11	166 ft/lbs
3/4 - 10	295 ft/lbs
1 - 8	715 ft/lbs
1 1/4 - 12	1,584 ft/lbs

LUBRICATION STANDARDS

Bearings and gears must be lubricated to minimize friction, cool, exclude foreign matter, and prevent corrosion. **CLINCHER®** recommends using Texaco Marfak MP 2 or equivalent for all grease zerts and bushings.

CLINCHER® UPPER IBOP MAKE/BREAK TOOL
PRE-ORDER CONSIDERATIONS

Information needed from rig before ordering:

1. What is the master bushing manufacturer and model?
2. Is the rig equipped with a PH-60 or PH-85 Pipe Handler?
3. What is the Upper IBOP manufacturer and model?
4. What is the distance from the top drive guide rail stops to the top of the rotary table?

Additionally, rigs that want the remote-operated air valve (available only on top drive mounted brake booster) will need to be notified of the following:

The remote solenoid option requires some modifications to the top drive control system and will increase the time required to make the brake booster operational. For this reason, Superior supplies the top drive mounted brake booster with the standard issue manual ball valve installed so that the booster kit can be installed relatively quickly on the initial use of the tool. The remote-operated air valve, and all associated electrical system and controls modifications, can be installed at a suitable time. This should avoid/minimize rig downtime.

In most cases to fully install the remote-operated air valve, the following will be required:

1. Add a two-position switch at the driller's console which will be used to select "high" or "low" brake pressure. (With most of our systems, these switches are simply connected to 24 volt input modules on the PLC and then there are either direct outputs from output modules on the PLC or output modules with isolated contacts that are used to switch the solenoid for a particular function). Assure that the solenoid valve used for remote operation is of the correct voltage, which will minimize modifications to the top drive control system at the time of installation.
2. Check for an available spare input at one of the PLC input modules.
3. Check for available spare output or isolated contact on one of the PLC output modules.
4. Check for one additional spare conductor from the transfer panel to the derrick junction box.
5. Check for an additional spare conductor in the service loop.
6. Check for an available entry on the top drive control junction box to install a cable gland and run cable to the new solenoid valve coil on the booster.
7. Make software changes to the PLC program to accept the new input and drive the new output accordingly.
8. If indication on the driller's console is required, this will require the addition of an indicator light at the driller's console, along with the minor software change to drive the indicator light output.
9. Document drawing and software changes and burn a spare EPROM for the PLC that includes these programming changes.

CLINCHER® UPPER IBOP MAKE/BREAK TOOL OPERATIONAL INSTRUCTIONS

The purpose of this document is to familiarize the drill and maintenance crews with the safe operation of the **CLINCHER®** Upper IBOP Make/Break Tool. If this procedure is followed correctly, it will allow removal and replacement of the upper IBOP on the Varco TDS3, TDS4 and TDS5 models.

Basic Tool Design Features:

- Personnel Safety – The tool has been designed with "Safety" in mind. It will allow removal and reinstallation of the upper IBOP without the use of rig tongs and other higher risk activities. It will allow reliable break out and accurate torque of the main shaft to the upper IBOP connection. Most of this work can be accomplished at rig floor level and without the requirement to remove any attachments or components from the top drive. Although generic JRA's (Job Risk Assessment) for removal and re-installation of the upper IBOP are included in this manual, **it is required to prepare and perform an accurate rig specific JRA before this operation is performed**. The attached JRA's will serve as guidelines for preparation of the rig specific JRA's.

- Efficiency – In addition to Safety, the tool has been designed to increase efficiency. Replacement of the upper IBOP can now be accomplished in a very short time and, in most cases, without having to remove any components from the top drive. With proper preparations and planning in place, which requires that the spare valve and tooling be maintained in a "ready" condition, this operation can be completed "safely" in approximately 1-2 hours rather than the original 6-12 hours that were normally experienced in many different fleet wide operations.

- Simplicity – The tool is extremely simple, with very few moving parts yet it is robust and capable of approximately 130,000 ft. lbs. of break out torque with a 2000 psi hydraulic supply. Once the brake booster plate has been installed on the top drive, it will remain permanently in place. There are no additional or complicated hook up requirements and the top drive can be prepared for tool use by simply switching a valve on the brake booster controls. The break out tool can be set in place and locked down to the rotary table in minutes.

- Storage – The tool can be designed with an optional storage base and can be moved around as a package. The control console may be attached to the storage base. **(Caution: The tool should be attached to the base with chain and binders to ensure safe handling if the unit is kept completely portable.** Some rigs may make a semi-permanent installation by removing the control console from the skid and permanently installing on the rig floor. With the controls installed and hoses stored on a local hose reel, it will only be required to lock the tool into the rotary table and hook up two hoses.

- Back-Up – In the very unlikely event of a hydraulic failure, the tool is strong enough to allow us to apply a manual tong at a reasonable height above the floor so that the Upper IBOP can be removed or torqued manually. The diameter of the tong bite area on the tool is small enough that it will not be required to use the larger SDD tongs. The standard drill pipe tongs can be used.

Preparations:

- Brake Pressure Intensifier – The **CLINCHER®** Top Drive Make Break (TDMB) Tool utilizes rig hydraulic power to generate torques greater than those generated by VARCO PH60 and PH85 Pipe Handlers for extreme torque application required to makeup or breakout Upper Internal Blowout Preventer Valves (UIBOPV) onto the top drive's output shaft. This system requires the air pressure used by the top drive gearbox brake system to be intensified from normal rig air pressures to approximately 170 psig. Two different air pressure intensifier systems are available. The original design features a top drive mounted brake air intensifier system (TDMBATS) that is permanently installed on the top drive and requires TDMBATS intensifier baseplate to select the required pressure. On some systems this manually operated valve has been replaced by an electrically controlled solenoid operated valve which can be controlled from the driller's console.

  The other air pressure intensifier system uses a control console mounted brake air intensifier system (CMBATS) attached to the TDMB control console and is connected to the top drive brake air pressure circuit only when the TDMB tool is being used. This system provides intensified air when the brake is manually actuated in combination with the operation of the TDMB tool's hydraulic control valves. *Note:* The electrically operated air valve is not available for the CCMBATS. When the CCMBATS brake air pressure valve is moved to the normal position, all pressure is bled from the top drive brake system. This intensifier

system is installed inside the control console for protection from the rig floor environment. Air is supplied to the intensifier from any convenient source on the rig floor. Intensified air is directed to the top drive brake by means of a jumper hose installed when the TDMB tool is being used. Note the air hoses required to supply air to the CCMBATS and to the top drive brake are not furnished as each rig will have differing requirements.

- Console Mounted Brake Air Intensifier Installation – **Note: If the top drive already has a TDMBATS installed, this device should be removed from the top drive when upgrading to the CCMBATS.** Installation of the CCMBATS requires that the air supply hose between the top drive air brake and the VARCO control valve be reconfigured at a convenient location to allow the installation of a male and female quick disconnect. This will allow quick connection of the CCMBATS output hose to be easily and quickly connected when required at a future date. The female quick disconnect must contain a check valve and be installed on the line coming from the VARCO control valve to avoid unnecessary loss of air while using the CCMBATS. During normal operations these quick connects are coupled together to allow normal operation of the top drive air brake. When using the Top Drive Make Break Tool, the CCMBATS output is connected to the male quick disconnect on the top drive allowing boosted air to be delivered to the brake when required. The CCMBATS control valve is used to apply and release the brake.

- Top Drive Mounted Brake Booster Installation – On receipt of the tool, it will be necessary to permanently mount the top drive brake booster kit and connect according to the air schematic. As there a number of differences in the various top drive configurations, it was not practical to design a mounting for each model and configuration. The air booster is supplied on a 15" square mounting plate that is drilled in each corner and will require some field fitting by the maintenance department. In addition, it will be necessary to make hoses to allow installation in the air circuit for the motor brake, per the air control schematic that is included with the tool documentation. As such, this one time installation will require the assistance of the rig welder and chief or mechanic for a short time. In most cases, the booster will be mounted on top of or near the motor brake on the top drive, being sure to use good sound methods that incorporate secondary retention on all fasteners to prevent falling object hazards.

- Hydraulic Installation – The Superior Make/Break Tool is provided with interconnecting hoses that run between the tool and control station. These are equipped with hydraulic quick disconnect couplings for easy tool set up. In addition, there is a set of 3/4" supply and return hoses supplied with the equipment. On receipt of the tool, it will be necessary to locate the nearest hydraulic supply and return lines and be sure that all quick disconnect fittings on the supply and return hoses are correct. Open the isolation valve on the side of the control console. The tool should be function tested and the make up regulator tested to be sure that the tool is set for the correct make up torque prior to use. This can be accomplished by cycling the tool in the make up mode while adjusting the panel mounted regulator. Break out requires no adjustment and will always provide maximum available torque. These preparations will prevent delays when the tool might be needed for an emergency valve change out. If absolutely necessary, the supply and return lines on the Varco pipe handler can be used as the supply to the control console. **(Caution: Always connect and open any valves in the return line before connecting the supply.)**

- Tool Storage – The tool should be anchored to the optional storage base when used, using binders, chains or straps and should be stored in a convenient location for quick and easy access, possibly even on the rig floor. **(Caution: The tool should be bound to the storage base before any lifting for transport.)** The control panel should be protected, as well as the hose ends to prevent contamination. If the tool is stored outside, in an area that is convenient to the drill floor, a heavy tarp should be secured over the unit to maintain the unit is clean and ready condition. All hose ends should be cleaned, preserved with a grease coating and wrapped to prevent contamination.

- Spare Upper IBOP Storage - The spare upper IBOP should be equipped with the operating shell, a set of cranks and have a 7-5/8" lift cap installed. This will minimize any time lost when doing an emergency valve change out by preventing the requirement to stop and transfer these items from the removed valve. (It may be possible to add a permanent storage rack for the spare Upper IBOP on the tool base.)

CLINCHER® UPPER IBOP MAKE/BREAK TOOL OPERATIONAL INSTRUCTIONS

Operating Sequence – With drill pipe in the slips.

Pull and review the JRA for this activity before proceeding. (A generic JRA has been prepared for your convenience and will serve as a basis for a job specific JRA that must be completed before proceeding.)

If the top drive is a TDS4, place the machine in Low gear before proceeding. Before starting this operation, drain the drill Kelly hose so that there will not be a column of mud to drain when the upper IBOP is removed.

1. Unlock and open the permanently installed selector valve on the top drive brake booster system. This will allow the brake booster to run when the brake is activated from the driller's console and the pressure will build up to 175 psi. It should be possible to hear the booster pump cycle and the pressure will be at or near 175 psi when the pump stops cycling. **(Caution: If the booster pump does not stop then there is a leak in the brake, quick release valve or brake piping that must be corrected prior to continuing with this operation.)**

2. Make up into the drill string or a single joint that is sitting in the slips and torque up as normal, close both the lower and upper IBOP valves.

3. With the UIBOP in the closed position, remove lift cylinder stop tubes on the PH60 or PH85 so that the pipe handler can raise and break out the connection between the upper and lower IBOP valves. Spin out with the top drive, leaving the saver sub and the lower IBOP valve on the drill pipe. Raise the top drive, latch the elevators on the drill string and set the pipe as low as possible in the slips. **(Caution: This total stick up height must not exceed 74 inches.)** Remove the slip handles so that the UIBOP tool can be set over the pipe with the slips in place.

4. Unlatch the elevators and raise the top drive until the elevators have cleared the pipe stick up height.

5. Attach a 20 ft sling to the elevators and allow it to hang down for later use. This sling will be used for handling the Superior Make/Break Tool.

6. Attach a 10 ft or longer sling to the pipe handler frame and allow it to hang down for later use. This sling will be used later in the process to pull the pipe handler clear of the Make/Break Tool.

7. Attach the other end of the 20 ft. sling to the Make/Break Tool handling sling and connect an air tugger to the base for handling. Slowly raise the blocks until the Make/Break Tool is raised high enough to clear the drill pipe while tailing in with the tugger line. Slowly lower the Make/Break Tool over the drill pipe, saver sub and lower IBOP valve that are in the slips. If only air tuggers are used for handling, it is desirable to attach two tuggers to the Make/Break Tool on opposite sides of the top drive to minimize swinging and help center the tool over the rotary table. Proper use of tag lines attached to the bottom of the tool is recommended. This process is rig dependent and should be discussed thoroughly in the JRA.

8. Place the Superior IBOP Make/Break Tool over the pipe stick up, and lock into the rotary table by tightening the bolts on the expandable feet to approximately 80 to 100 ft.lbs. **(Caution: Do not tighten bolts to expand feet unless engaged in rotary tables sockets. Doing so will damage feet.)** Rotate the rotary table until the Make/Break Tool is perpendicular to the V door and the hydraulic connections are facing the control panel skid. Connect the make and break hoses to the Superior Make/Break Tool and connect the supply and return hydraulic hoses to a suitable location that will provide a 2000 psi supply. **(Caution: Always be sure that the supply valves are closed and that the return line valve has been opened before connecting the supply hose.)**

9. Open the isolation valve on the side of the control console and function test the tool.

10. Fully extend the link tilt toward the V door and lower the top drive until the pipe handler is just above the Make/Break Tool. Attach a tugger line to the sling on the back of the pipe handler and slowly pull clear of the upper IBOP. **(Caution: If the torque tube on the pipe handler will not clear the bottom of the upper IBOP, it may be necessary to loosen the four bolts on the lift cylinder rod attachment point in order to allow the pipe handler to drop slightly lower.)**

11. Lock the rotary table dogs to prevent the table from turning during torquing operations.
12. Lower the Top Drive slowly while holding the pipe handler back to clear the Make/Break Tool until the splines on the upper IBOP engage the receiving collar on the top of the Make/Break Tool. Apply a slight set down force on the Make/Break Tool (1000-2000 lbs.) to ensure that the valve bottoms out in the receiving collar. **(Caution: Be sure that the top drive brake is off so that the shaft can rotate and align with the splines in the drive collar.)**

CLINCHER® UPPER IBOP MAKE/BREAK TOOL OPERATIONAL INSTRUCTIONS

13. With the main hydraulic unit switched on and top drive brake off, cycle the Superior hydraulic cylinders by holding the handle to the make up position, allowing the top drive shaft to turn as the tool rotates.

14. Have the driller set the top drive brake and allow enough time for the brake booster to increase the brake pressure to 175 psi. (You can hear the booster cycle and then stop as the correct pressure is reached.)

15. Once the brake is locked, move the control lever on the Make/Break Tool to the break position and watch for breakout movement between the upper IBOP and main shaft. If necessary, release the top drive brake, recycle the tool and repeat the breakout sequence. (It may be helpful to put a mark across the main shaft to UIBOP connection so that it will be easier to see the movement as the connection loosens.)

16. Once the upper IBOP valve connection has been broken, switch the top drive brake off, lift the top drive very slightly to remove the 1000-2000 lbs. of set down weight and spin the main shaft out leaving the upper IBOP valve sitting in the receiving collar on the breakout tool.

17. Raise the top drive until the elevators will clear the upper IBOP when the link tilt is retracted, release the link tilt and raise further until the sling on the elevators is near the top of the IBOP. Using a step ladder, attach a lifting cap to the top of the IBOP and attach the sling and a tag line to lift cap. Using the blocks, slowly raise the IBOP out of the drive collar on the Make/Break Tool and lower to the drill floor. Dope the upper connection on the replacement valve and transfer the lift cap, lifting sling and at least two tag lines to the fully outfitted replacement IBOP. Use this rigging to raise the valve and dope the lower connection prior to placing the new valve into the drive collar. (The actuator collar and cranks should already be installed and adjusted on the new valve to save time.) <u>The valve needs to be in the closed position so that the pipe handler arms will realign later when the pipe handler is moved back into place</u>.

18. With the brake released and top drive in spin mode, slowly lower the top drive and spin into the replacement valve. Follow through with the top drive torque function and torque the valve to main shaft connection as high as possible with the top drive motor to minimize the required number of torque cycles with the Make/Break Tool.

19. With the top drive brake switched off, cycle the torque cylinders to their full break position by holding the selector in the break position.

20. Have the driller set the top drive brake and allow the air pressure to reach 175 psi.

21. Reduce the torque regulator setting on the control console.

22. Place the Make / Break valve on the Superior console to the make position while watching the torque gauge. Slowly raise the torque adjustment until the desired torque setting is reached and hold for the required time interval (30 seconds).

23. Release the top drive brake and recycle the tool for another torque stroke. Set the brake and torque again to be sure that the torque cylinders have not reached the end of stroke on the previous sequence. Repeat these steps until connection is properly torqued.

24. Raise the top drive, remove the Superior IBOP Make/Break Tool from the rotary table and return it to the storage base using the same lifting methods utilized during installation.

25. Lower the top drive. Release the pipe handler when it is just above the lower IBOP, being careful to align the IBOP operating arms with the actuator shell.

26. Release the top drive brake and close the permanently installed selector valve on the top drive brake booster system.

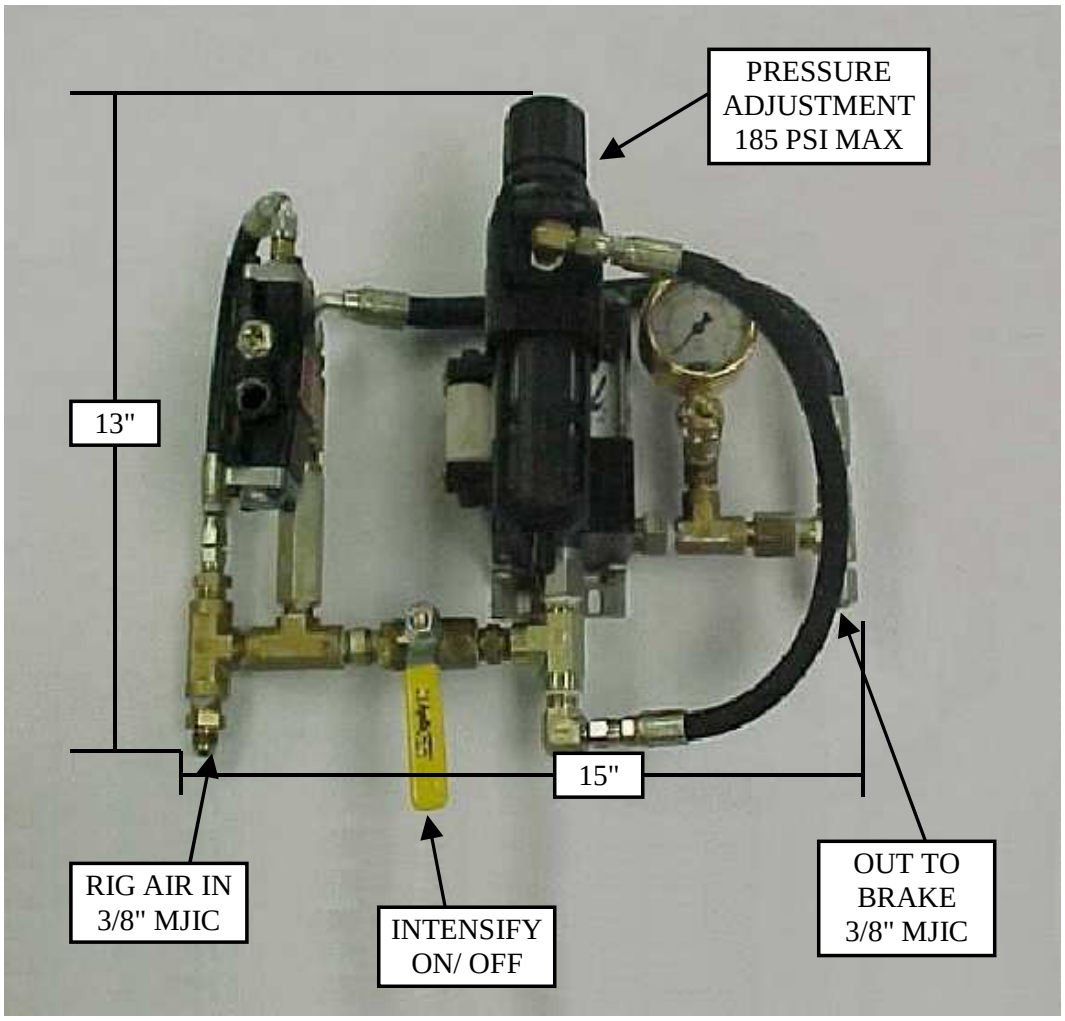
27. Place the top drive in spin mode and lower to stab into the lower IBOP while carefully guiding the pipe handler back over the lower IBOP valve. Use the top drive torque function to make this connection up as high as possible with the DC motor.

28. Set the make up torque on the pipe handler to the required torque for the upper to lower IBOP connection and use the pipe handler to complete the torque sequence on this connection.

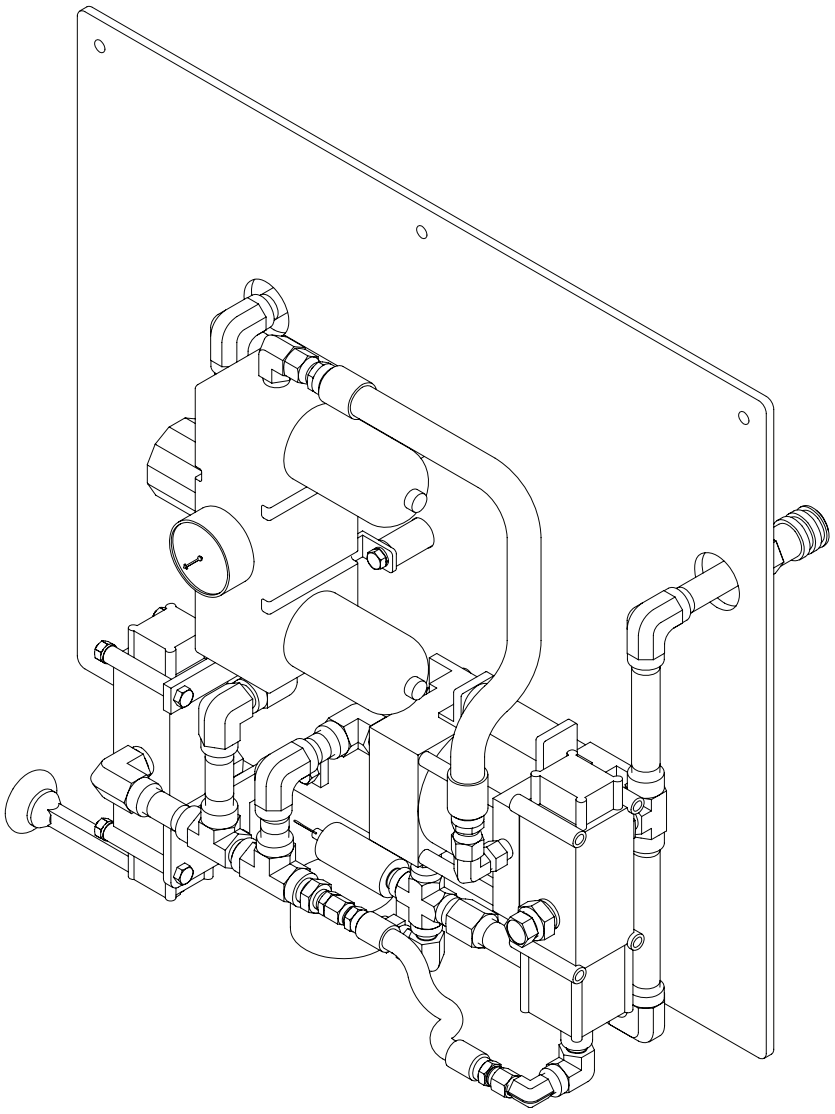
29. Replace the stop tubes on the pipe handler lift cylinder to prepare for normal drilling mode.

30. Reset the make up torque on the top drive console for the type of drill pipe connection that is being used and proceed with drilling operations.

CLINCHER® TOP DRIVE MOUNTED BRAKE AIR INTENSIFIER SYSTEM & UPPER IBOP MAKE/BREAK TOOL



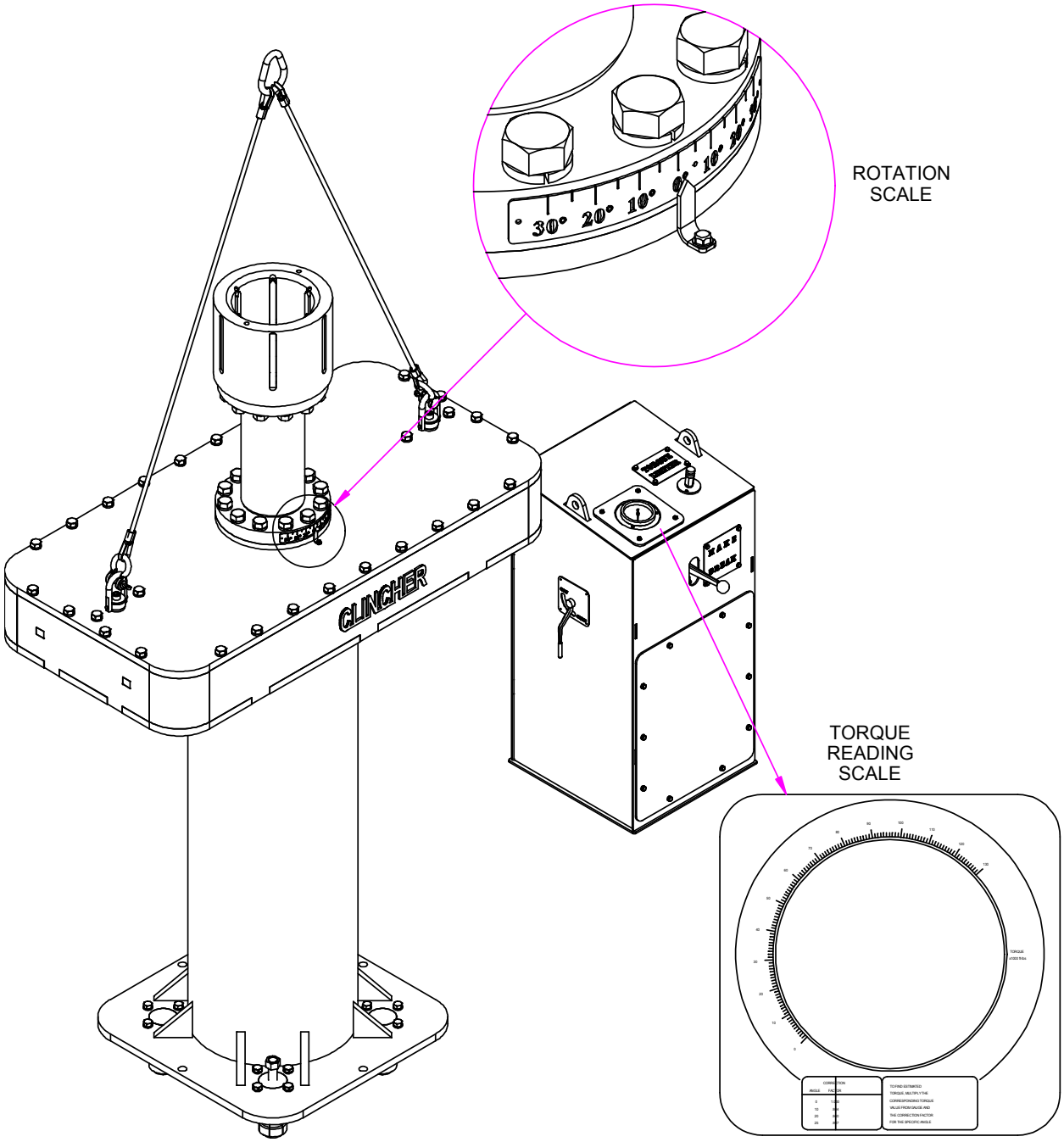
CLINCHER® CONSOLE MOUNTED BRAKE AIR INTENSIFIER SYSTEM & UPPER IBOP MAKE/BREAK TOOL

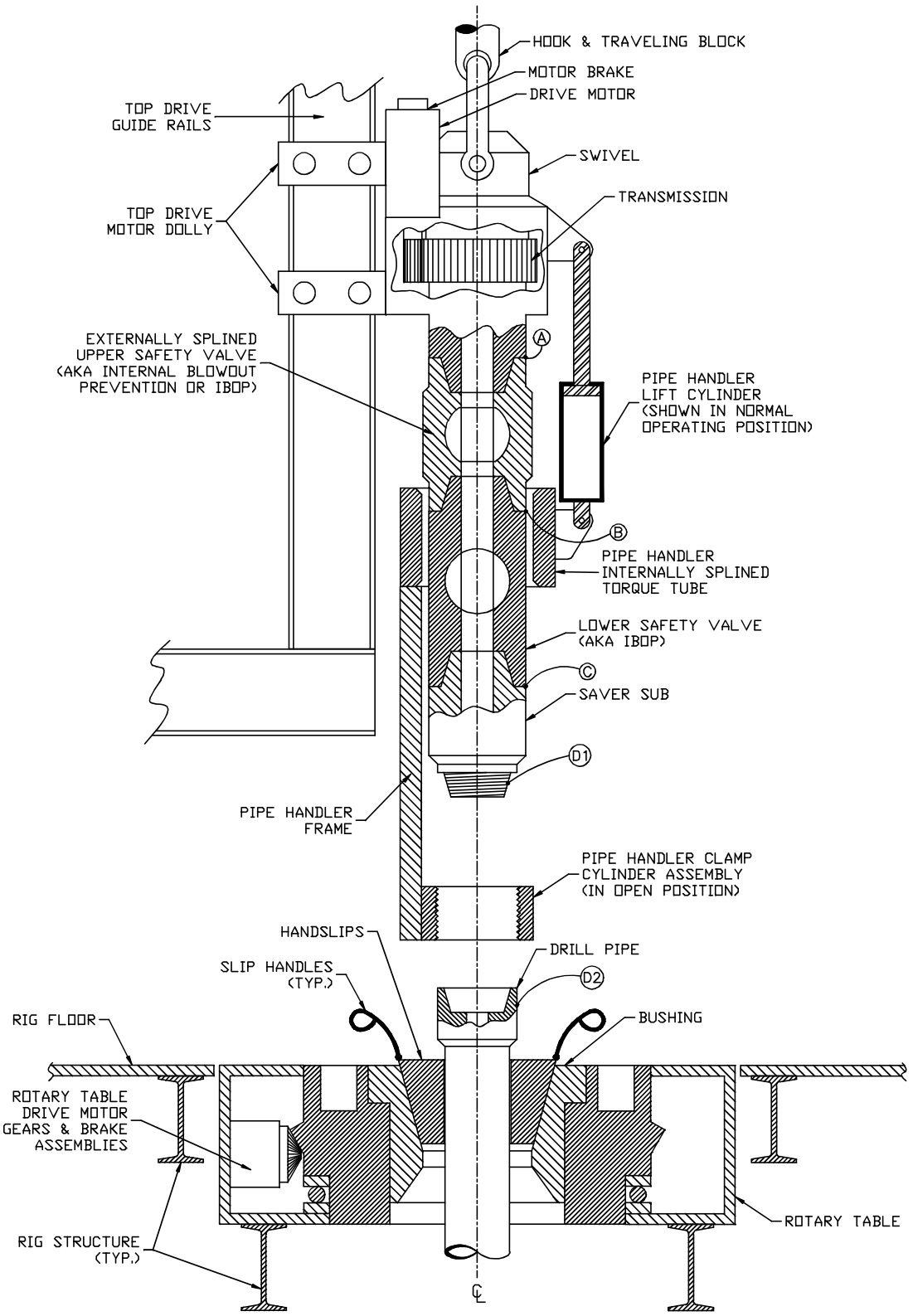


AI1100 AIR INTENSIFIER ASSEMBLY

INSTRUCTIONS FOR MEASURING TORQUE

To find the estimated torque, take the reading from the Torque Reading Scale (on the console). Multiply it by the Correction Factor of the Angle which corresponds to the reading on the Rotation Scale (on the Make/Break Tool). See illustration below.





TOP DRIVE, PIPE HANDLER AND ROTARY TABLE GENERAL ARRANGEMENT

SUPERIOR Manufacturing & Hydraulics
4225 HWY. 90 EAST
BROUSSARD, LA 70518
(318) 837-8847

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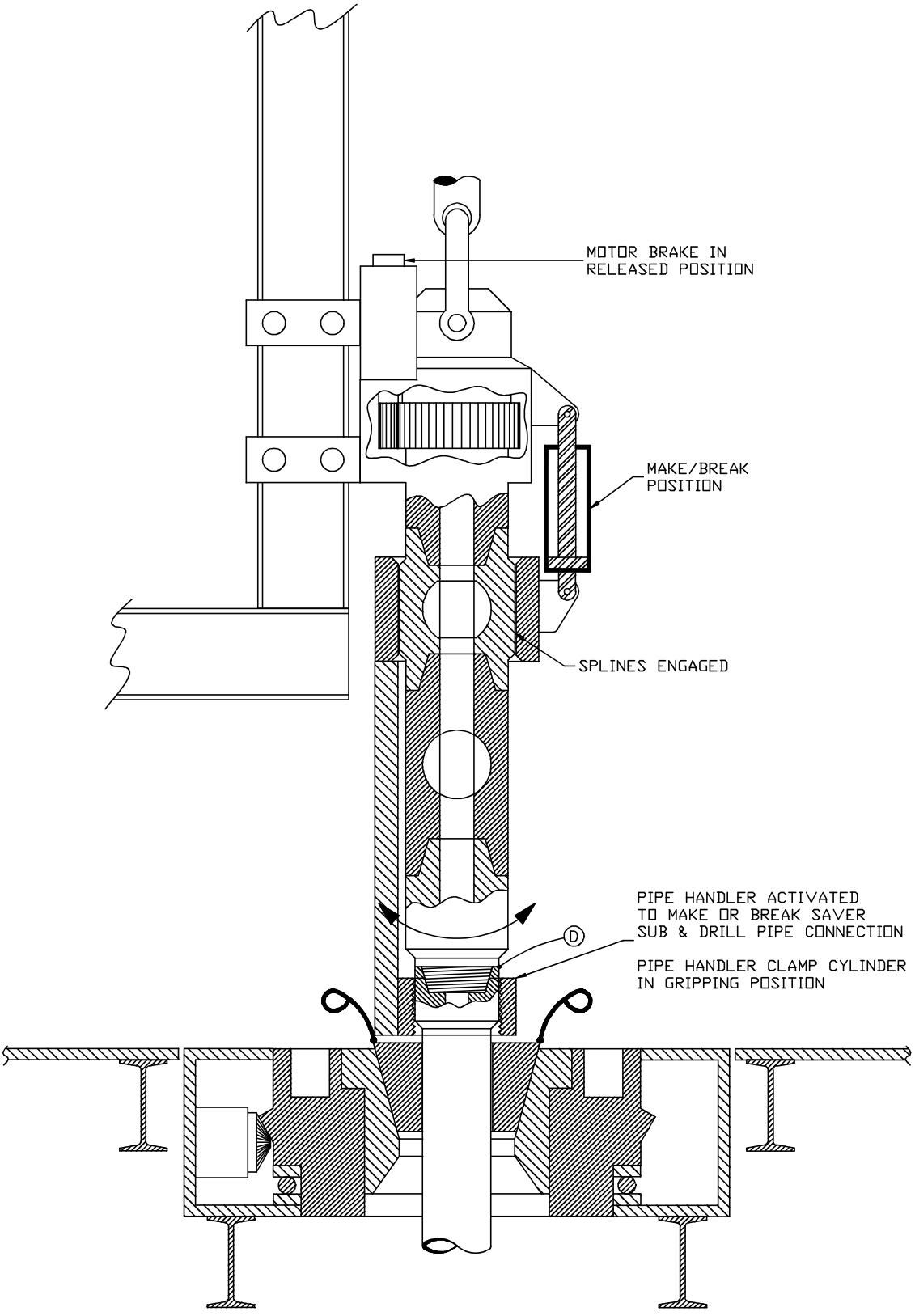

PIPE HANDLER IN MAKE - UP AND BREAK - OUT POSITION

SUPERIOR Manufacturing & Hydraulics
4225 HWY. 90 EAST
BROUSSARD, LA 70518
(318) 837-8847

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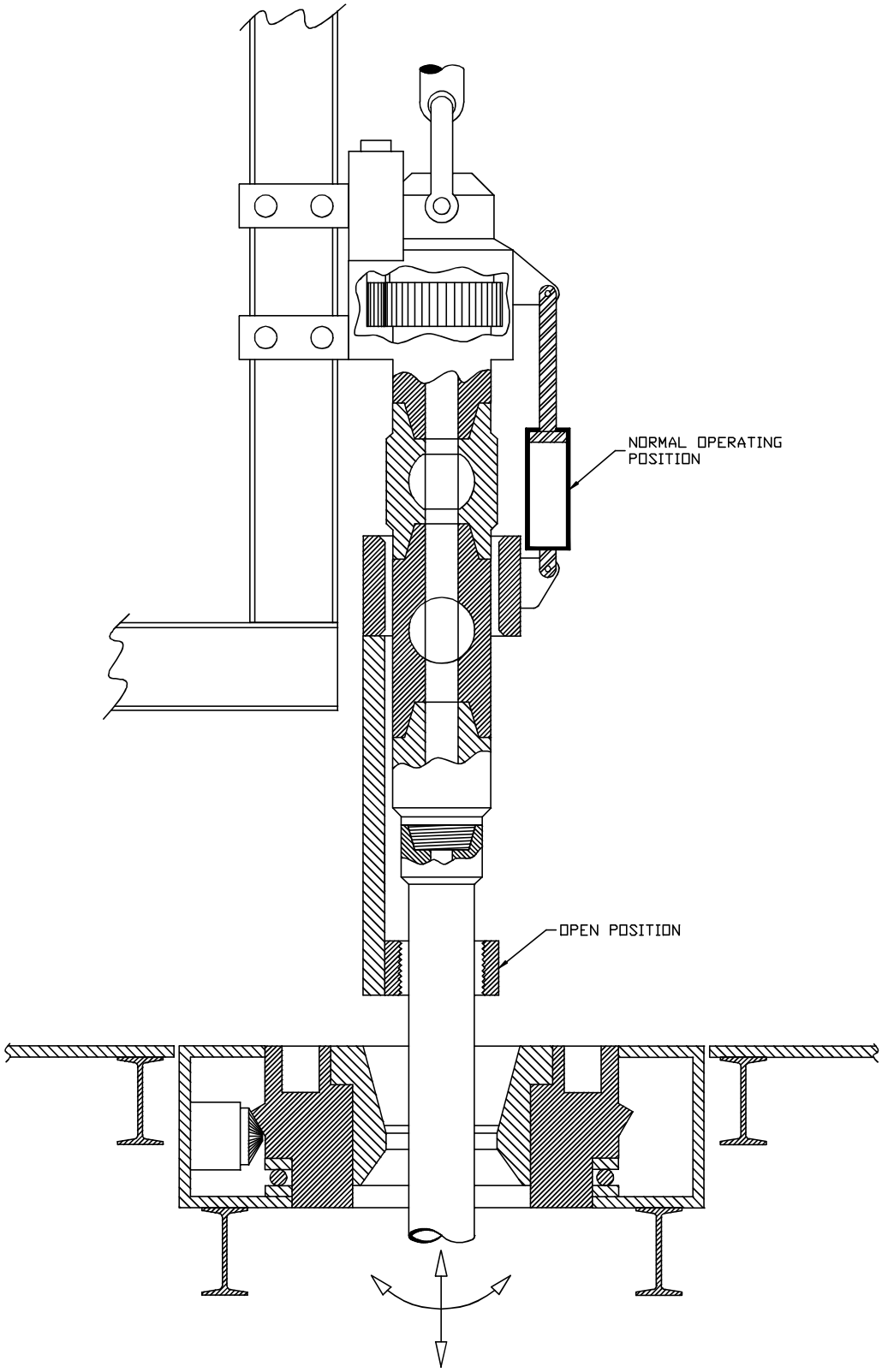

TOP DRIVE CONNECTED TO DRILL PIPE IN NORMAL OPERATING MODE FOR ROTATING AND TRIPPING

SUPERIOR Manufacturing & Hydraulics
4225 HWY. 90 EAST
BROUSSARD, LA 70518
(318) 837-8847

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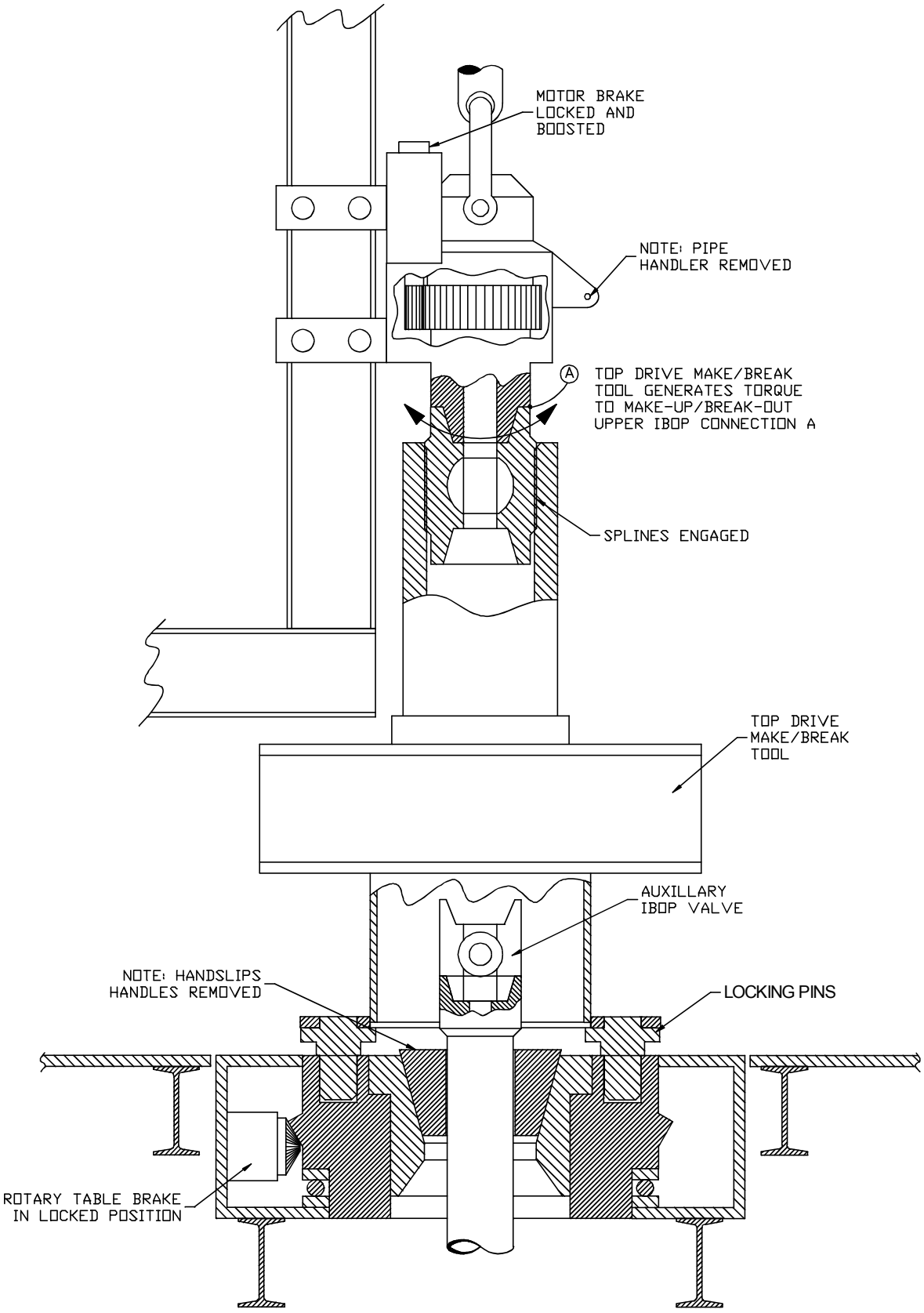

TOP DRIVE MAKE / BREAK TOOL IN MAKE / BREAK POSITION

SUPERIOR Manufacturing & Hydraulics
4225 HWY. 90 EAST
BROUSSARD, LA 70518
(318) 837-8847

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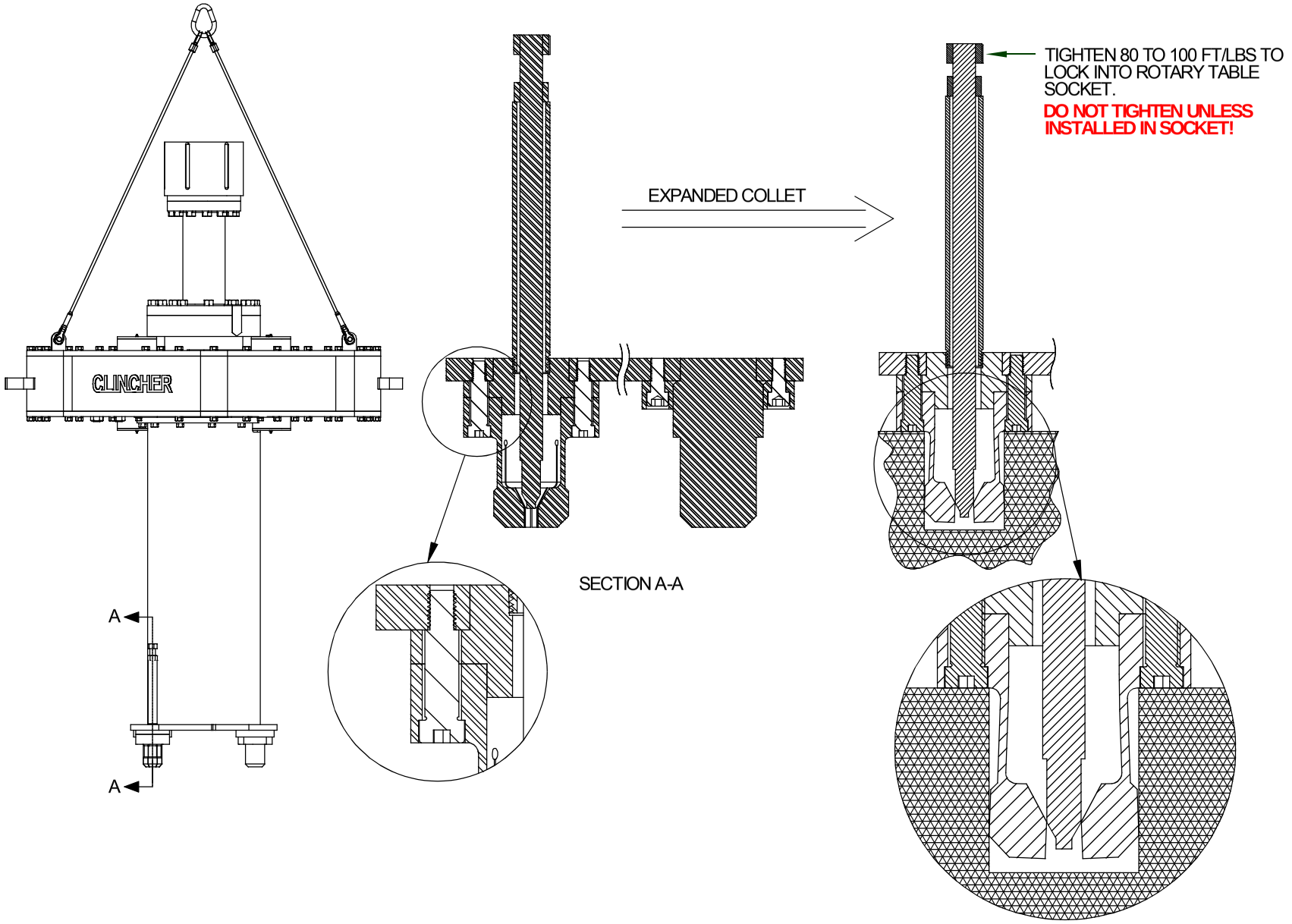

DRIVE PIN ILLUSTRATION

SUPERIOR Manufacturing & Hydraulics
4225 HWY. 90 EAST
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(318) 837-8847

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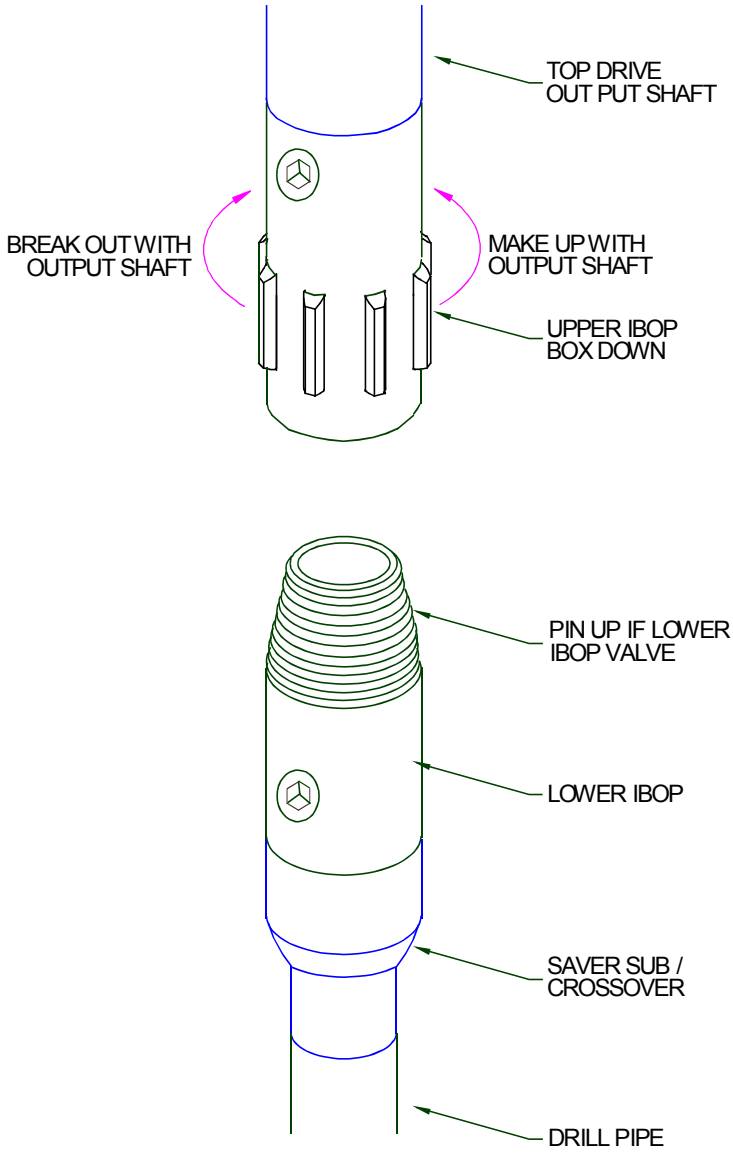

IBOP ILLUSTRATION

SUPERIOR Manufacturing & Hydraulics
4225 HWY. 90 EAST
BROUSSARD, LA 70518
(318) 837-8847

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MAINTENANCE INSTRUCTIONS

Superior recommends that owners of Make/Break Tools and accessories adapt a regularly scheduled maintenance program. Implementation of this type of program offers several benefits. First you increase the life of your equipment, secondly, you may find a problem before it escalates to a costly repair or down time on the job, and most importantly, prevent injury to operating personnel.

A major inspection should be carried out if equipment is suspected to have been damaged during transit or is to be mobilized to a remote location where maintenance operations are difficult to carry out.

Note: Follow Technical Manual Operating & Safety Procedures.

Routine Maintenance

Cleaning:

A) Pre-wash unit to remove majority of dirt and grease build up as to allow inspection of overall condition of unit.

B) Clean and inspect for damage or excessive wear (cracks, breakage, and uneven wear patterns).

C) Inspect all hoses for wear, replace as necessary.

D) Lubricate zerts on bearings.

E) While maintaining pressure visually inspect hoses, stainless steel lines, fittings, etc., for seepage of air or hydraulic fluid. Repair or replace parts causing leaks. If you see no visible external leaks and you are still losing pressure, there may be an internal leak in the load holding valve. It is recommended that the unit be returned to the manufacturer for repair.

F) Test. Re-inspect hydraulic system for leaks.

G) Actuate the brake pressure booster weekly. Adjust air supply pressure regulator stem to insure it remains free to rotate. Haskel pump doesn't require a lubricator but might benefit from a dryer if excess water vapor or free water is present in the air supply. We suggest that a Haskel repair kit and spare air pressure regulator be stocked on rig for quick turnaround on repairs.

H) Inspect and actuate controls weekly even if the unit is not connected to rig hydraulic power supply. If TDMB Tool is permanently connected to rig hydraulic power supply, it should be actuated through its full stroke in both directions weekly. Actuate all controls fully including the pressure control valve leaving it set at a maximum of 2,000 psi. Apply grease with corrosion inhibitor to threads on stem of panel mounted pressure control valve.

I) During weekly inspection, insure that the ID of the drive sub is protected with grease with corrosion inhibitor and that the drain port is open to prevent the collection of water.

J) During weekly inspection, check flexible inserts for damage or corrosion. Verify flexible insert actuator threaded rod is coated with grease to protect against corrosion. CAUTION: DO NOT EXPAND flexible insert unless it is installed in rotary table drive socket.

K) Every ninety days the unit's grease zerts should be re-lubricated to insure moving parts are lubricated to guard against wear and corrosion.

L) At least annually, follow Maintenance Instructions shown in Technical Manual Section 6 and make any repairs necessary. If corrosion is observed on unit, repair the affected area by removing any residual paint and corrosion products. Repaint using primer and top coat in accordance with paint manufacturer's instructions.

M) Annually inspect, proof test and certify lifting slings and eyes for 4.5 tons safe working load limit for sling included angle of 50 degrees.

TROUBLE SHOOTING

	Problem	Solution
A)	Unit does not function.	Insure all hoses are properly connected and isolation valve is open..
B)	If fluid is heard flowing through console within the directional control valve in the neutral position.	Adjust inlet section pressure relief valve setting to pressure greater than hydraulic power unit supply pressure.
C)	Unit does not generate maximum break out torque or reach 2000 psi.	Check hydraulic power unit supply pressure. If greater than 2000 psi, verify break out pressure relief valve's setting (inside console) is greater than 2000 psi.
D)	Unit does not generate maximum make up torque or reach 2000 psi.	Check panel mounted adjustable relief valve to insure it is not backed off. Verify make up pressure relief valve's setting (inside console) is greater than 2000 psi.

SECTION 7 PARTS LISTS

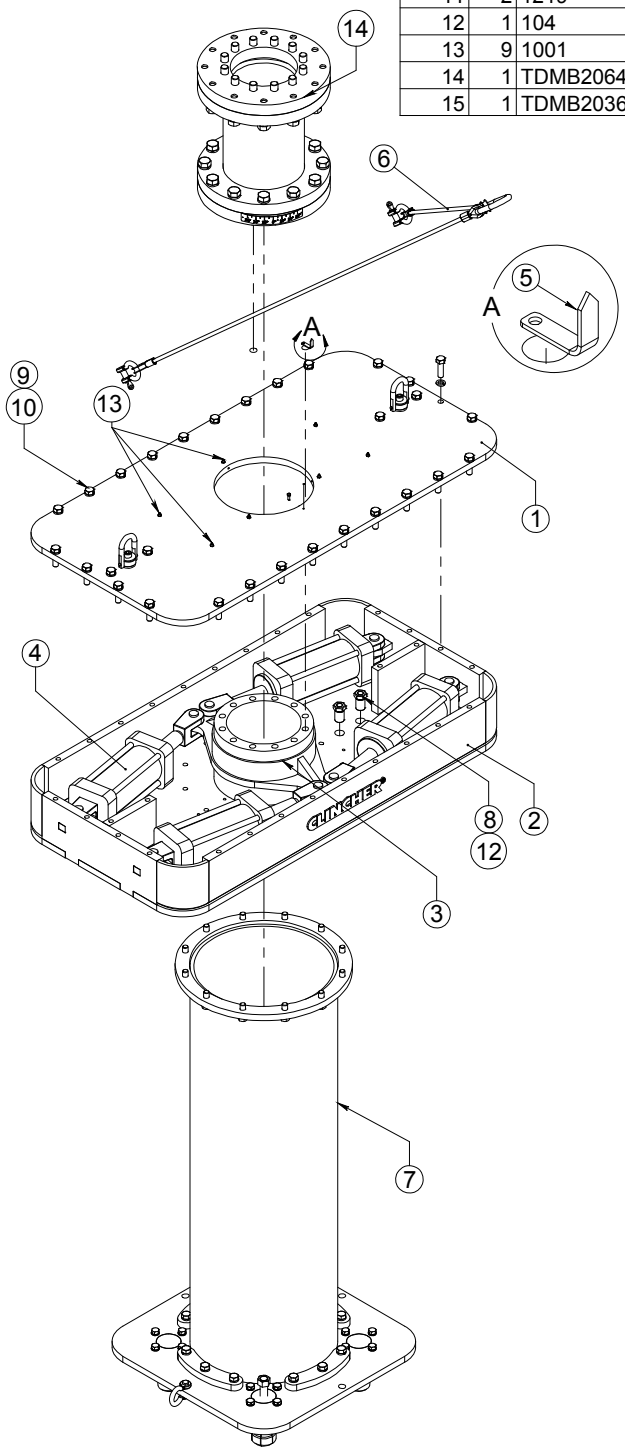
RECOMMENDED SPARE PARTS LIST

Part Number	***Quantity***	***Description***
Superior PN 1001	8	1/8 NPT Zerts
6533N-T2NV	2	Cylinder Rod Seal Kit
6633N-T2NU	2	Cylinder Piston Seal Kit
A20-STDBK	2	Valve Seal Kit
S26-58475-0	2	Dump Valve Seal Kit
Superior PN CRSS20009	1	Remote Operated Relief Valve
Superior PN TDMB1010	2	2" Pin
TDMB1025	1	Sling Assembly

SECTION 8 MAKE/BREAK TOOL ILLUSTRATIONS

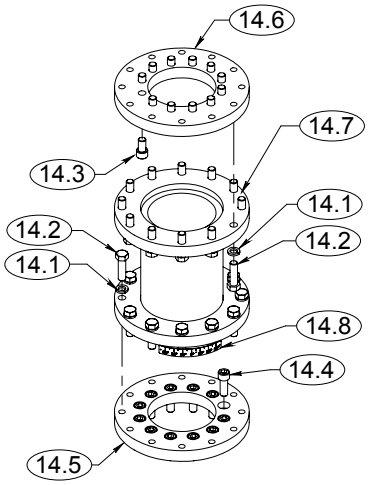
TOP DRIVE MAKE/BREAK TOOL ASSEMBLY *(Assembly No. TDMB2000-03)* ..... 8 - 3
LOWER EXTENSION ASSEMBLY *(Assembly No. TDMB2040)* ..... 8 - 4
FLEXIBLE INSERT ASSEMBLY *(Assembly No. TDMB2013)* ..... 8 - 4
SLING ASSEMBLY *(Assembly No. TDMB1025)* ..... 8 - 5
CONTROL CONSOLE ASSEMBLY - COMPLETE *(Assembly No. TDMB203602)* ..... 8 - 6
CONSOLE MOUNTED AIR INTENSIFIER ASSEMBLY *(Sht.1) (Assembly No. AI1100)* ..... 8 - 7
CONSOLE MOUNTED AIR INTENSIFIER ASSEMBLY B.O.M. *(Sht.2) (Assembly No. AI1100)* ..... 8 - 8
TOP DRIVE MOUNTED AIR BOOSTER PANEL *(Assy. No. TDMB1036)* ..... 8 - 9
HYDRAULICALLY ENERGIZED DRIVE SUB *(Assy. No. HEDS9750)* ..... 8 - 10

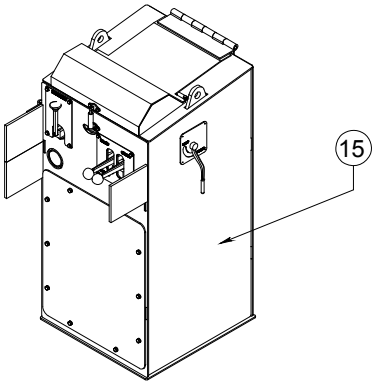
Item #	Qty.	Part Number	Part Name
1	1	TDMB2003	TOP PLATE ASSEMBLY
2	1	TDMB2004	BOTTOM PLATE/MIDBODY WELDMENT
3	1	TDMB2006	HUB WELDMENT
4	4	TDMB2007	CYLINDER 5" BORE, 10" STROKE, 2" ROD
5	1	TDMB202701	POINTER
6	1	TDMB1025	SLING
7	1	TDMB2040	LOWER EXTENSION ASSEMBLY
8	2	BUCST7623	BULKHEAD CONNECTOR
9	30	1171	3/4" LOCKWASHER
10	30	1183	3/4"-10 x 2 1/2 HHCS
11	2	1219	1 1/4"-12 JAMNUT
12	1	104	1/4"-20 X 1 1/4" HHCS GR8
13	9	1001	1/8 NPT ZERT
14	1	TDMB206401	UPPER EXTENSION KIT ASSEMBLY
15	1	TDMB203602	TOP DRIVE MAKE/BREAK CONTROL CONSOLE ASSEMLBY



TDMB206401 UPPER EXTENSION KIT ASSEMBLY

Item #	Qty.	Part Number	Part Name
14.1	24	1218	1" LW
14.2	24	1288-B	HHCS 1"-8 X 3 1/2"
14.3	12	1245	1"-8 x 1 3/4" SHCS
14.4	12	1355	SHCS 1"-8 X 2 3/4"
14.5	1	TDMB2060	LOWER FLANGE
14.6	1	TDMB2062	UPPER FLANGE
14.7	1	TDMB2063	UPPER EXTENSION WELDMENT
14.8	1	TDMB2001-S3	ROTATION SCALE





TOP DRIVE MAKE/BREAK TOOL

ASSEMBLY NO. TDMB2000-03

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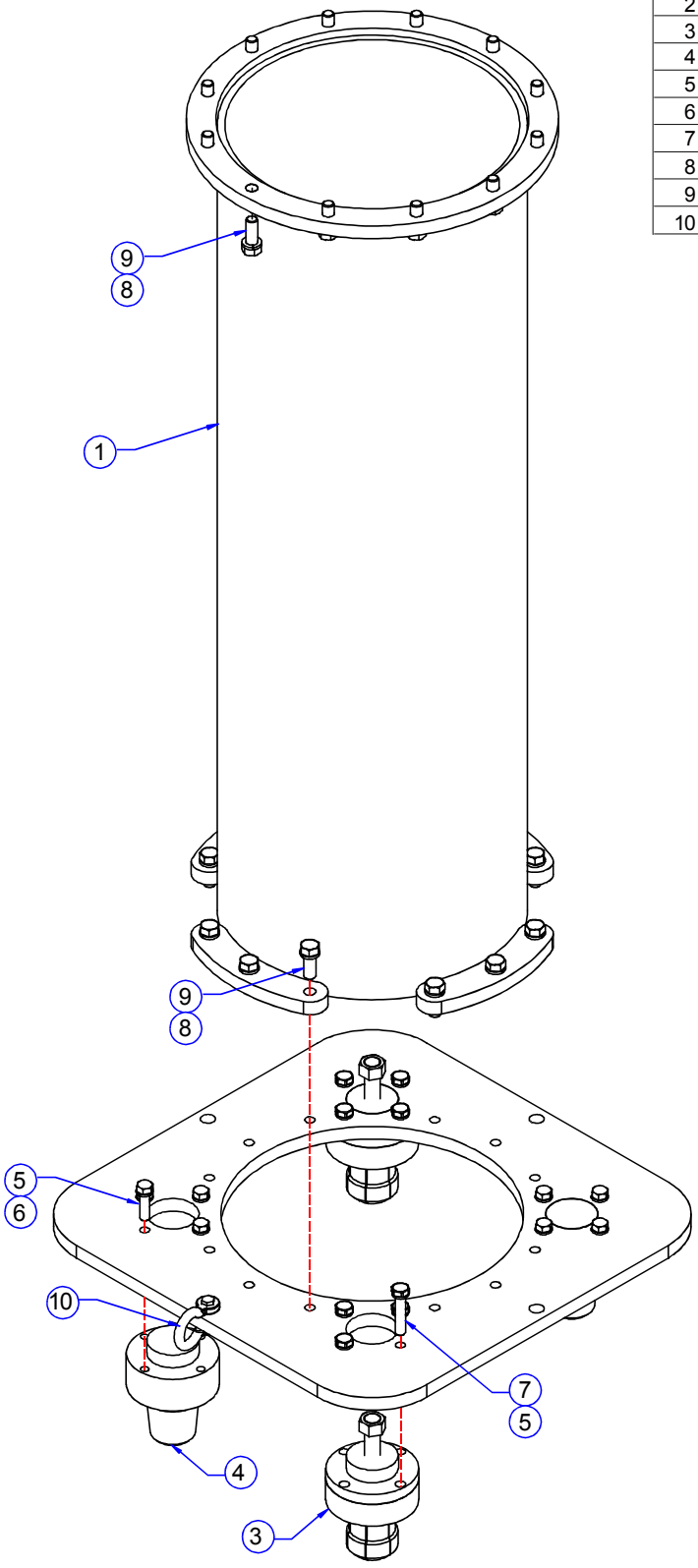
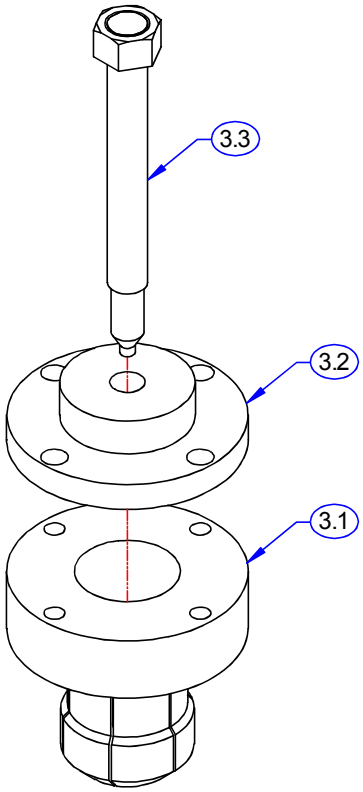
(318) 837-8847

REV. #	LOG #	DATE
		7/14/10

Item #	Qty.	Part Number	Part Description
1	1	TDMB2019	LOWER EXTENSION WELDMENT
2	1	TDMB2019-S3	BOTTOM PLATE
3	2	TDMB2013	FLEXIBLE INSERT ASSEMBLY
4	2	TDMB2012	SOLID INSERT
5	16	1151	5/8" LOCKWASHER
6	8	201	5/8"-11 X 2 1/4" HHCS
7	8	204-A	5/8"-11 X 3 1/4" SHCS
8	24	1171	3/4" LOCKWASHER
9	24	1190	3/4"-10 X 2" HHCS
10	1	TDMB1025-S2	5/8" X 3 1/4 TON BOLT TYPE SHACKLE





FLEXIBLE INSERT ASSEMBLY NO. TDMB2013

Item #	Qty.	Part Number	Part Name
3.1	1	TDMB2010	FLEXIBLE INSERT
3.2	1	TDMB2011	FLEXIBLE INSERT CAP
3.3	1	TDMB2014	ALL-THREAD WELDMENT

LOWER EXTENSION ASSEMBLY

ASSEMBLY NO. TDMB2040

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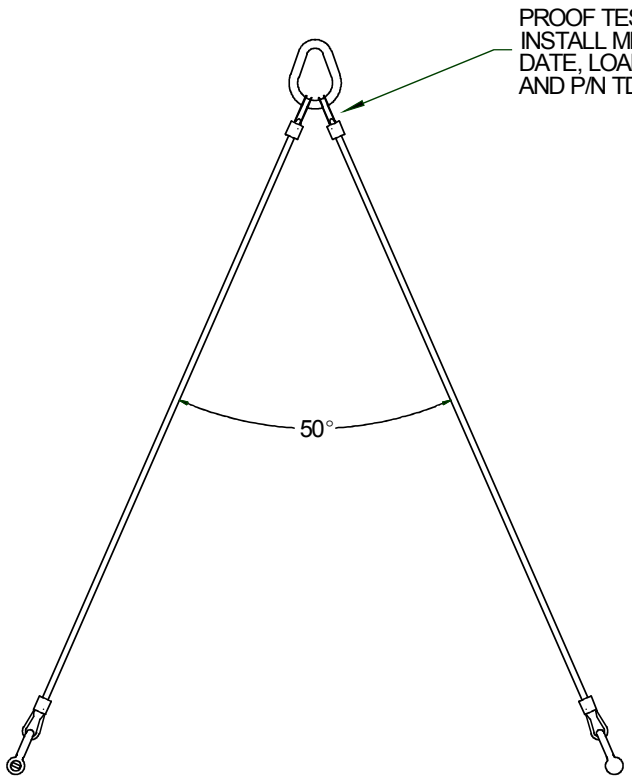
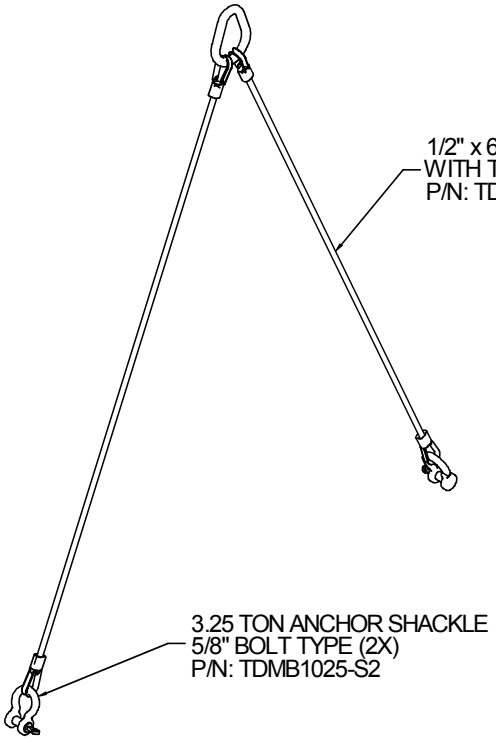
		01/03/08
REV. #	LOG #	DATE

REF: P:\Manuals\Equip Manuals\Dwgs\TDMB2000-01\TDMB2040 Low Ext.wpg



WORKING LOAD LIMIT:
SLING 4.5 TONS AT 65° (50° INCLUDED ANGLE)



APPROXIMATE WEIGHT (LBS.) = 11.045865

SLING ASSEMBLY

ASSEMBLY NO. TDMB1025

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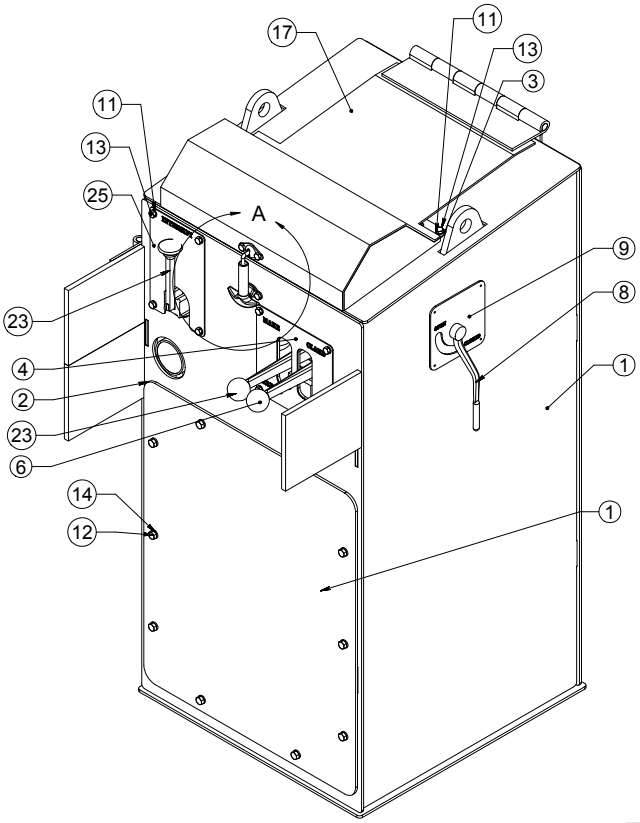
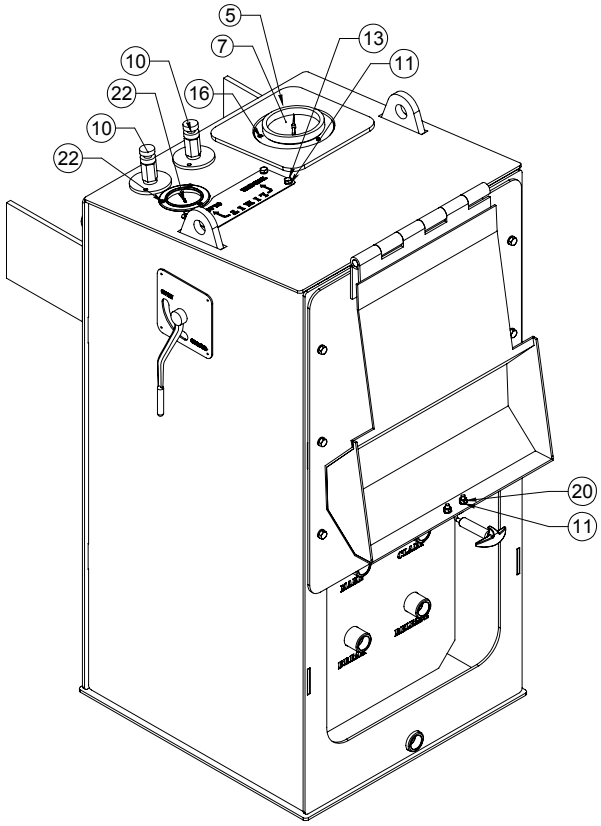
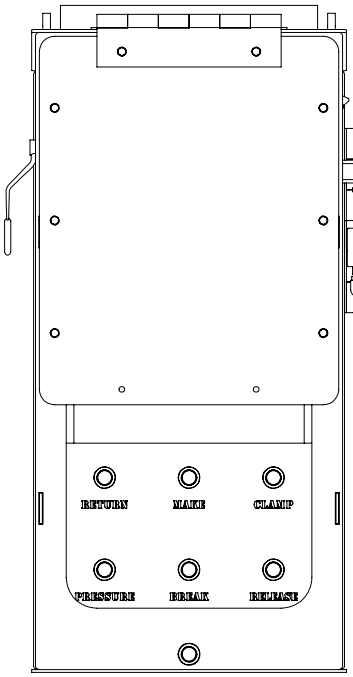
REV. #	LOG #	DATE
1		01/04/08

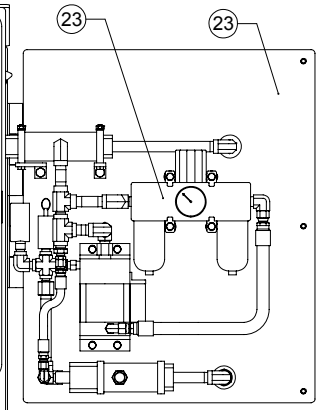
REF: P:\Manuals\Equip Manuals\Dwgs\TDMB1000-01\TDMB1025 Sling rev1.wpg

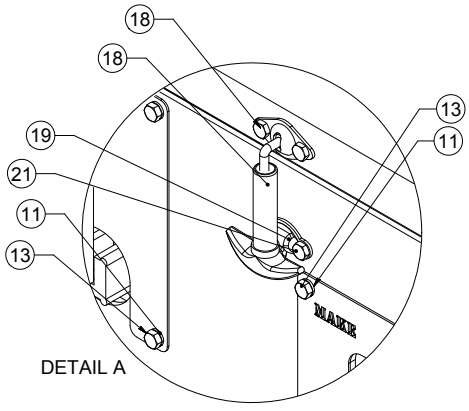


Item #	Qty.	Part Number	Part Name
1	1	TDMB203501	TDMB CONTROL CONSOLE WELDMENT
2	2	TDMB2035-S7	ACCESS PANEL
3	1	TDMB203501-S8	LIMITER LABEL
4	1	TDMB203501-S12	VALVE LABEL
5	1	TDMB2026	TORQUE READING SCALE
6	1	TDMB102801	VALVE ASSEMBLY
7	1	TDMB1029	PRESSURE GAUGE
8	1	TDMB1030	3/4" NPT BALL VALVE HIGH PRESSURE
9	1	TDMB1032-S1	PRESSURE VALVE COVER
10	2	CRSS20009	PANEL MTD. PRES. CONT. RELIEF VALVE
11	18	101	1/4" LOCKWASHER
12	18	120	5/16" X 1/2" HHCS
13	16	1008-B3	1/4"-20 X 1/2" HHCS
14	21	1023-B	5/16 LOCKWASHER
15	3	1150-A	#6-32 BRASS NUT
16	3	1150-B	#6-32 x 3/4" BRASS SCREW
17	1	TDMBC1	COVER FOR TDMB CONSOLE
18	1	1344A260a	STAINLESS STEEL DRAW LATCH
19	1	1344A260b	STAINLESS STEEL DRAW CATCH
20	4	100	1/4"-20 HEX NUT GR8
21	4	104	1/4"-20 X 1 1/4" HHCS GR8
22	1	BAC-3M25RCFF-A	3000 PSI GAUGE ASSEMBLY
23	1	AI1100	AIR INTENIFIER ASSEMBLY
24	3	122	5/16" X 1" HHCS
25	1	TDMB203501-S9	INTENSIFY TAG









DETAIL A

TDMB CONTROL CONSOLE

ASSEMBLY NO. TDMB203602

APPROX.WEIGHT (lbs.) = 427

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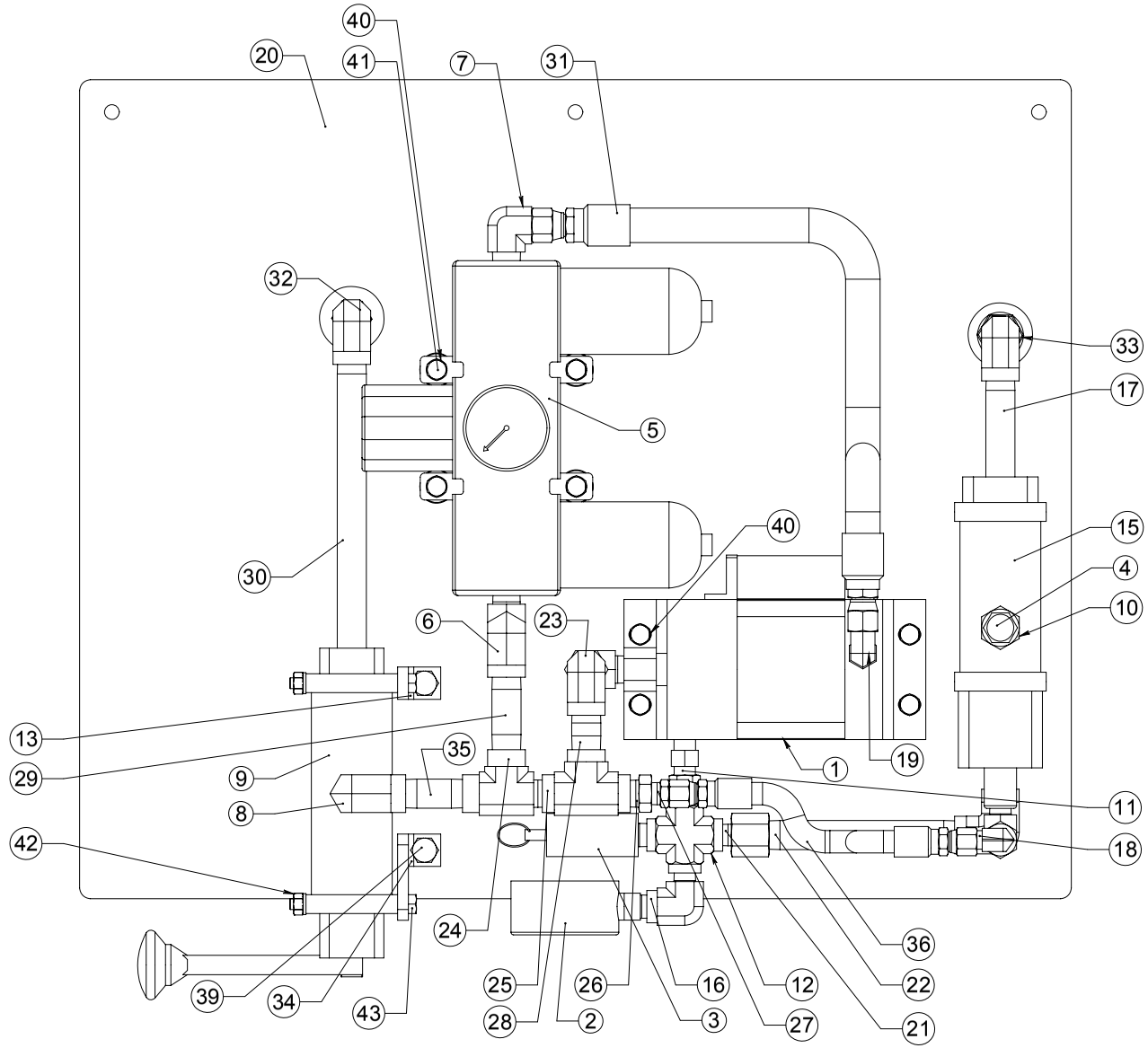

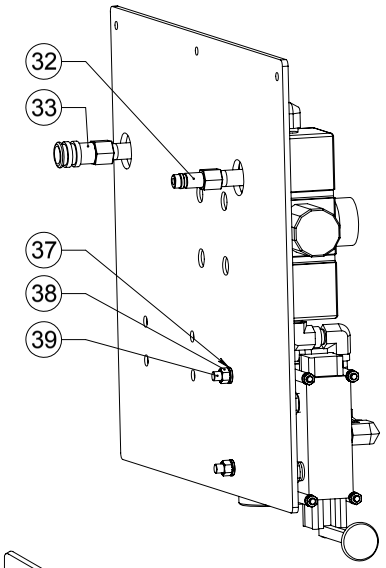

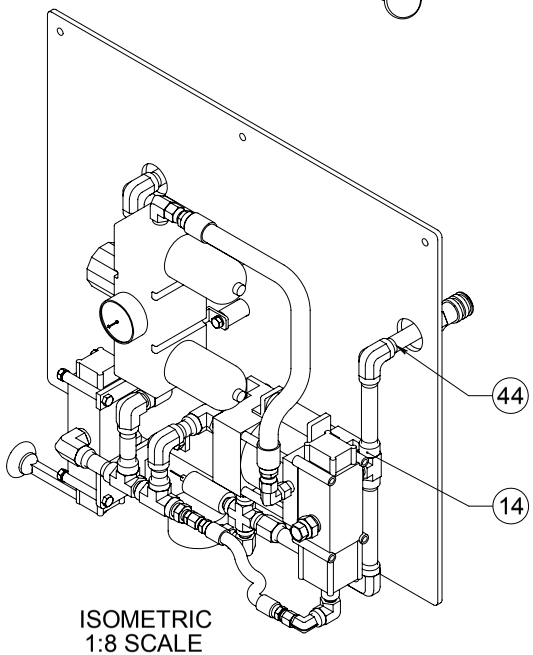

ISOMETRIC
1:8 SCALE

CONSOLE MOUNTED
AIR INTENSIFIER ASSEMBLY

ASSEMBLY NO. AI1100

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REV. #	LOG #	DATE

Item #	Qty.	Part Number	Part Name
1	1	HAA31-2.5	HASKEL AIR INTENSIFIER (2.5:1)
2	1	BAC-600-25	600 PSI GAGE (1/4" MNPT)
3	1	9889K19	1/4" MNPT AIR POPOFF VALVE (185 PSI)
4	2	1579C	3/8" BREATHER VENT
5	1	C18-03-FGG0	FILTER REGULATOR LUBRICATOR UNIT (3/8" AUTOMATIC DRAIN)
6	3	1450	3/8" STREET ELBOW
7	1	6-6 CTX	3/8" MNPT x 3/8" MJIC ELBOW
8	2	1449-G	1/2" MNPT x 3/8" FNPT ELBOW
9	1	PD4-32-9802	PILOTAIR THREE-WAY, TAPPED EXHAUST VALVE
10	3	12 x 38 PTR	1/2" MNPT x 3/8" FNPT REDUCER
11	1	1456	1/4" NPT HEX NIPPLE
12	1	14 KMOO	1/4" FNPT CROSS
13	1	AI1003	VALVE MOUNT
14	1	1595A	3/8" BRANCH TEE
15	1	PD4-20-0011	TWO-WAY, TWO POSITION PILOT OPERATED, SPRING RETURN PNEUMATIC CONTROL VALVE
16	2	1449	1/4" STREET ELBOW
17	1	PN6-4	3/8" NPT PIPE NIPPLE (4" LG)
18	1	1576	90 DEG. 1/4 MNPT X 1/4 MJIC
19	1	1576-A	1/4" MNPT x 3/8" MJIC ELBOW
20	1	AI11015	MOUNTING PLATE WELDMENT
21	1	38 x 14 FG	3/8" FNPT x 1/4" MNPT ADAPTOR
22	2	PN6-5	3/8" NPT PIPE NIPPLE (5" LG)
23	4	1580	90 3/8" F X F NPT
24	1	1595	3/8" RUN TEE
25	1	1620	3/8" TEE
26	1	1486	3/8" MNPT x 1/4" NPT REDUCER BUSHING
27	1	1562	1/4 MNPT x 1/4 MJIC ADAPTOR
28	2	PN6-1.5	3/8" NPT PIPE NIPPLE (1 1/2" LG)
29	1	PN6-2.25	3/8" NPT PIPE NIPPLE (2 1/4" LG)
30	1	PN6-8	3/8" NPT PIPE NIPPLE (8" LG)
32	1	H1F	3/8" FNPT INDUSTRIAL NIPPLE (1/2" BODY)
33	1	HF406F-6	3/8" FNPT QUICK COUPLER (3/8" BODY)
34	1	AI1015	VALVE MOUNT
35	2	PN6-2	3/8" NPT PIPE NIPPLE (2" LG)
37	2	1027	WASHER, LOCK 3/8"
38	2	1024	3/8-16 NUT (1024)
39	2	1048	3/8"-16 X 1 1/4" HHCS
40	12	101	1/4" LOCKWASHER
41	8	1008-B3	1/4"-20 X 1/2" HHCS
42	4	100	1/4"-20 HEX NUT GR8
43	4	112	1/4"-20 X 2 3/4" HHCS
44	1	PN6-3	3/8" NPT PIPE NIPPLE (3" LG)

CONSOLE MOUNTED AIR INTENSIFIER ASSEMBLY B.O.M.

ASSEMBLY NO. AI1100

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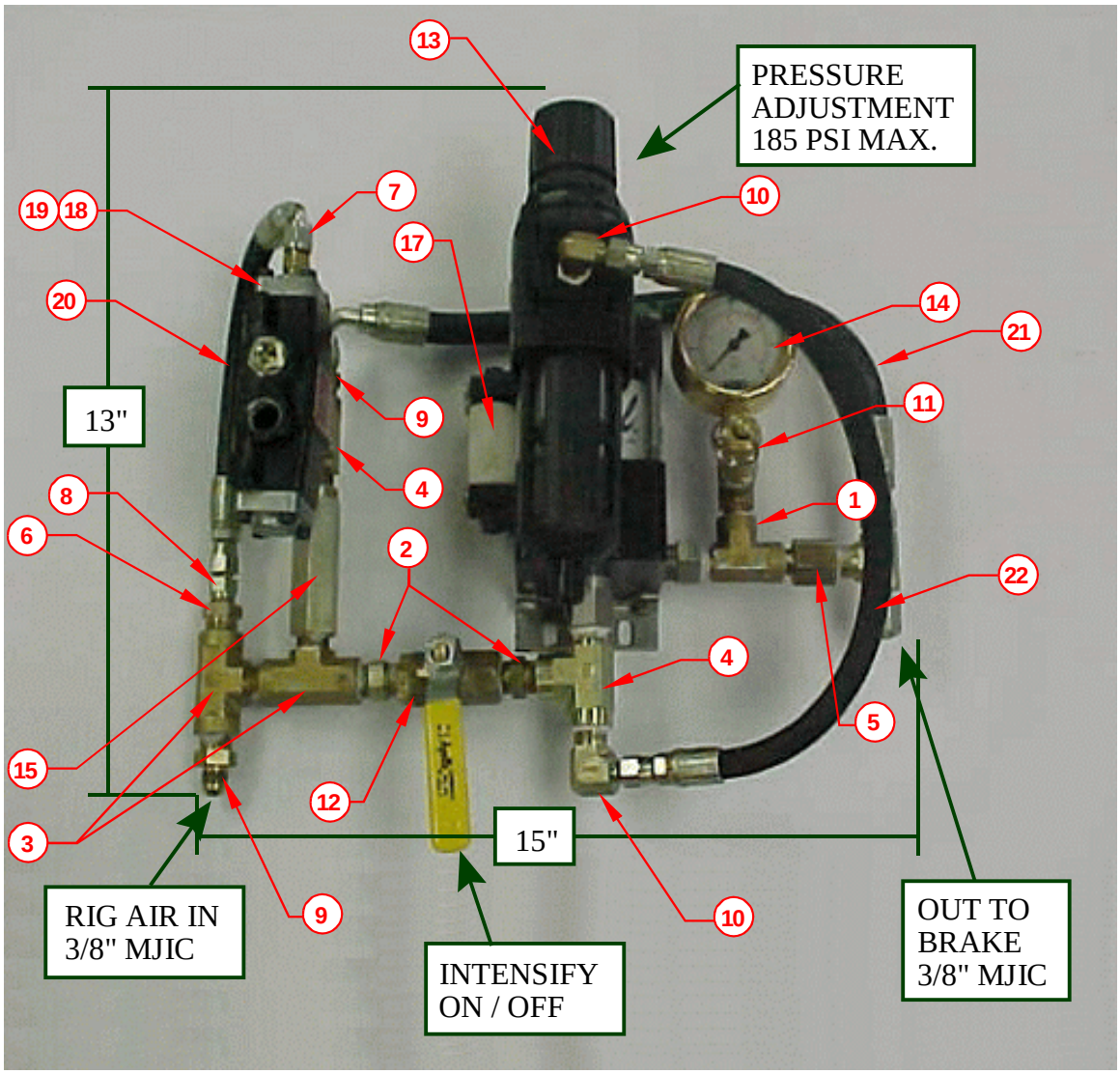
REV. #	LOG #	DATE



Item #	Qty.	Part Number	Part Description
1	2	1/4 MRO	1/4" MALE RUN TEE
2	3	3/8 FF	3/8" MALE PIPE NIPPLE
3	2	3/8 MMS	MALE BRANCH TEE 3/8" MNPT X 3/8" FNPT
4	2	3/8 MRO	3/8" MALE RUN TEE
5	1	3/8 X 1/4 FG	3/8" NPT X 1/4" NPT EXPANDER/ADAPTER
6	1	3/8 X 1/4 PTR	3/8" NPT X 1/4" NPT PIPE THREAD REDUCER
7	1	4 FTX	MALE CONNECTOR 1/4" MJIC X 1/8" MNPT
8	1	4-4 FTX	1/4" MNPT X 1/4" MJIC STRAIGHT
9	2	6-6 FTX	3/8" MNPT X 3/8" MJIC STRAIGHT
10	1	6-6 CTX	MALE ELBOW 3/8" MJIC X 3/8" MNPT
11	1	9889K19	AIR POP OFF VALVE 185 PSI, 1/4" NPT
12	1	1478	BALL VALVE BRASS, 3/8" FNPT
13	1	B18-02-FK00	AIR FILTER/REGULATOR 1/4" NPT PORTS
14	1	BAC-600-25	GAUGE 600# 2-1/2" DIA. BRASS
15	1	CM4554	3/8" CHECK VALVE
16	- -	- - - - -	- - - - -
17	1	HAA31-2.5	GAS BOOSTER, 2.5:1 RATIO
18	1	TDMB2039	AIR BOOSTER MOUNTING PLATE WELDM.
19	1	TDMB1036-S2	2 POSITION / 4 WAY PILOTED AIR VALVE
20	1	H4-11-FJFJ9	1/4" HOSE X 11" LONG FJIC X FJIC 90°
21	1	H6-16-FJFJ9	3/8" HOSE X 16" LONG FJIC X FJIC 90°
22	1	H6-18-FJFJ	3/8" HOSE X 18" LONG 3/8" FJIC BOTH ENDS

NOT SHOWN IN THIS ILLUSTRATION:

Item #	Qty.	Part Number	Part Description
	4	1008-B3	1/4"-20 X 1/2" HHCS
	4	101	1/4" LOCKWASHER
	1	1456	1/4" HEX NIPPLE
	3	1579-C	3/8" NPT VENT
	1	1599-A	3/8" MNPT X MJIC BRANCH TEE
	2	1606	1/4" FLUSH PLUG
	1	1609	3/8" NPT FLUSH PLUG
	1	6 CTX	3/8" MJIC X 1/4" MNPT 90° ELBOW

OPTIONAL:

Item #	Qty.	Part Number	Part Description
	1	TDMB2028	SOLENOID VALVE EXPLOSION PROOF
	3	1491	1/2" MNPT X 3/8" FNPT REDUCER BUSHING
	1	1402	3/8" X 3" PIPE NIPPLE

TOP DRIVE MOUNTED AIR BOOSTER PANEL

ASSEMBLY NO. TDMB1036

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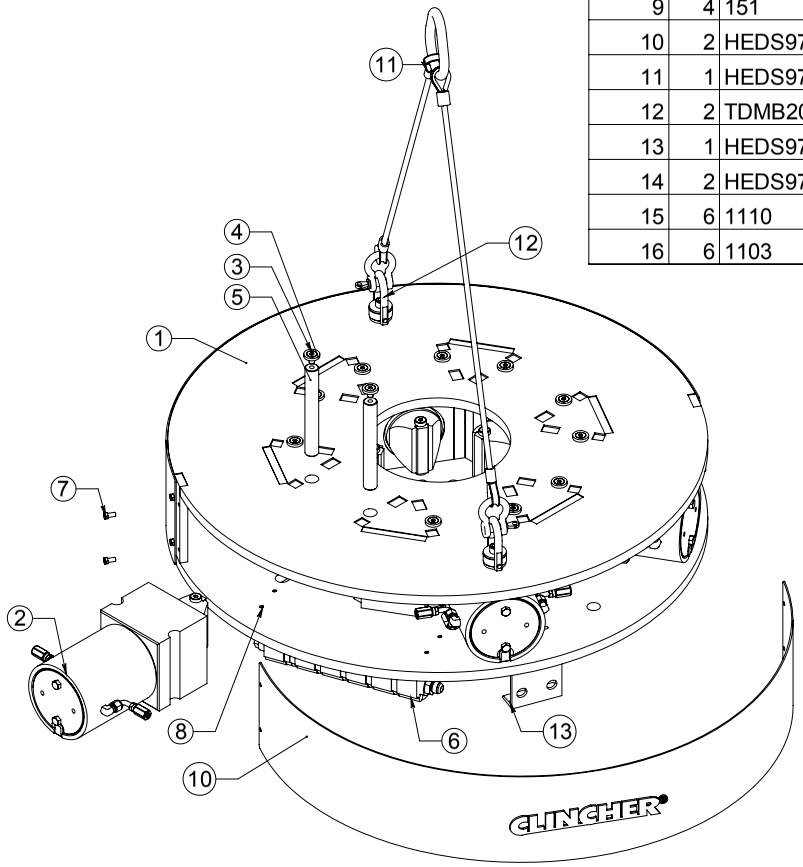
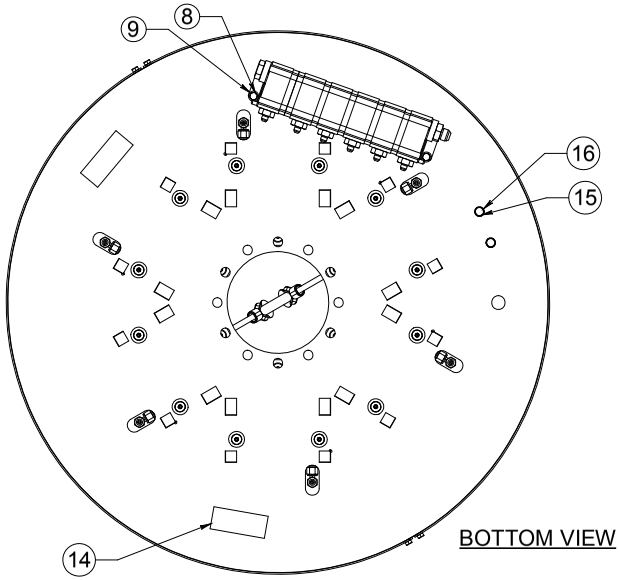
REV. #	LOG #	DATE
2		01/09/08

REF: P:\Manuals\Equip Manuals\Dwgs\TDMB2000\Air Booster rev2.wpg

Item #	Qty.	Part Number	Part Name
1	1	HEDS9751	HEDS BODY WELDMENT
2	6	450-3000-1	CLAMP CYLINDER ASSEMBLY
3	24	1773	SHCS Flat 1/2"-13 x 1"
4	24	361-7000	TAILSTOCK PIN COVERS
5	12	222-7000	HEADSTOCK PIN
6	1	330-3500	DELTA POWER 6 PORT FLOW DIVIDER
7	8	1308	HHCS 3/8-16 X 3/4 SLOTTED SELF TAPPING
8	4	154	7/16-14 X 1" HHCS
9	4	151	7/16" FLATWASHER
10	2	HEDS9753	COVER WELDMENT F/ HEDS
11	1	HEDS9754	SLING
12	2	TDMB2009	SWIVEL HOIST RING
13	1	HEDS9755A	FOOT
14	2	HEDS9755	FOOT
15	6	1110	1/2"-13 x 1" HHCS
16	6	1103	1/2" LOCKWASHER





BOTTOM VIEW

HYDRAULICALLY ENERGIZED DRIVE SUB

ASSEMBLY NO. HEDS9750

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REV. #	LOG #	DATE

SECTION 9 TECHNICAL DATA

To request copy of Technical Data, please contact:

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www.superior-manf.com