

Hitachi EX160LC-5 Excavator
SN#13KP001832

160LC Excavator Repair



TECHNICAL MANUAL

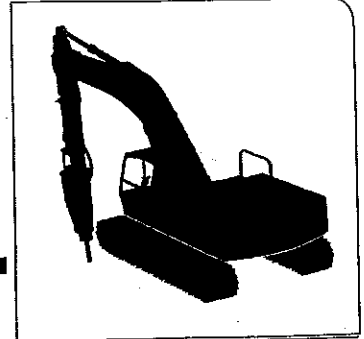
For complete service information also see:

160LC Excavator Operation and Tests	TM1661
POWERTECH 4.5 L (4045) Engine	CTM104
Alternators and Starting Motors	CTM77
Undercarriage Appraisal Manual	SP326

John Deere Dubuque Works
TM1662 (16J/.N98)

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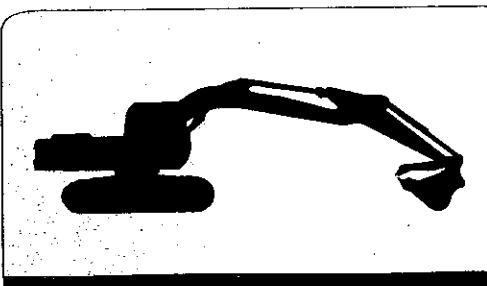
PRODUCT INSTALLATION AND MAINTENANCE MANUAL

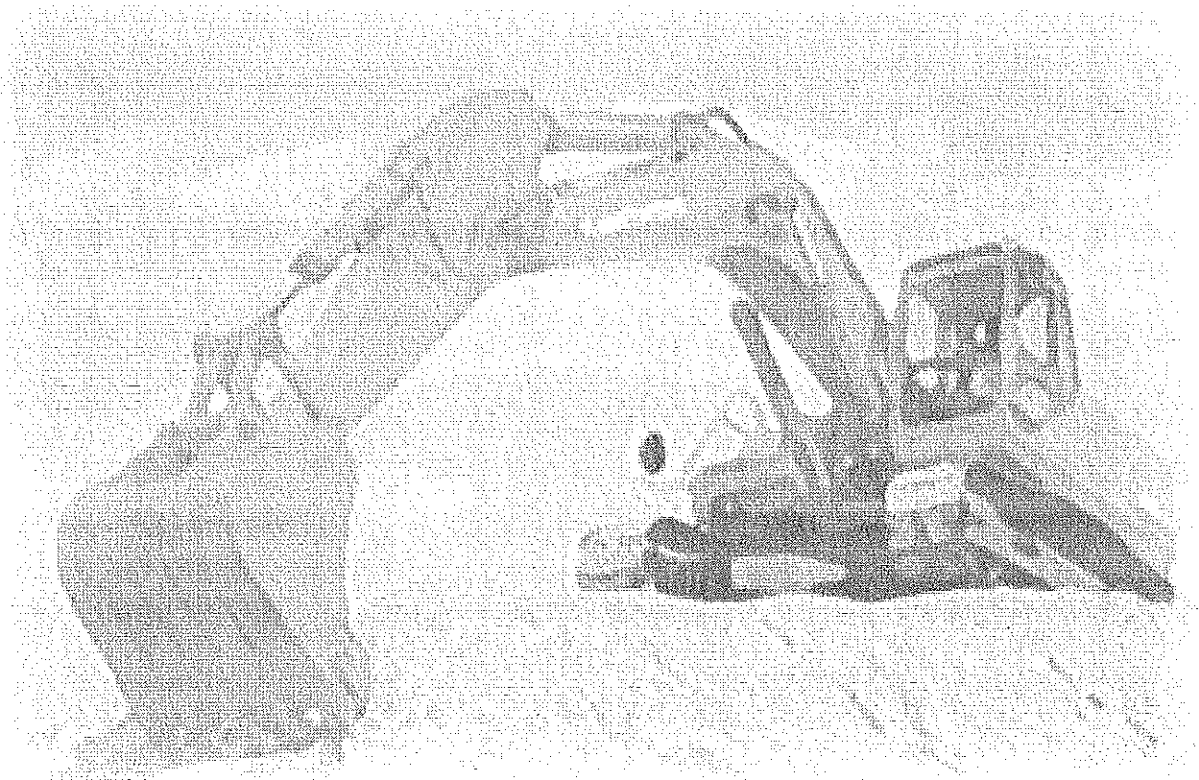
HYDRAULIC KITS FOR EXCAVATORS

⚠ WARNING

It is imperative to read, follow and understand all safety precautions and installation procedures found in this manual before attempting any installation or operation of product. Deviation from this manual may cause damage to machine, attachment and product. Damage to machine may cause serious injury or death. Installation and maintenance personnel must read this manual before installation or maintenance of this product on this machine. This manual should be kept near the machine for installation procedures and reference while installing this product. HKX, Inc. cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are therefore not all inclusive.

PAPE MACHINERY
160C LC DEERE EXCAVATOR
HYDRAULIC BREAKER/THUMB KIT
H27007 **DATE: 12.15.03**





CONGRATULATIONS!

You have purchased a quality hydraulic piping kit designed specifically for your excavator. This kit was designed by HKX, Incorporated and is optimized to take full advantage of your excavator and maintain its high standard of quality.

This manual contains specific technical drawings, step-by-step installation instructions, parts lists, flow and pressure testing and troubleshooting charts. We are confident that it will exceed your requirements.

HKX recommends that you read this manual thoroughly before installing the kit. Follow the manual and drawings for proper installation. Deviation from this manual may increase the installation time and/or cause damage to the machine or attachment. If the manual is followed precisely, the most efficient installation in the shortest amount of time will be achieved.

The kit is designed to fit the specific carrier. HKX has endeavored to deliver the highest degree of accuracy possible. However, continuous improvement is a HKX policy for all kits and manufacturers continually make improvement changes. Therefore product specifications are subject to change without notice.

Readers are encouraged to notify HKX and send in suggestions for improvement. All communications will be carefully considered for future printings of this and other manuals.

Please write, call, email or fax your comments to our Technical Publications team at the information below:

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If the kit cannot be installed per manual, please contact HKX before deviating from kit instructions and design. Our Technical Support team will assist you to correct the problem without affecting the HKX kit integrity or warranty.

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READ, UNDERSTAND AND FOLLOW ALL SAFETY PRECAUTIONS AND PROCEDURES FOUND IN THE OPERATOR'S MANUAL FOR THE MACHINE AND INSTALLATION INSTRUCTIONS OF HYDRAULIC KIT BEFORE ATTEMPTING ANY OPERATION, INSPECTION OR MAINTENANCE OF THIS MACHINE, ATTACHMENTS AND/OR SYSTEMS.

No one can anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are therefore not all inclusive. If a tool, procedure, work method or installation technique not specifically covered in this manual is used, you must satisfy yourself that it is safe for you and others. You must also ensure that the product will not be damaged or made unsafe by the installation, lubrication, maintenance and/or operation procedures you choose.

SAFETY PRECAUTIONS

FOREWORD | SAFETY ALERT SYMBOL | SIGNAL WORDS & SYMBOLS | IMPORTANCE OF SAFETY | PRECAUTIONS | ATTACHMENT SELECTION

■ FOREWORD

This section is intended to point out some of the basic situations, which may be encountered during installation, operation and maintenance of a hydraulic kit and/or machine and to suggest possible ways of dealing with these conditions. This is not a substitute for the manufacturer's manual(s). Additional precautions may be necessary, depending on attachments used and conditions at the work site or in your service area.

IMPORTANT: IF YOU DO NOT HAVE THE MANUFACTURER'S MANUAL(S) FOR YOUR PARTICULAR MACHINE, GET A REPLACEMENT MANUAL BEFORE ANY INSTALLATIONS, OPERATIONS OR MAINTENANCE.

■ SAFETY ALERT SYMBOL



**ATTENTION! BECOME ALERT!
YOUR SAFETY IS INVOLVED!**

The **Safety Alert Symbol** identifies important safety messages on machine, safety signs, in manuals, or elsewhere. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instruction in the safety message.

■ SIGNAL WORDS & SYMBOLS

! DANGER !

- **DANGER | RED** used to indicate the presence of an imminently hazardous situation which, if not avoided, will result in death or serious injury.

! WARNING !

- **WARNING | ORANGE** used to indicate the presence of a potentially hazardous situation which, if not avoided, will result in death or serious injury.

! CAUTION !

- **CAUTION WITH SAFETY ALERT SYMBOL | YELLOW** used to indicate the presence of a potentially hazardous situation which, if not avoided, may cause minor or moderate injury.

! CAUTION !

- **CAUTION WITHOUT SAFETY ALERT SYMBOL | YELLOW** used to indicate the presence of a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

- **NOTICE WITHOUT SAFETY ALERT SYMBOL | GREEN** used to indicate installation, operation or maintenance information.

■ IMPORTANCE OF SAFETY

Why is SAFETY important to you?

3 BIG REASONS: Accidents Disable & Kill
Accidents Cost
Accidents Can Be Avoided

It is YOUR responsibility to read and understand these safety precautions and the manufacturer's manual(s). You are the key to safety. Good safety practices not only protect you but the people around you. So always **Be Alert, Be Aware** and **Be Careful**. Human error is caused by many factors. Damages to machines can be fixed but injury, or death, has a lasting effect. For your safety and the safety of others, encourage your fellow workers to act safely.

Make sure a Safety Program is implemented at your service location. Follow all rules and regulations governing operation, installation and maintenance of equipment. Always check with your supervisor or the safety coordinator for regulations and updates.

Protect yourself and others. Protective clothing and personal safety devices should be issued to all service department personnel.

Know your machine. Respect your machine. Study the Operator's Manual before starting the engine. Know how to operate all equipment on your machine.

For an industry standard Hydraulic Excavator "Safety Manual" for operators and mechanics, visit the Equipment Manufacturers Institute (EMI) website at www.emi.org or write to them at address: 10 S. Riverside Plaza, Chicago, Illinois, 60606, USA.

■ PRECAUTIONS

! WARNING !



AVOID OIL SPILLS. USE CONTAINERS, RAGS AND/OR ABSORBENT PADS TO CONTAIN ANY OIL LEAKAGE. DISPOSE OF ALL WASTE OILS, FLUIDS, LUBRICANTS AND OTHER HAZARDOUS WASTE PROPERLY

! WARNING !



USE PERSONAL PROTECTION EQUIPMENT SUCH AS: HARD HAT, SAFETY GLOVES, SAFETY SHOES AND SAFETY GLASSES NEEDED TO PERFORM THE JOB

! WARNING !



NEVER USE GASOLINE, DIESEL FUEL OR OTHER FLAMMABLE LIQUIDS TO CLEAN PARTS. ALWAYS CLEAN PARTS IN A WELL VENTILATED AREA

■ CONTINUED

-PRECAUTIONS- continued

WARNING



NEVER WORK ON A MACHINE THAT HAS REACHED NORMAL OPERATING TEMPERATURE. ALLOW SUFFICIENT TIME FOR THE MACHINE TO COOL BEFORE PERFORMING ANY INSTALLATION OR MAINTENANCE.

WARNING



EXTRA CARE SHOULD BE TAKEN WHEN INSTALLING COMPONENTS ON THE BOOM, ARM OR TOP OF THE MACHINE, TO AVOID FALL HAZARDS. IF THE BOOM, ARM AND ATTACHMENT CYLINDERS ARE NOT IN A RELAXED STATE ON THE GROUND, THEY COULD DROP RESULTING IN SERIOUS INJURY OR DEATH.

WARNING



READ, UNDERSTAND AND FOLLOW WELDING SPECIFICATIONS IN THE OPERATOR'S MANUAL BEFORE WELDING ON MACHINE. DISCONNECT BATTERY, COMPUTER AND REMOVE ALL FLAMMABLE MATERIALS AND LIQUIDS FROM WORK AREA BEFORE WELDING.

WARNING



ENGINE EXHAUST GASES CAN CAUSE LOSS OF JUDGEMENT, LOSS OF ALERTNESS AND LOSS OF MOTOR CONTROL. THESE GASES CAN ALSO CAUSE UNCONSCIOUSNESS, SERIOUS INJURY AND FATAL ACCIDENTS. MAKE SURE OF ADEQUATE VENTILATION BEFORE STARTING THE ENGINE IN ANY ENCLOSED AREA. YOU SHOULD ALSO BE AWARE OF OPEN WINDOWS, DOORS OR DUCTWORK INTO WHICH EXHAUST FUMES MAY BE CARRIED, OR BLOWN BY THE WIND, EXPOSING OTHERS TO DANGER.



CAUTION

IT IS IMPERATIVE TO FOLLOW THE MANUAL AND ILLUSTRATIONS FOR PROPER INSTALLATION. DEVIATION FROM THIS MANUAL MAY CAUSE DAMAGE TO THE MACHINE, ATTACHMENTS AND COMPONENTS IN THE KIT, AS WELL AS, HYDRAULIC SYSTEM PROBLEMS. CONTACT KIT MANUFACTURER PRIOR TO INSTALLATION FOR ASSISTANCE IN EVALUATING MODIFICATIONS OR MACHINE/ ATTACHMENT CHANGES. THE KIT MANUFACTURER WILL NOT PAY FOR ANY INCIDENTAL CHARGES, LABOR CHARGES OR MODIFICATIONS TO KITS WITHOUT PRIOR WRITTEN APPROVAL. UNAUTHORIZED MODIFICATIONS & INCORRECT USE OF KIT WILL VOID ALL KIT WARRANTIES.

CAUTION

PROTECT ALL AREAS IN, ON AND AROUND THE MACHINE WITH A FLAME RETARDANT COVERING, DURING GRINDING AND WELDING. THIS WILL PREVENT SPARKS AND WELD SPLATTER THAT COULD CAUSE SHATTERING OF TEMPERED GLASS AND DAMAGE TO CYLINDERS, ELECTRICAL COMPONENTS, SEAT CUSHIONS, COSMETIC PARTS AND OTHER COMPONENTS ON THE MACHINE. AFTER WELDING, ALL SURFACES SHOULD BE TREATED AND PAINTED THOROUGHLY TO PREVENT RUST AND CORROSION.

CAUTION

NEVER ALLOW A HYDRAULIC LINE OR COMPONENT TO BECOME CONTAMINATED. THIS COULD CAUSE SEVERE SYSTEM DAMAGE. CONTACT YOUR MACHINE DEALER OR MANUFACTURER FOR PROPER CAPS AND PLUGS TO BE USED ON THE MACHINE.

CAUTION

WHEN CUTTING AND DRILLING, ALWAYS ENSURE ENOUGH CLEARANCE TO AVOID DAMAGE TO ELECTRICAL WIRING, HOSES, COMPONENTS AND MACHINE.

CAUTION

FAILURE TO VERIFY, INSTALL AND SET FLOW CONTROL AND PRESSURE RELIEF CARTRIDGE REQUIREMENTS FOR THE ATTACHMENT MAY CAUSE SEVERE DAMAGE TO MACHINE AND VOID ATTACHMENT, MACHINE AND KIT WARRANTIES. DO NOT EXCEED MAXIMUM OPERATING PRESSURE AND FLOW OF ATTACHMENT. CONTACT ATTACHMENT MANUFACTURER FOR OPERATING PRESSURE AND FLOW REQUIREMENTS. CONTACT MACHINE DEALER OR MANUFACTURER TO PURCHASE PORT RELIEF CARTRIDGES.

■ ATTACHMENT SELECTION



When choosing an attachment, the following things are imperative:

■ STABILITY.

The attachment must fall within the excavator lift capacity and tip-over weight limits.

■ HYDRAULIC FLOW.

The excavator must be able to provide sufficient hydraulic flow (i.e. GPM, LPM, Etc.) to operate the attachment.

■ HYDRAULIC PRESSURE.

Similar to flow, sufficient hydraulic pressure (i.e. PSI, Bar, Kg/cm², etc.) must be available at the required flow.

IMPORTANT: PLEASE NOTE ALL SECTIONS DEALING WITH SELECTION, MASS, OPERATION AND MAINTENANCE OF ATTACHMENTS FOR EXCAVATORS IN ALL MANUFACTURER'S MANUAL(S).

CONTACT EXCAVATOR OR ATTACHMENT MANUFACTURER FOR ASSISTANCE IN CORRECTLY SELECTING AN ATTACHMENT FOR A PARTICULAR MACHINE.

SYMBOL

MEANING

	SAFETY. <i>Indicates procedures requiring special attention from a safety viewpoint.</i>
	WRENCH (Standard) <i>Indicates tightening or loosening with a Standard wrench.</i> 001_SYM
	WRENCH (Socket) <i>Indicates tightening or loosening with a Socket wrench.</i> 013_SYM
	WRENCH (Allen/HEX) <i>Indicates tightening or loosening with an Allen wrench/(HEX keys).</i> 062_SYM
	HAND <i>Indicates tightening, loosening, pushing, pulling, installation, etc. by hand.</i> 003_SYM
	VISUAL <i>Indicates items requiring visual inspection.</i> 004_SYM
	READ <i>Indicates items that are required to read.</i> 015_SYM
	TIPS & IDEAS <i>Indicates tips, techniques and/or ideas for installation.</i> 006_SYM

SYMBOL	MEANING
	MEASURE <i>Indicates items requiring measurement and inspection by dimensions, etc.</i>
	MEASURE <i>Indicates items requiring measurement and inspection by amperage, voltage, etc.</i>
	WELDING <i>Indicates items that require welding.</i>
	ADHESIVE <i>Indicates application of adhesive, locktite and/or liquid gasket.</i>
	LUBRICATION <i>Indicates external parts to be lubricated with oil.</i>
	CLEANING <i>Indicates items requiring cleaning for disassembly and/or assembly.</i>
	ADJUSTMENTS <i>Indicates components requiring adjustment or precise settings.</i>
	SAFETY EQUIPMENT <i>Indicates when protective clothing or gear needs to be worn for safety purposes.</i>

NOTES

[illegible]

PREPARATION

BEFORE YOU START

-  **IS THE KIT CORRECT FOR THIS INSTALL?**
Check and make sure you have the correct installation kit for your excavator and attachment. Check the excavator information against the kit description. All kits are designed for a specific excavator. IF THERE ARE ANY DISCREPANCIES, IMMEDIATELY CONTACT THE KIT MANUFACTURER.
-  **INVENTORY PARTS**
Open boxes and take inventory of parts received, while reviewing the parts lists and illustrations, before you begin. This will ensure there are no missing or damaged parts, which may affect installation time. Every precaution is taken to ensure every installation kit is shipped complete, but sometimes errors can occur. IF THERE ARE ANY DISCREPANCIES, IMMEDIATELY CONTACT THE KIT MANUFACTURER.

NOTICE

Take special care when removing parts from box and checking off parts on list. All parts are marked with a part number for ease of identification. Place checked parts in a clean area to prevent damage and contamination. Do not remove parts from protective packaging until ready for use.

-  **CLEANING SUPPLIES**
Insure their are sufficient absorbent pads, rags or paper towels for cleaning purposes
-  **FLOW METER & PRESSURE GAUGE**
A flow meter and pressure gauge are needed for the function testing process
-  **CLEAN & PAINT COMPONENTS**
Before painting, thoroughly clean any piping, brackets and other components that need to be painted. Piping and components are provided in a grey primer or anodized finish and may be painted before or after installation.
-  **READ INSTALLATION INSTRUCTIONS**
Read the entire installation instructions. Familiarize yourself with the installation process.

CAUTION

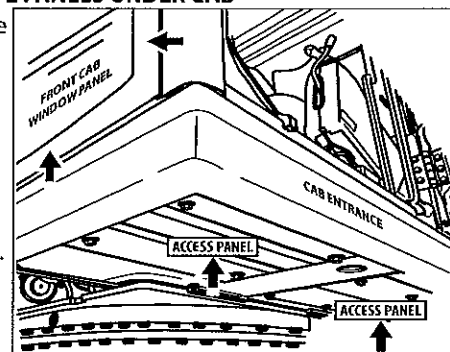
IT IS IMPERATIVE TO FOLLOW THE MANUAL AND ILLUSTRATIONS FOR PROPER INSTALLATION. DEVIATION FROM THIS MANUAL MAY CAUSE DAMAGE TO THE MACHINE, ATTACHMENTS AND COMPONENTS IN THE KIT, AS WELL AS HYDRAULIC SYSTEM PROBLEMS, WHICH WILL INCREASE INSTALLATION TIME. IF THIS MANUAL IS FOLLOWED CLOSELY, THE MOST EFFICIENT INSTALLATION IN THE SHORTEST AMOUNT OF TIME WILL BE ACHIEVED.

CAUTION

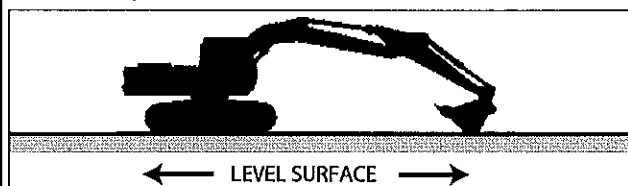
IN ADDITION TO THE PIPING KIT INSTALLATION INSTRUCTIONS, HAVE ALL MANUFACTURER'S SERVICE MANUALS AND BULLETINS ON HAND, INCLUDING ANY REPAIR AND WELDING MANUALS. MAKE SURE YOU HAVE ALL MACHINE AND ATTACHMENT DOCUMENTATION HANDY FOR FLOW AND PRESSURE SETTINGS. ALL PHASES OF THE INSTALLATION MUST BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

MACHINE PREPARATION

-  **REMOVE PANELS UNDER CAB**
Remove access panels from underneath and behind the cab. It is easier to do this before the machine is pulled into the shop, because there is more room outside to swing the upper carriage to clear the tracks.



HKX_PREP_001_FIG



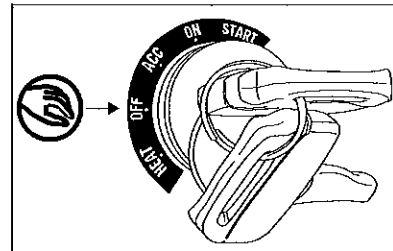
HKX_PREP_002_FIG

-  **POSITION MACHINE**
Move machine into a suitable bay, swing house so area under cab is accessible for "G4-CONTROLS" installation and access to the lower side of the spare spool (there is a small opening under the frame for this purpose)

NOTICE

Always park machine on a flat level surface. Lower bucket or other working attachment to the ground or to an overnight support saddle and either tuck in the arm or extend out depending on available work space. Turn auto-idle switch off.

-  **ENGINE SHUTOFF**
Run the engine at low idle speed without a load for five minutes. Turn key switch OFF. Remove key from switch.



HKX_PREP_003_FIG

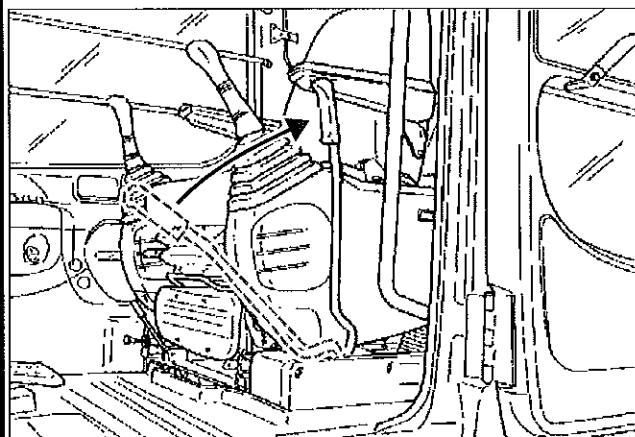
WARNING

-  **IF MAINTENANCE OR INSTALLATION MUST BE PERFORMED WITH ENGINE RUNNING, DO NOT LEAVE MACHINE UNATTENDED**

WARNING

-  **IF MAINTENANCE OR INSTALLATION IS TO TAKE PLACE, BE AWARE THAT ACCUMULATOR(S) IN THE SYSTEM STORE FLUID UNDER PRESSURE AFTER SYSTEM LOCK DOWN. RELEASE THE PRESSURE BY WORKING THE CONTROLS WITH THE ENGINE OFF, UNTIL PRESSURE IN THE PILOT CIRCUIT HAS BEEN BLED OFF.**

CONTINUED



HKX_PREP_004_FIG



SAFETY LEVER IN LOCKED POSITION

Pull the pilot control shut-off lever to the LOCKED and up position before leaving the cab.

No. 0100	DATE _____
DANGER	
DO NOT OPERATE	
THIS DANGER TAG HAS BEEN ATTACHED BECAUSE:	
DO NOT USE, MOVE OR PURSUE WHILE THIS TAG IS ATTACHED	
NAME _____	DEPT. _____
TEAR OFF THIS TAG, FILL IN AND GIVE TO YOUR SUPERVISOR	
No. 0100	DATE _____
TAG ATTACHED TO _____	
REASON _____	
SIGNED _____	

HKX_PREP_005_FIG

! DANGER !

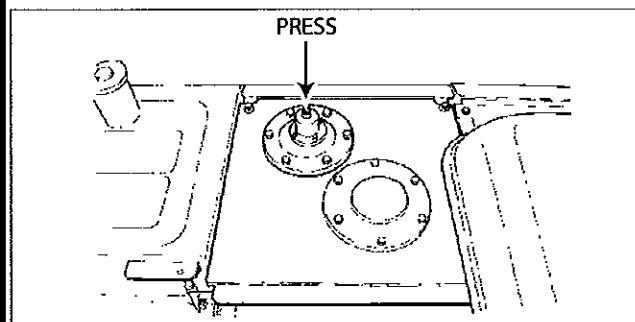
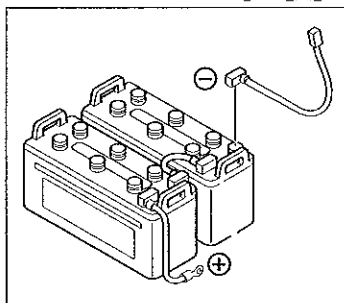
DO NOT OPERATE TAG.

Before performing any installation or maintenance on the machine, attach a "Do Not Operate" tag on the operator's cab controls to alert others that service or maintenance is being performed. A tag is supplied with this manual for this purpose.

HKX_PREP_009_FIG

DISCONNECT BATTERY

Disconnect the negative cable on the battery to avoid damage to machine, computer and electrical devices and before doing any installation, welding or maintenance.

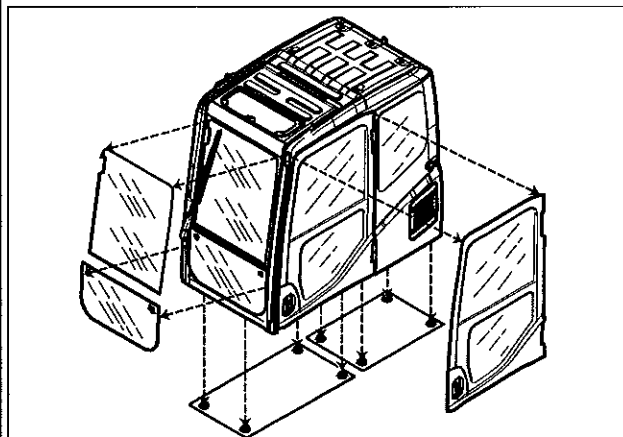


HKX_PREP_006_FIG



PRESS RESERVOIR CAP BUTTON

Press button on reservoir cap to relieve pressure, remove cap and leave in place (loose) during installation to avoid pressure buildup due to temperature changes.



HKX_PREP_008_FIG



REMOVE WINDOWS & PANELS

You may find it helpful, if you remove tempered glass windows and panels around the cab for easier access into areas during install and to decrease chances for damage to machine.

TIPS & TECHNIQUES



Here are some tips, bright ideas and pointers we have gathered to better help you in installing a hydraulic kit. If you have a great piece of advice not listed below, please email them to support@hkx.com or fax at 800.353.5736 to be added to the list.



A "DRY CONNECT" BY GROUP INSTALLATION

The installation manuals are in the particular group order to do the "dry connects" first. Start with "G1-BOOM" and follow in order the remaining groups. A "dry connect" means that when a fitting or line is removed or disconnected, there is not a continuous loss of oil (although there might be a small flow of oil buildup due to normal blowby). A "wet connect" involves a continuous flow of oil (such as a direct flow-path to the reservoir). Wherever possible, make all hydraulic connections of the "dry connect" type first to minimize oil loss. When making "wet connects", have plenty of oil absorbent pads on hand if any oil is spilled. Sprinkle the floor with a liberal amount of "dry sand" or "oil absorbent pellets" to prevent slipping on oil spills.



OIL O-RINGS AND FACE SEALS

Apply oil to all face seal and O-ring boss fittings before connection to avoid "dry-spooling". Please read the Service Bulletin on correct O-ring installation procedures.



STANDARD AND DEEP SOCKETS

Standard sockets can be used to remove port plugs. Deep sockets could be needed for installing some of the adapters, cartridges, etc.



FACTORY PAINT

Using factory paint is preferable when painting the components and touch-up of weld locations.

TORQUE SPECIFICATIONS

INSTALLATION OF O-RING FACE SEAL (ORFS) FITTINGS | TIGHTENING TORQUE CHART - BOLTS/SCREWS | TIGHTENING TORQUE CHART - TUBES/MANIFOLD AND ADAPTER FITTINGS

■ INSTALLATION OF O-RING FACE SEAL (ORFS) FITTINGS

When installing ORFS fittings, the following steps must be followed:

- ☐ Check O-ring and fittings for damage, (see Fig. SB01-A & SB01-B). Replace either, if necessary.

FIG. SB01-A

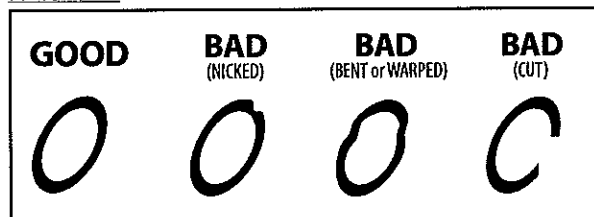
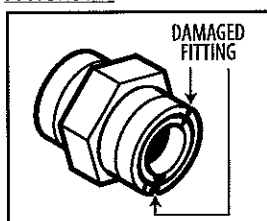


FIG. SB01-B



CAUTION

NOTE: Replacement O-rings must have a 90 durometer hardness. Anything rated lower will cause leaks).

- ☐ **DO NOT** tighten tube or hose clamps until ORFS connections are torqued.

- ☐ Make sure the fitting face and the tube or hose face are parallel, (see Fig. SB01-C). Apply a small amount of grease to the o-ring and o-ring groove to hold the o-ring in place before assembly, (see Fig. SB01-D).

FIG. SB01-C

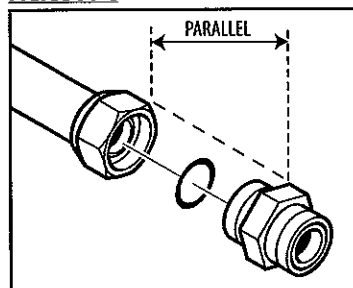
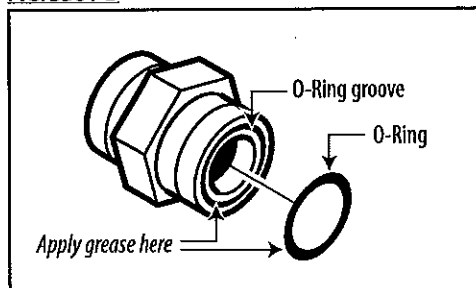


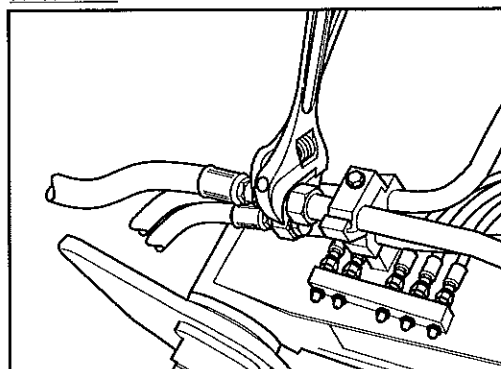
FIG. SB01-D



- ☐ Torque fittings as tight as possible by hand with standard wrenches. The face seal will not deform with high torque.

- ☐ Use two wrenches to hold fitting and hoses in place while tightening, (see Fig. SB01-E).

FIG. SB01-E



- ☐ Start carrier and heat oil to operating temperature (180° F). Re-tighten all fittings as per Torque Chart below.

O-ring Face Seal

SAE DASH SIZE	TUBE SIDE THREAD SIZE	TUBE SIDE ASSEMBLY TORQUE (+10% -0%)	
		in.-lb.	ft.-lb.
-4	9/16-18	220	18
-6	11/16-16	360	30
-8	13/16-16	480	40
-10	1-14		60
-12	1 3/16-12		85
-14	1 5/16-12		95
-16	1 7/16-12		110
-20	1 11/16-12		140
-24	2-12		180
-32	2 1/2-12		360

- ☐ There is an alternative method of tightening fittings, if a torque wrench is unavailable. This is known as the Flats From Wrench Resistance (F.F.W.R.) method. Wrench tighten the nut onto the fitting body until wrench resistance is reached. Tighten further to the appropriate F.F.W.R. value from the chart below.

O-ring Face Seal

SAE DASH SIZE	TUBE SIDE THREAD SIZE	FLATS FROM WRENCH RESISTANCE (F.F.W.R.)	
		Tube Nuts	Swivel & Hose Ends
-4	9/16-18	1/4 to 1/2	1/2 to 3/4
-6	11/16-16	1/4 to 1/2	1/2 to 3/4
-8	13/16-16	1/4 to 1/2	1/2 to 3/4
-10	1-14	1/4 to 1/2	1/2 to 3/4
-12	1 3/16-12	1/4 to 1/2	1/3 to 1/2
-14	1 5/16-12	1/4 to 1/2	1/3 to 1/2
-16	1 7/16-12	1/4 to 1/2	1/3 to 1/2
-20	1 11/16-12	1/4 to 1/2	1/3 to 1/2
-24	2-12	1/4 to 1/2	1/3 to 1/2
-32	2 1/2-12		

■ CONTINUED

TORQUE SPECIFICATIONS

■ TIGHTENING TORQUE CHART - BOLTS / SCREWS

Bolt Dia.	Wrench Size	Hexagon Wrench Size	  			  			 		
			Socket Bolt								
			Nm	kgf m	lbf ft	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
M8	13	6	29.5	3	22	19.5	2	14.5	9.8	1	7.2
M10	17	8	64	6.5	47	49	5	36	19.5	2	14.5
M12	19	10	108	11	80	88	9	65	34	3.5	25.2
M14	22	12	175	18	130	137	14	101	54	5.5	40
M16	24	14	265	27	195	205	21	152	78	8	58
M18	27	14	390	40	290	295	30	220	118	12	87
M20	30	17	540	55	400	390	40	290	167	17	123

The required torque is shown as kgf-m.

NOTICE

Ensure bolt and nut threads are clean before installation.
Apply lubricate to bolts and nuts, to stabilize their friction coefficient, unless locktite or thread lock is being applied.

HXK PREP 007 FIG

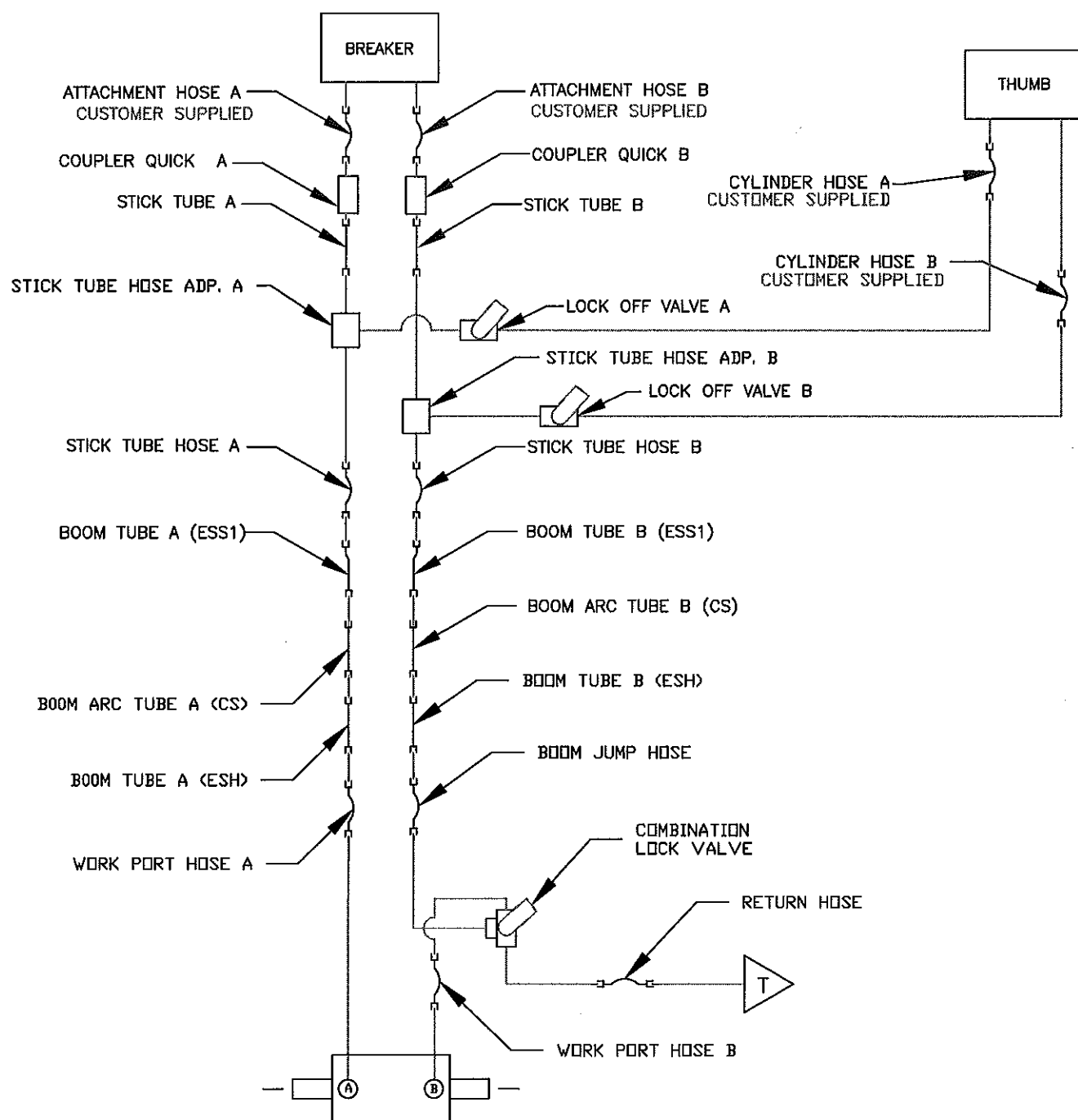
■ TIGHTENING TORQUE CHART - TUBE / MANIFOLD AND ADAPTER FITTINGS

- ☐ ENSURE THAT THE CORRECT O-RING IS PROPERLY PLACED ON THE FITTING, FLUSH AGAINST THE MAIN (HEX) BODY OF FITTING. THREAD THE FITTING BY HAND, THEN TIGHTEN IT TO THE RECOMMENDED TORQUE SPECIFICATIONS FROM THE TABLES BELOW.

SAE O-ring Boss Port (tube fitting - installed into Aluminum)			
SAE Dash size	Torque	SAE Dash size	Torque
-4	11 ft-lbs / 14.9 Nm	-12	93 ft-lbs / 126.1 Nm
-6	23 ft-lbs / 31.2 Nm	-16	139 ft-lbs / 188.5 Nm
-8	40 ft-lbs / 54.2 Nm	-20	172 ft-lbs / 233.2 Nm
-10	69 ft-lbs / 93.6 Nm	-24	208 ft-lbs / 282 Nm

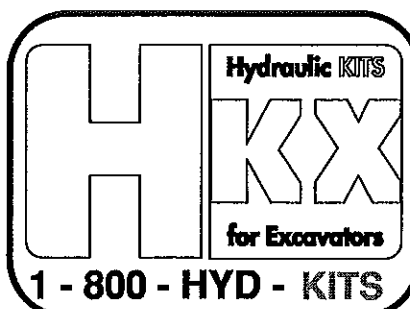
SAE O-ring Boss Port (tube fitting - installed into Steel)			
SAE Dash size	Torque	SAE Dash size	Torque
-4	16 ft-lbs / 21.7 Nm	-12	140 ft-lbs / 190 Nm
-6	35 ft-lbs / 47.5 Nm	-16	210 ft-lbs / 284.7 Nm
-8	60 ft-lbs / 81.3 Nm	-20	260 ft-lbs / 352.5 Nm
-10	105 ft-lbs / 142.4 Nm	-24	315 ft-lbs / 427.1 Nm

Seal-Lok (NPT) (Adapter Fittings)			
SAE Dash size	Torque	SAE Dash size	Torque
-4	18 ft-lbs / 24.4 Nm	-12	90 ft-lbs / 122 Nm
-6	27 ft-lbs / 36.6 Nm	-16	120 ft-lbs / 162.7 Nm
-8	40 ft-lbs / 54.2 Nm	-20	140 ft-lbs / 190 Nm
-10	63 ft-lbs / 85.4 Nm	-24	165 ft-lbs / 223.7 Nm



SPARE VALVE SECTION ON MAIN CONTROL VALVE (MCV)

 RETURN TO TANK



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**HYDRAULIC BREAKER/THUMB
WORK LINES**

PAPE MACHINERY INC.

JOHN DEERE 160C LC

H27007

01-21-04

SPARE VALVE SECTION ON MAIN CONTROL VALVE (MCV)

PILOT SHIFT HOSES

PLUG SM PORT
(REMOVE HOSE)

PILOT SIGNAL MANIFOLD

PILOT SIGNAL HOSES

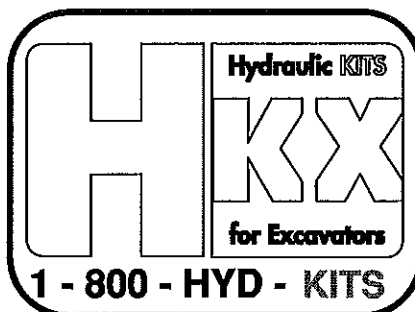
PILOT SUPPLY &
RETURN HOSES

MTG
BRACKET

900-0166



SOURCE OF PILOT SUPPLY
AND RETURN



HKX, INCORPORATED

MONROE, WASHINGTON 98272

1-360-805-8600 & 1-800-493-5487

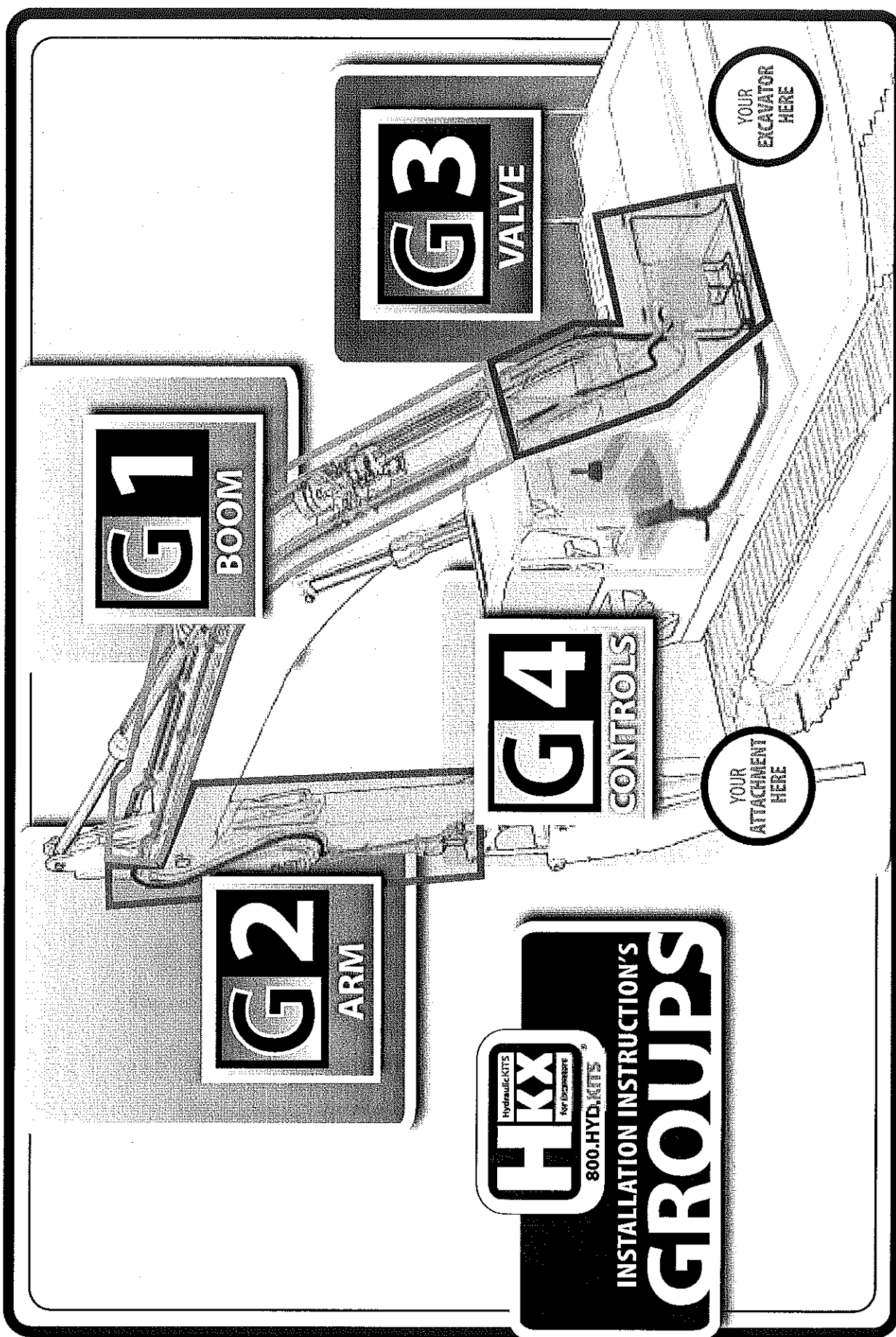
**HYDRAULIC BREAKER/THUMB
CONTROLS (JS)**

PAPE MACHINERY INC.

JOHN DEERE 160C LC

H27007

01-21-04



HKX hydraulic KITS
800.HYD.KITS
INSTALLATION INSTRUCTION'S
GROUPS



GROUP 1 - BOOM

PARTS LIST ▶

GROUP ILLUSTRATION ▶

STEP-BY-STEP INSTRUCTIONS ▶

FIGURE ILLUSTRATIONS ▶

- ▶ The **BOOM GROUP** is part of the circuit providing oil to the attachment from the machine. This group may consist of boom piping and hose, piping fittings, interlocking clamps and weld plates (if necessary).



Customer:	Pape' Machinery, Inc. - Tacoma
Excavator:	DEERE 160C LC
Kit Code:	205
Order No:	H27007

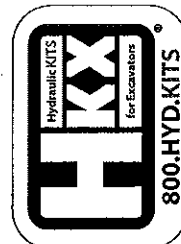
GROUP 1 : Parts List

ITEM NUMBER	PART NUMBER	QUANTITY		DESCRIPTION
1.00		1		G1-BOOM-PRIMARY
1.13	750-0002	1	s	Boom Tube Clamps A (ESH)
1.14	750-0002	1	s	Boom Tube Clamps B (ESH)
1.11	310-0136	2		Bolt Hex M12 x 1.75 x 100mm Gr
1.13	983-0004	1		Boom Tube Clamp A (ESH)
1.14	983-0004	1		Boom Tube Clamp B (ESH)
1.11	310-0123	2		Bolt Hex M12 x 1.75 x 65mm
1.11	350-0014	2		Washer Lock m12
1.15	983-0004	1		Boom Tube Clamp A (CS)
1.16	983-0004	1		Boom Tube Clamp B (CS)
1.11	310-0123	2		Bolt Hex M12 x 1.75 x 65mm
1.11	350-0014	2		Washer Lock m12
1.17	983-0004	1		Boom Tube Clamp A (ESS2)
1.18	983-0004	1		Boom Tube Clamp B (ESS2)
1.11	310-0123	2		Bolt Hex M12 x 1.75 x 65mm
1.11	350-0014	2		Washer Lock m12
1.17	983-0004	1		Boom Tube Clamp A (ESS1)
1.18	983-0004	1		Boom Tube Clamp B (ESS1)
1.11	310-0123	2		Bolt Hex M12 x 1.75 x 65mm
1.11	350-0014	2		Washer Lock m12
1.01	666-0312	1	s	ESH A
1.03	665-0271	1	s	CS A
1.07	666-0168	1	s	ESS1 A
1.02	666-0312	1	s	ESH B
1.04	665-0271	1	s	CS B
1.08	666-0168	1	s	ESS1 B
1.23	100-0137	2		Boom Tube Adp A Reducer
1.21	100-0103	2		Boom Tube Adp A
1.20	100-0103	4		Boom Tube Adp B

s = subkit

G1

BOOM



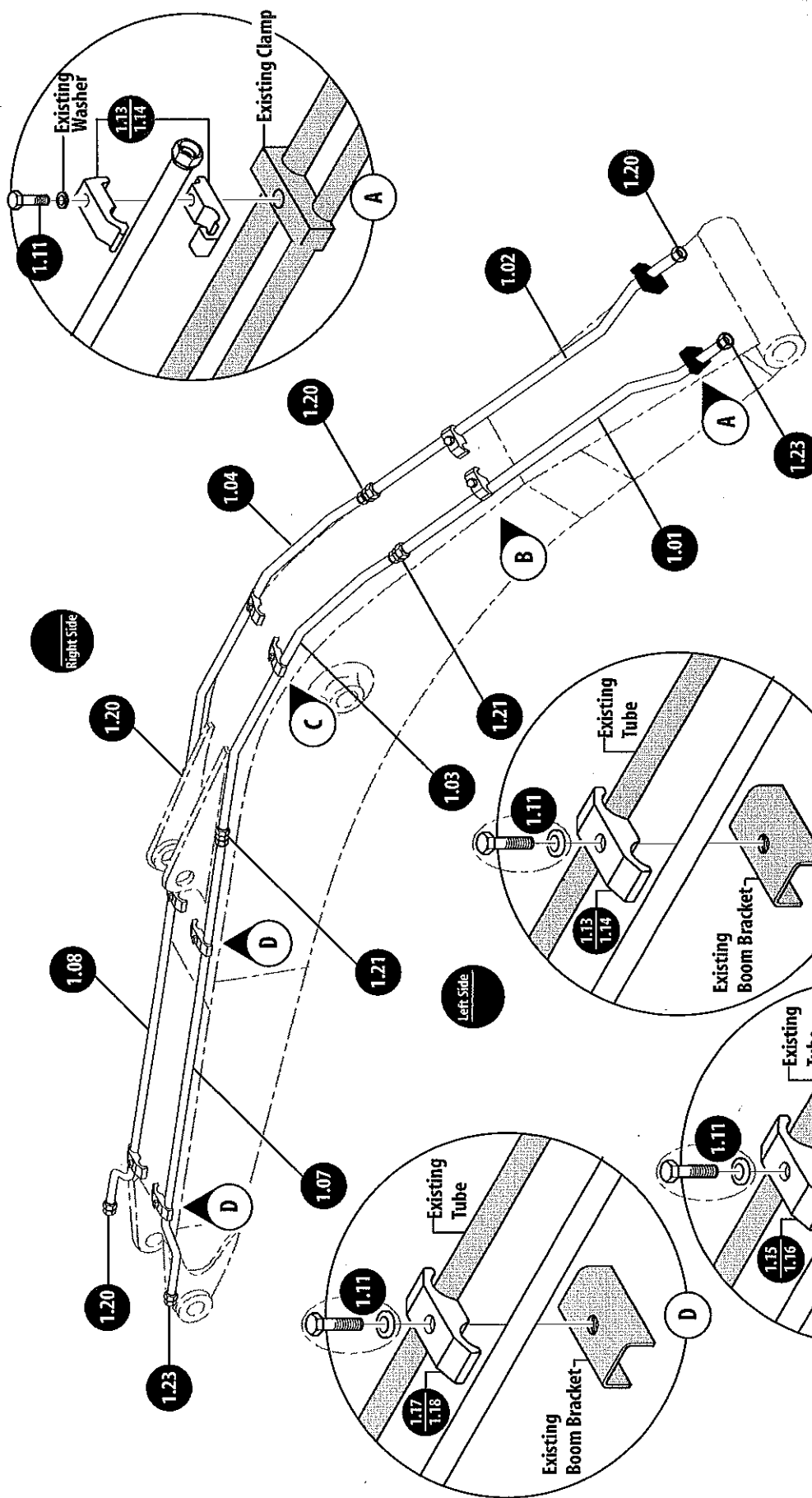
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TITLE: JDR_G1_1009-T-B_G1 DATE: 12-23-03

DRW: M. MELAND CHK'D: J. DICKSON

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Left Side
Right Side

X.XX
X.XX



GROUP 1 - INSTALLATION INSTRUCTIONS



- ▶ READ "SAFETY PRECAUTIONS" AND "PREPARATION" SECTIONS OF THIS MANUAL PRIOR TO INSTALLATION
- ▶ REFER TO "G1-BOOM" INSTALLATION ILLUSTRATION, WHILE PROCEEDING WITH THE FOLLOWING STEPS ON THIS PAGE

□ STEP 1-1

 **NOTE:** Boom piping can be left primed, or painted before or after installation. (Refer to the "Preparation" section).

 **NOTE:** Insure O-rings are installed into all adapters, before install.

 **NOTE:** Start install on left side of boom.

- A. Install adapter (1.21) into straight end of boom piping (1.07). Install adapter (1.23) into "Z"-bend end of boom piping (1.07).
- B. Install adapter (1.21) into straight end of boom piping (1.01). Install adapter (1.23) into angle end of boom piping (1.01).
- C. Tighten and torque all hydraulic connections to specifications.

□ STEP 1-2

 **NOTE:** This step will require assistance from a second person.

- A. Locate (2) existing boom clamps between boom arch and boom tip, then remove them.
- B. Place piping assembly (1.07) along side of existing piping (between boom arch and boom tip), with "Z-bend" end of piping towards arm.
- C. Secure piping (1.07) to existing piping, by using (2) double clamps (1.17), along with kit hardware (1.11), (refer to "G1-BOOM" Installation Instructions, Detail D).
- D. Hand tighten bolts at this time for repositioning purposes.

□ STEP 1-3

- A. Locate existing piping clamp at boom arch, then remove.
- B. Connect boom piping (1.03) to boom piping (1.07), then install double clamp (1.15) to piping (1.03) and existing piping, where existing clamp was removed, (refer to "G1-BOOM" Installation Illustration, Detail C).
- C. Tighten and torque all hardware to specifications.

□ STEP 1-4

 **NOTE:** This step will require assistance from a second person.

- A. Connect straight end of boom piping (1.01) to long angled end of boom piping (1.03).
- B. Remove existing clamp, between boom arch and boom foot, then replace with double clamp (1.13), securing existing piping to piping (1.01), using kit hardware (1.11).

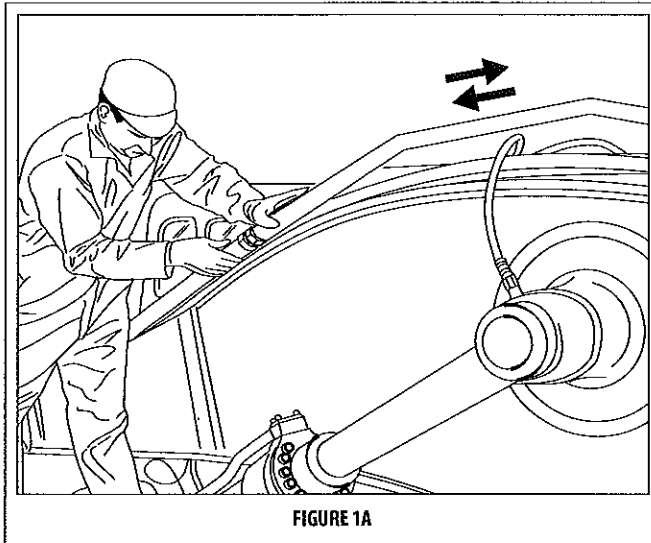
- C. Locate existing clamp at boom foot and remove hardware, then install (2)-piece clamps (1.13) onto boom piping assembly (1.01) and secure with kit hardware (1.11), (refer to "G1-BOOM" Installation Illustration, Detail B).
- D. Leave hardware loose for adjustment purposes.

□ STEP 1-5

- A. Adjust piping position to get correct profile of piping curvature (approximately match to contour of existing piping or hose, over boom arch), (see Fig. 1A).
- B. Tighten and torque all hardware and hydraulic connections to specifications.

□ STEP 1-6

- A. Repeat previous steps for installation on opposite side of boom with respective components.





GROUP 2 - ARM

PARTS LIST ▸

GROUP ILLUSTRATION ▸

STEP-BY-STEP INSTRUCTIONS ▸

FIGURE ILLUSTRATIONS ▸

- The **ARM GROUP** is part of the circuit providing oil to the attachment from the machine. This group may consist of arm piping and hoses, piping fittings, interlocking clamps, shutoff valves, weld plates (if necessary), and attachment hoses (optional).



Customer:	Pape' Machinery, Inc. - Tacoma
Excavator:	DEERE 160C LC
Kit Code:	205
Order No:	H27007

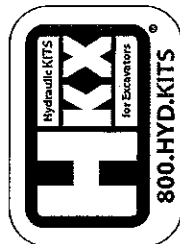
GROUP 2 : Parts List

ITEM NUMBER	PART NUMBER	QUANTITY		DESCRIPTION
2.00		1		G2-ARM-PRIMARY (PAPE)
2.01	645-1144	1		Stick Hose A (10ft - 2in)
2.02	645-1264	1		Stick Hose B (10ft - 2in)
2.05	100-0188	1		Stick Tube Hose Adp A
2.09	102-0049	1		Shut-Off Valve Adaptor A
2.09	100-0139	1		Shut-Off Valve Adaptor A
2.07	970-0042	1		Shut-Off Valve A
2.07	360-0086	1	s	Shut-Off Valve Bracket A
2.05	180-0030	1		Stick Tube Hose Adp A
2.06	100-0167	1		Stick Tube Hose Adp B
2.10	102-0049	1		Shut-Off Valve Adaptor B
2.10	100-0139	1		Shut-Off Valve Adaptor B
2.08	970-0042	1		Shut-Off Valve B
2.08	360-0086	1	s	Shut-Off Valve Bracket B
2.06	180-0030	1		Stick Tube Hose Adp B
2.11	750-0002	2	s	Stick Tube Clamps A
2.12	750-0002	2	s	Stick Tube Clamps B
2.13	310-0115	4		Bolt Hex M12 x 1.75 x 65mm
2.03	661-0174	1	s	Stick Tube A (10ft - 2in)
2.04	661-0174	1	s	Stick Tube B (10ft - 2in)
2.07	970-0063	1		Shut-Off Valve A
2.07	970-0070	1		Shut-Off Valve A
2.09	101-0008	1		Shut-Off Valve Adaptor A
2.08	970-0062	1		Shut-Off Valve B
2.08	970-0069	1		Shut-Off Valve B
2.10	101-0008	1		Shut-Off Valve Adaptor B

s = subkit

G2

ARM



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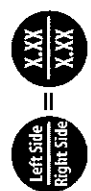
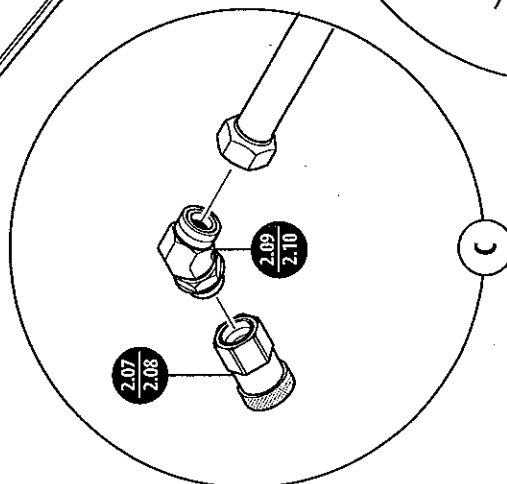
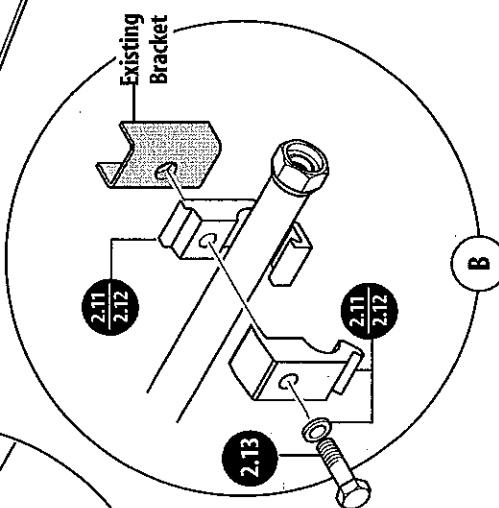
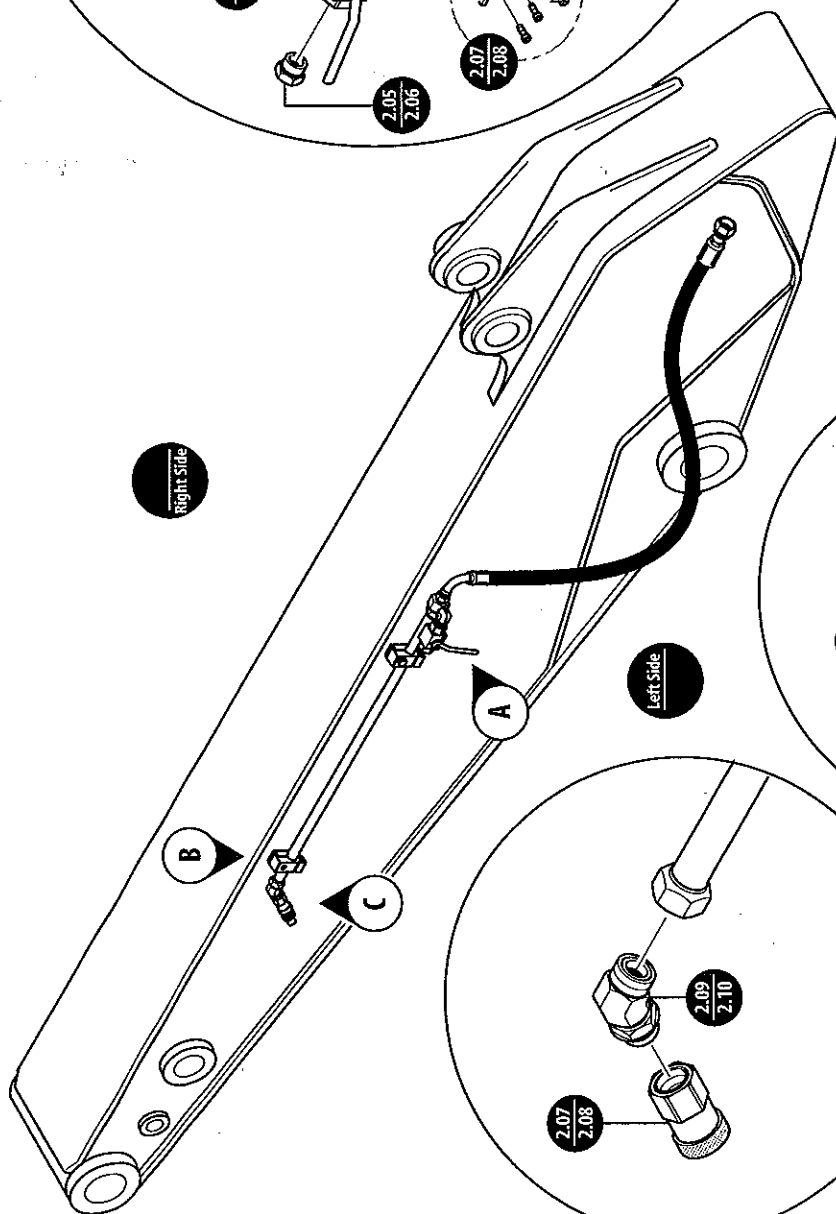
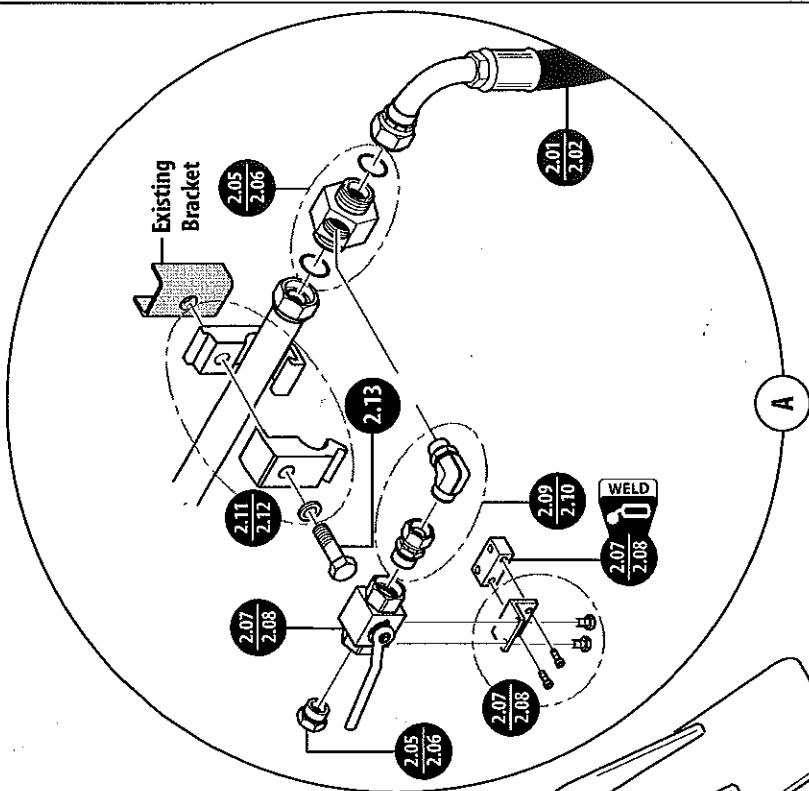
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TITLE: JDR_G2_2005_G1 DATE: 12.23.03

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GROUP 2 - INSTALLATION INSTRUCTIONS



- ▶ READ "SAFETY PRECAUTIONS" AND "PREPARATION" SECTIONS OF THIS MANUAL PRIOR TO INSTALLATION
- ▶ REFER TO "G2-ARM INSTALLATION ILLUSTRATION, WHILE PROCEEDING WITH THE FOLLOWING STEPS

□ STEP 2-1

 **NOTE:** Arm piping can be left primed, or painted before or after installation. (Refer to the "Preparation" section).

 **NOTE:** Insure O-rings are properly installed into all adapters before installation.

 **NOTE:** For instruction purposes, this install will be conducted on left side of arm.

- A. Install (2)-piece adapter set (2.09) and cap (2.05) into 3-way ball valve (3BV) (2.07), (refer to "G2-ARM" Installation Illustration, Detail A).
- B. Install angle bracket onto (3BV), using kit hardware.
- C. Install weld-on pad to angle bracket. Leave hardware hand tight.
- D. Tighten and torque all hydraulic connections to specifications.

□ STEP 2-2

- A. Install union adapter (2.05) into end of arm piping (2.03), (refer to "G2-ARM" Installation Illustration, Detail A).
- B. Install (3BV) assembly to union adapter.
- C. Install 45° adapter (2.09) and quick disconnect with cap (2.07) into opposite end of arm piping.
- D. Tighten and torque all hydraulic connections to specifications.

□ STEP 2-3

 **NOTE:** During this step, it is recommended to get assistance from a second person, so they can hold entire assembly in place, for mounting purposes.

- A. Attach (2)-piece clamps (2.11) towards each end of piping assembly, then attach to existing brackets on side of arm, (refer to "G2-ARM" Installation Illustration, Details A and B). Leave clamp hardware loose.
- B. Connect boom to arm hose (2.01) and attachment hose to arm piping assembly.
- C. Adjust position of arm piping assembly, as needed, to get correct "S-curve" shape from arm hose (2.01), (see Figure 2A).
- D. Adjust hose curvature to match existing hoses. Allow sufficient clearance between kit hose and existing hoses to avoid rubbing and wear.

 **NOTE:** Arm hose should remain evenly positioned, flat against surface of arm, within one (1) - two (2) inches throughout arms entire range of motion (i.e. arm cylinder fully extended and fully retracted).

- E. When position of arm piping assembly has been finalized, mark location of (3BV) weld-on pad onto side of arm.
- F. Mark clamp locations onto piping, then remove piping assembly from arm and grind off paint from marked location.



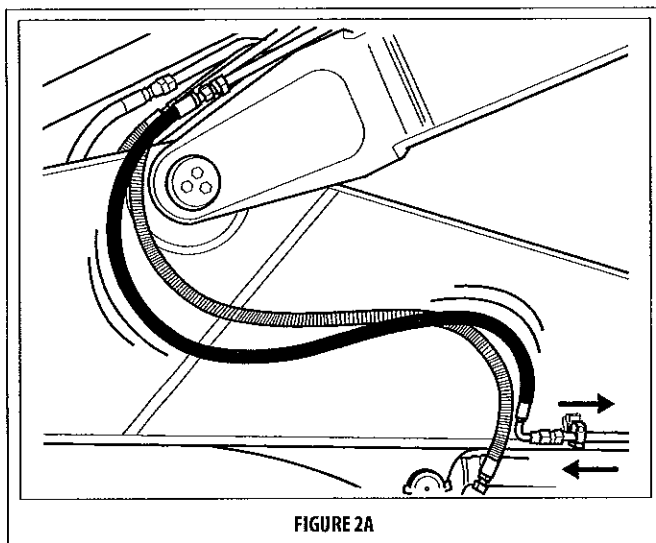
- ▶ READ AND FOLLOW ALL WELDING RELATED ITEMS IN THE MACHINE PREPARATION AND SAFETY SECTIONS

- G. Reinstall piping assembly to side of arm, then weld (3BV) mounting pad into place.
- H. Remove assembly, and chip or brush off excess weld slag, then wipe areas down with a damp cloth.
- I. Touch up weld area with factory paint.
- J. Reinstall piping assembly (align clamps to marks on piping) and hoses, when position of arm piping assembly and hoses have been finalized, tighten and torque all hardware and hydraulic connections to specifications.

□ STEP 2-5

- A. Repeat previous installation on opposite side of arm with respective parts.

 **NOTE:** If machine is safely operable at this point, then it is advisable to cycle arm through its entire range of motion (arm cylinder fully extended and fully retracted) to ensure that thumb cylinder hoses have suitable slack and are not kinked, twisted or stretched.





GROUP 3 - VALVE

PARTS LIST ▶

GROUP ILLUSTRATION ▶

STEP-BY-STEP INSTRUCTIONS ▶

▶ The **VALVE GROUP** is the source of flow and pressure from the spare valve section on the main control valve (MCV).

☐ Before operating the attachment(s) the Port Relief Cartridges (PRC) and Priority Flow Divider Valve (PRV) **MUST** be set to the attachment manufacturer's recommendations.

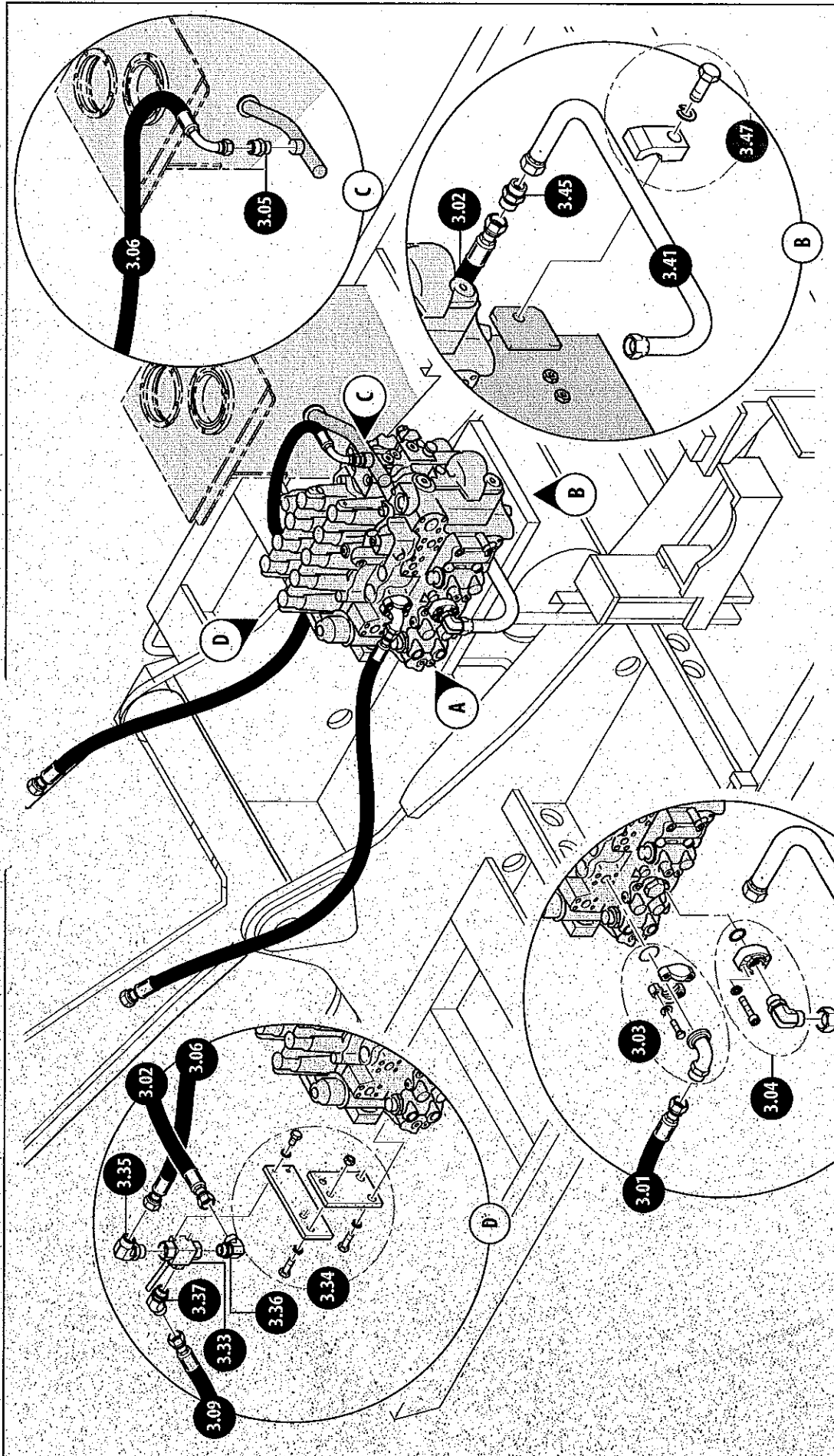


Customer: **Pape' Machinery, Inc. - Tacoma**
 Excavator: **DEERE 160C LC**
 Kit Code: **205**
 Order No: **H27007**

GROUP 3 : Parts List

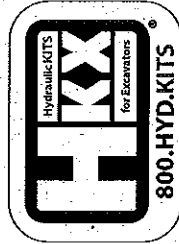
ITEM NUMBER	PART NUMBER	QUANTITY		DESCRIPTION
3.00		1		G3-VALVE-PRIMARY
3.03	112-0010	1		Work Port Adaptor A
3.03	114-0002	1		Work Port Adaptor A
3.03	300-0028	1	s	Work Port Adaptor A
3.04	110-0014	1	s	Work Port Adaptor B
3.04	102-0068	1		Work Port Adaptor B
3.41	665-0258	1	s	Cross Over Tube B-1
3.45	100-0137	1		Cross Over Tube Adp
3.47	983-0002	1		Cross Over Tube Clamp
3.47	310-0115	1		Bolt Hex M12 x 1.75 x 65mm
3.47	350-0014	1		Washer Lock m12
3.05	190-0107	1		Return Port Adaptor
3.01	645-1110	1		Work Port Hose A
3.02	645-1103	1		Work Port Hose B
3.09	645-1228	1		Boom Tube Jump Hose B
3.06	645-1252	1		Return Hose
3.33	970-0056	1		Lock Off Valve B
3.34	360-0289	1		Lock Off Valve Mtg
3.34	360-0290	1		Lock Off Valve Mtg
3.34	310-0134	2		Bolt Hex M14 x 2 x 25mm
3.34	350-0027	2		Washer Lock M14
3.34	310-0123	2		Bolt Hex M12 x 1.75 x 60mm
3.34	350-0019	2		Washer Flat m12
3.34	350-0014	2		Washer Lock m12
3.34	340-0022	2		Nut Hex M12
3.34	310-0127	2		Bolt Hex M10 x 1.5 x 40mm
3.34	350-0015	2		Washer Lock m10
3.35	102-0044	1		Lock Off Adp B - Return Hose
3.36	102-0036	1		Lock Off Adp B - WPB Hose
3.37	101-0008	1		Lock Off Adp B - BTJ Hose

s = subkit



G3

VALVE



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GROUP 3 - INSTALLATION INSTRUCTIONS



- ▶ READ "SAFETY PRECAUTIONS" AND "PREPARATION" SECTIONS OF THIS MANUAL PRIOR TO INSTALLATION.
- ▶ REFER TO "G3-VALVE" INSTALLATION ILLUSTRATION, WHILE PROCEEDING WITH THE FOLLOWING STEPS ON THIS PAGE.

□ STEP 3-1

- A. Remove all covers and shields necessary, to allow access to the Main Control Valve (MCV).
- B. Place bolts and covers in secure area.

□ STEP 3-2

NOTE: Verify O-rings are properly installed in all adapters, before assembly.

NOTE: There will be some oil loss while installing adapters, so have all tools, components and plenty of oil absorbing pads nearby.

- A. Connect work port hose A (3.01) to boom piping (1.01). Route hose to left side (cab side) of (MCV).
- B. Remove cover plate from upper work port on spare spool, then install flange adapter (3.03), using split flange halves and kit hardware to secure, (refer to "G3-VALVE" Installation Illustration, Detail A).
- C. Connect work port hose A (3.01) to adapter (3.03).
- D. Tighten and torque all hardware and hydraulic connections to specifications.

□ STEP 3-3

NOTE: Verify O-rings are properly installed in all adapters, before assembly.

- A. Connect boom jump hose B (3.09) to boom piping (1.02). Route hose to front side of (MCV).
- B. Tighten and torque all hydraulic connections to specifications.

□ STEP 3-4

NOTE: Verify O-rings are properly installed in all adapters, before assembly.

- A. Connect both mounting brackets (3.34) together using kit hardware to secure, (refer to "G3-VALVE" Installation Illustration, Detail D).
- B. Locate existing bolt holes on lower front left of (MCV) and remove hardware.
- C. Mount bracket assembly using kit hardware (3.34) to secure.
- D. Install 90° adapters (3.36 & 3.35) and 45° adapter (3.37) respectively, into 3-way ball valve (3BV).
- E. Mount (3BV) assembly to bracket (3.34) using kit hardware to secure.
- F. Tighten and torque all hardware and hydraulic connections to specifications.

□ STEP 3-5

- A. Connect straight end of return hose (3.06) to 90° adapter (3.36) on (3BV), then route hose to left side (step side) of (MCV) to return port, (refer to "G3-VALVE" Installation Illustration, Detail D).
- B. Connect boom jump hose B (3.09) to 45° adapter (3.37) on (3BV), routed from boom piping (1.02).
- C. Connect work port hose B (3.02) to 90° adapter (3.36) on (3BV), then route hose to left side (step side) of (MCV).
- D. Tighten and torque all hydraulic connections to specifications.

□ STEP 3-6

NOTE: There will be some oil loss while installing adapters, so have all tools, components and plenty of oil absorbing pads nearby.

- A. Remove plug from return port and install 90° adapter (3.05), (refer to "G3-VALVE" Installation Illustration, Detail C).
- B. Connect return hose (3.06) to adapter (3.05).
- C. Tighten and torque all hydraulic connections to specifications.

□ STEP 3-7

NOTE: There will be some oil loss while installing adapters, so have all tools, components and plenty of oil absorbing pads nearby.

- A. Install 90° adapter (3.04) into flange block (3.04), (refer to "G3-VALVE" Installation Illustration, Detail A).
- B. Connect short bend of piping (3.41) to adapter (3.04), then install adapter (3.45) into other end of piping (3.41).
 NOTE: Make sure piping (3.41) is connected in a way that it will be able to go under (MCV).
- C. Remove cover plate from lower work port on spare spool, then install (4)-piece adapter set, from step B, using kit hardware to secure, (refer to "G3-VALVE" Installation Illustration, Detail A).
- D. Connect work port hose B (3.02) to adapter (3.45) on piping (3.41).
- E. Tighten and torque all hardware and hydraulic connections to specifications.

□ STEP 3-8

- A. Locate existing bolt hole, on lower back right of (MCV) bracket.
- B. Secure piping (3.41) to bracket using single clamp (3.47) and kit hardware to secure, (refer to "G3-VALVE" Installation Illustration, Detail B).
- C. Tighten and torque hardware connections to specifications.



GROUP 4 - CONTROLS

PARTS LIST ▶

GROUP ILLUSTRATION ▶

STEP-BY-STEP INSTRUCTIONS ▶

(JS) WIRING DIAGRAM & INSTRUCTIONS ▶

- ▶ The **CONTROLS GROUP** may consist of a foot pedal, foot switch and/or joystick (operator control) and pressure reducing valve options to set the flow



Customer: **Pape' Machinery, Inc. - Tacoma**
 Excavator: **DEERE 160C LC**
 Kit Code: **205**
 Order No: **H27007**

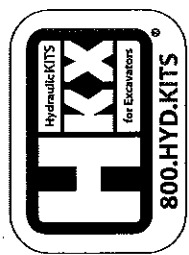
GROUP 4 : Parts List

ITEM NUMBER	PART NUMBER	QUANTITY		DESCRIPTION
4.00		1		G4-CONTROL-PROPORTIONAL
4.10	400-0037	1	s	Joystick
4.12	430-0011	1	s	Joystick Adaptor
4.15	280-0003	1		Proportional Controller
4.15	370-0003	2		Proportional Controller Mtg
4.15	350-0005	2		Washer Lock 1/4"
4.16	290-0030	1		Proportional Control Harness
4.17	260-0035	1		Rocker
4.17	290-0032	1		Rocker Harness
4.18	290-0031	1		PV Power Harness
4.11	900-0166	1	s	Pilot Valve
4.11	160-0038	1	s	Pilot Valve
4.13	360-0298	1	s	Pilot Valve Mtg Kit
4.13	310-0121	2		Bolt Hex M12 x 1.75 x 25mm
4.13	350-0014	2		Washer Lock m12
4.13	310-0192	2		Bolt Hex 5/16-18 x 2-1/2"
4.13	350-0003	2		Washer Lock 5/16"
4.13	350-0006	2		Washer Flat 5/16"
4.04	641-1190	1		Pilot Supply Hose
4.04	641-1190	1		Pilot Return Hose
4.24	641-0063	1		Pilot Signal Manifold Hose M
4.24	641-0063	1		Pilot Signal Manifold Hose N
4.23	190-0079	2		Pilot Signal Manifold Adp (M & N)
4.23	180-0007	2		Pilot Signal Manifold Adp (SM & tank
4.23	190-0079	2		Pilot Signal Manifold Adp (13 & 14)
4.23	102-0032	2		Pilot Signal Adaptor
4.07	641-1037	1		Pilot Shift Hose A (13)
4.07	500-0005	1		Pilot Shift Hose B (14)
4.05	500-0051	1	s	Pilot Sup & Ret Adps
4.08	160-0009	1	s	Shift Port Adaptors

s = subkit

G4

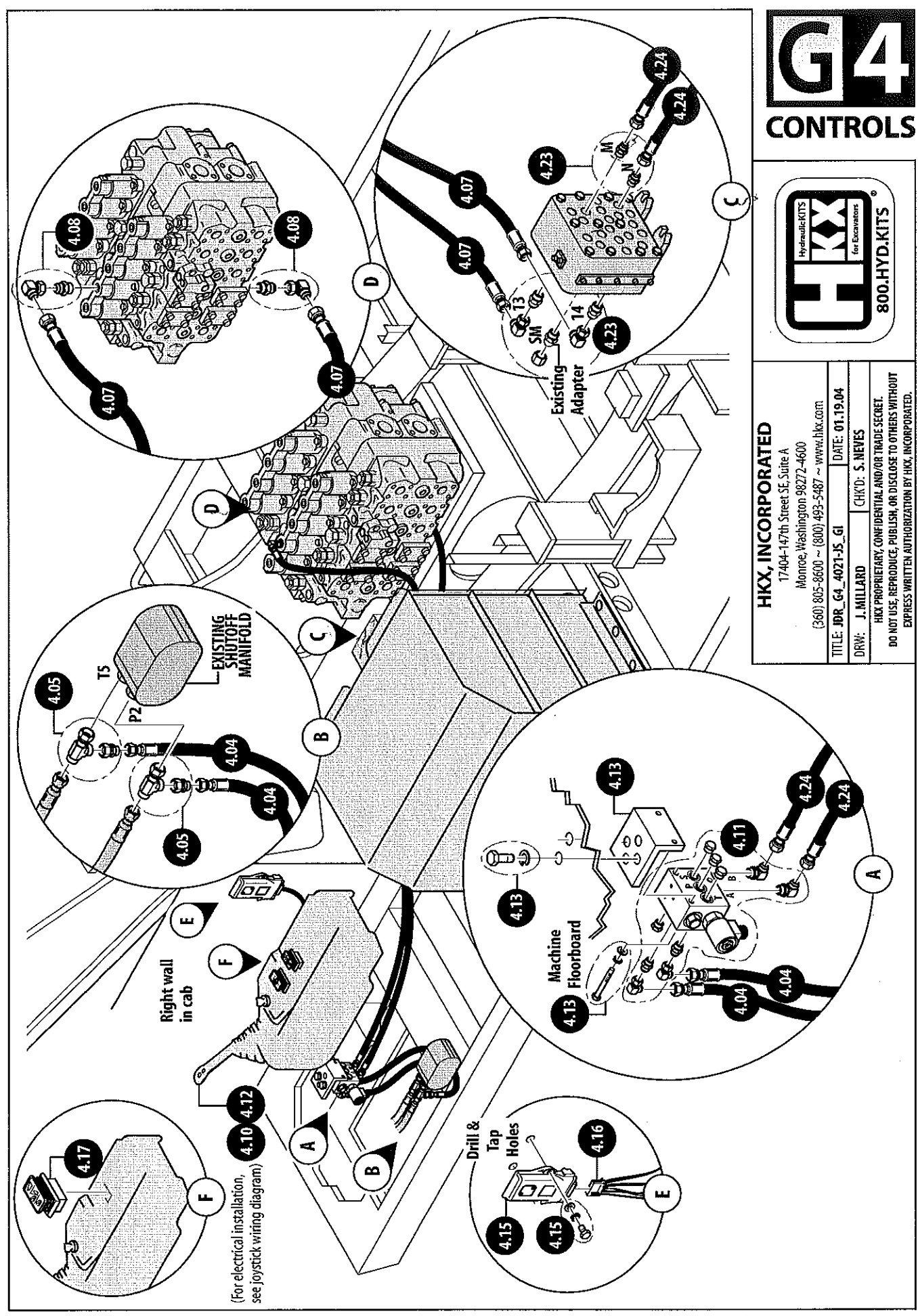
CONTROLS



HKX, INCORPORATED

17404-147th Street SE, Suite A
 Monroe, Washington 98272-4600
 (360) 805-8600 ~ (800) 493-5487 ~ www.hkx.com

TITLE: JDR_G4_4021-J5_G1	DATE: 01.19.04
DRW: J. MILLARD	CHK'D: S. NERVES
HKX PROPRIETARY, CONFIDENTIAL AND/OR TRADE SECRET. DO NOT USE, REPRODUCE, PUBLISH, OR DISCLOSE TO OTHERS WITHOUT EXPRESS WRITTEN AUTHORIZATION BY HKX, INCORPORATED.	



(For electrical installation, see joystick wiring diagram)

GROUP 4 - INSTALLATION INSTRUCTIONS



- ▶ READ "SAFETY PRECAUTIONS" AND "PREPARATION" SECTIONS OF THIS MANUAL PRIOR TO INSTALLATION
- ▶ REFER TO "G4-CONTROLS" INSTALLATION ILLUSTRATION, WHILE PROCEEDING WITH THE FOLLOWING STEPS ON THIS PAGE

□ STEP 4-1

- A. Remove any necessary panels or covers to gain access under and behind cab and Main Control Valve (MCV) area.
- B. Place removed hardware in a safe location.

□ STEP 4-2

- A. For Joystick (JS), Pilot Valve (PV) and proportional wiring installation, refer to G4-CONTROLS (JS) instructions and (JS) wiring diagram.

□ STEP 4-3

 **NOTE:** It is recommended to have a second person help for (PV) installation.

- A. Locate existing bolt holes on floor of cab, remove bolts, then mount (PV) mounting bracket (4.13), using kit hardware to secure, (refer to "G4-Controls" Installation Illustration, Detail A).
- B. Install adapters and plugs into (PV) (4.11).
- C. Install supply and return hoses (4.04) to "T" and "P" ports on (PV). Install Pilot Signal Manifold (PSM) hoses M & N (4.24) to "A" and "B" ports on (PV).
- D. Mount (PV) assembly to mounting bracket (4.13), using kit hardware to secure.
- E. Tighten and torque all hardware and hydraulic connections to specifications.

□ STEP 4-4

 **NOTE:** There will be some oil loss during this installation process, so have all necessary tools, components and plenty of oil absorbing pads and rags nearby.

- A. Route pilot supply hose (4.04), from "P" port adapter on (PV), to shut-off manifold (located under cab), (refer to "G4-Controls" Installation Illustration, Details A and B).
- B. Route pilot return hose (4.04) from "T" port adapter on (PV), to shut-off manifold (located under cab).
- C. Disconnect existing pilot return hose, on shut-off manifold T5 port, located under cab and temporarily plug it, (refer to "G4-Controls" Installation Illustration, Detail B).
- D. Install (2)-piece adapter set (4.05) onto existing adapter.
- E. Connect pilot return hose (4.04), from "T" port on (PV), to adapter (4.05).
- F. Reconnect existing pilot return hose to (newly installed) tee adapter (4.05).
- G. Disconnect existing pilot supply hose, on shut-off manifold P2 port, located under cab and temporarily plug it, (refer to "G4-Controls" Installation Illustration, Detail B).
- H. Install (2)-piece adapter set (4.05), onto existing adapter.
- I. Connect pilot supply hose (4.04), from "P" port on (PV), to adapter (4.05).

- J. Reconnect existing pilot supply hose to (newly installed) tee adapter (4.05).
- K. Tighten and torque all hydraulic connections to specifications.

□ STEP 4-5

 **NOTE:** There will be some oil loss during this installation process, so have all necessary tools, components and plenty of oil absorbing pads and rags nearby.

 **NOTE:** Label ends of (PSM) hoses, before routing through frame, to help differentiate hose "M" from hose "N".

- A. Route (PSM) hose M (4.24), from (PV) "A" port to existing (PSM) "M" port, (refer to "G4-Controls" Installation Illustration, Details A & C).
- B. Route (PSM) hose N (4.24), from (PV) "B" port to existing (PSM) "N" port.
- C. Remove plug from "M" port on (PSM), then install adapter (4.23). Connect (PSM) hose M (4.24) to adapter (4.23).
 **NOTE:** Some machines have a jumper hose between the "M" and "N" ports on (PSM). If applicable, remove existing hose and adapters.
- D. Remove plug from "N" port on (PSM), then install adapter (4.23). Connect (PSM) hose N (4.24) to adapter (4.23).
- E. Tighten and torque all hydraulic connections to specifications.

□ STEP 4-6

 **NOTE:** There will be some oil loss during this installation process, so have all necessary tools, components and plenty of oil absorbing pads and rags nearby.

- A. Remove plug from "13" port on (PSM), then install (2)-piece adapter set (4.23). Connect pilot shift hose A (4.07) to adapter (4.23).
- B. Remove plug from "14" port on (PSM), then install (2)-piece adapter set (4.23). Connect pilot shift hose B (4.07) to adapter (4.23).
- C. Remove drain hose between (PSM) SM port and tank. Cap existing ports, using cap adapters (4.23).
- D. Route pilot shift hose A (4.07), from (PSM) "13" port to spare valve upper shift port on (MCV), (refer to "G4-Controls" Installation Illustration, Details C and D).
- E. Route pilot shift hose B (4.07), from (PSM) "14" port to spare valve lower shift port on (MCV).
- F. Remove upper shift port plug, from spare spool, on (MCV) and install (2)-piece adapter set (4.08), (refer to "G4-Controls" Installation Illustration, Detail D).
- G. Connect pilot shift hose A (4.07), to adapter (4.08).
 **NOTE:** Pilot shift hoses can be swapped to change actuation of Joystick controls, (reverse control direction).
- H. Remove lower shift port plug, from spare spool, on (MCV) and install (2)-piece adapter set (4.08).
- I. Connect pilot shift hose B (4.07), to adapter (4.08).
- J. Tighten and torque all hydraulic connections to specifications.

Continued

GROUP 4 - INSTALLATION INSTRUCTIONS

□ STEP 4-7

 **NOTE:** Some harnesses may be pre-assembled together at factory.

- A. Mount proportional controller on right side cab wall, (refer to "G4-Controls" Installation Illustration, Detail E).
- B. Plug Deutsche connector end of proportional harness into proportional controller.
- C. Open right side console, then remove existing Joystick (JS) and install proportional (JS) (4.10) in its place, using (JS) adapter and nuts (4.12) on (JS) shaft.
- D. After (JS) has been installed, connect (JS) wires to proportional wire harness (4.16), (see electrical diagram for additional information).
- E. Pop out switch cover on right side control console, then push rocker switch (4.17) into place, (refer to "G4-Controls" Installation Illustration, Detail F).
- F. Connect rocker switch harness to proportional wire harness.
- G. Locate existing spare power wire (red w/black stripe) and ground wire (black w/red stripe) near fuse panel, behind seat and connect power harness (4.16) to existing wires, then route to opposite side of cab and connect to proportional wire harness, (see Fig. 4A).
- H. Connect (PV) wire harness (4.11) to both (PV) solenoids, then route harness through hole in cab floor (right of travel pedals) and connect to branch of proportional wire harness.

□ STEP 4-8

- A. Use proportional Joystick (JS) diagram to adjust (JS) sensitivity, if needed.

GROUP 4 - INSTALLATION INSTRUCTIONS

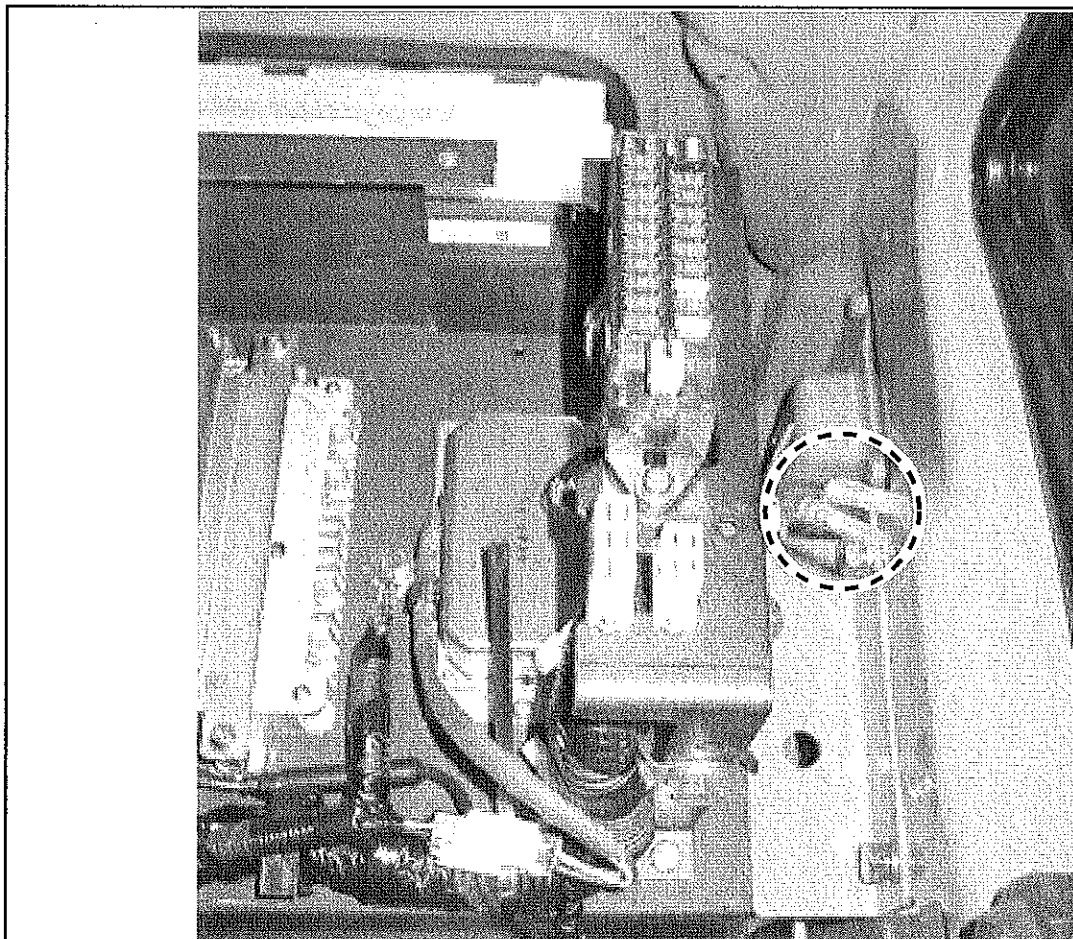
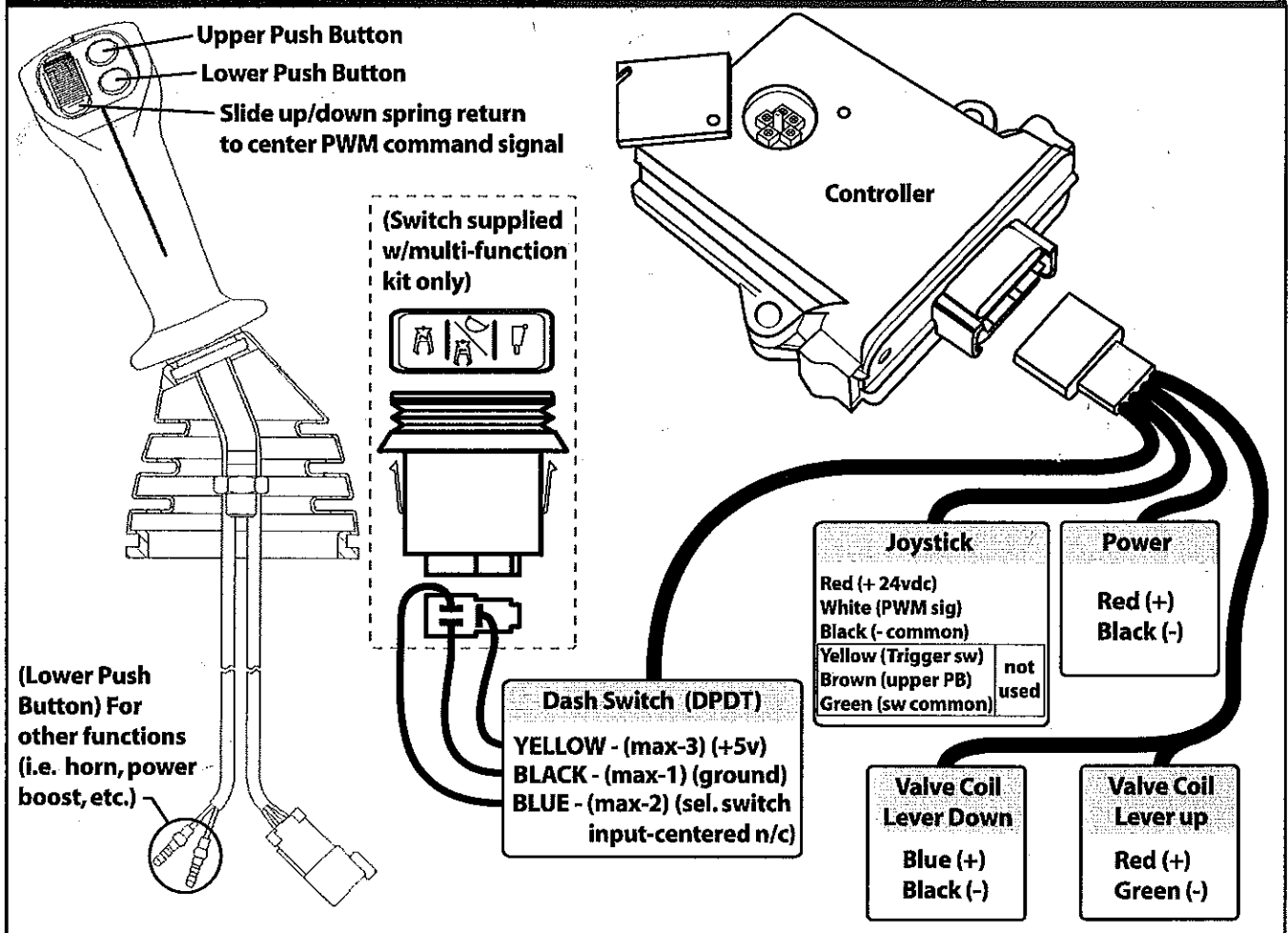


FIGURE 4A

PROPORTIONAL JOYSTICK CONTROLLER

JOYSTICK CONTROLLER DIAGRAM AND SETUP



Center Joystick Slide

With joystick slide in neutral position, slowly adjust centering pot until LED light is solid green. Note: When joystick slide is being operated, LED will change to yellow, this is normal.

Pre-set Min Pot (Ramp Rate)

Turn min. pot down to lowest value. Note: Min. pot must always be at a lower value than any of max 1, max 2 or max 3.

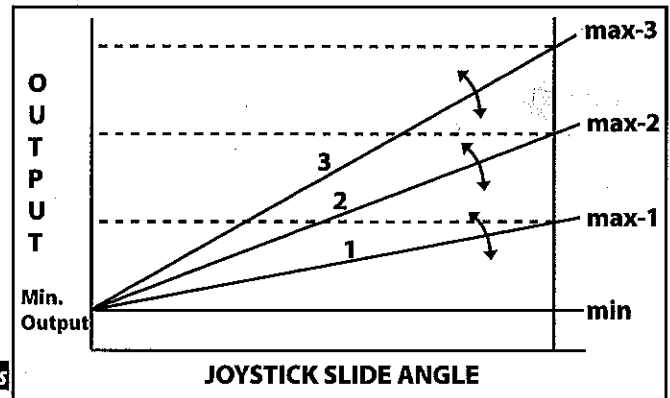
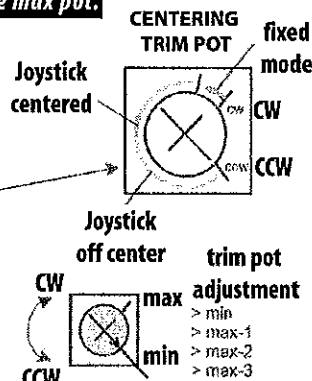
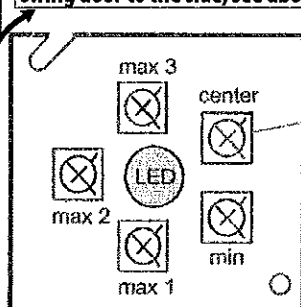
Set Max 1, Max 2 and Max 3.

These three pots correspond to the three positions of the toggle switch. These three values are used to set maximum flow for three different attachments; example, Max 3 = Breaker @ 36gpm, Max 2 = Compactor @ 30gpm, Max 1 = Thumb @ 25gpm. **If your kit does not utilize a toggle switch, Max 2 is the only operable max pot.**

Final Min Pot Set

Adjust min. pot up to desired value. Remember, min. pot must always be at a lower value than any of max 1, max 2 or max 3.

Access door, loosen screws and swing door to the side, see above



multi-color LED status		
○ solid Green = centered	} joystick mode	
○ solid Yellow = off center		
⊗ blinking Green = joystick fault		
● solid Red = fixed mode		
⊗ pause, repeat	over current fault	>2.5amps
⊗ pause, repeat	over voltage fault	>32vdc
⊗ pause, repeat	under voltage fault	<10vdc
all three faults require power reset to clear		

FUNCTION TESTING

BEFORE YOU START TESTING | STARTUP PROCEDURE | SETTING (PRC) | SETTING PILOT VALVE AND (PRV)/FLOW REGULATOR PRESSURE

BEFORE YOU START TESTING

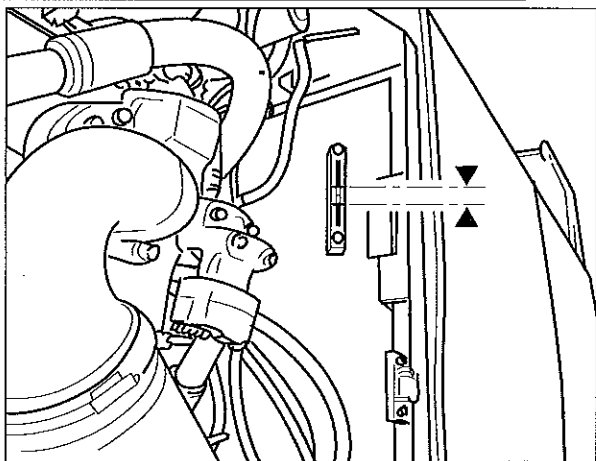
CAUTION

- ☐ Verify all Installation Steps have been completed
- ☐ Verify all hoses, piping, fittings and hardware have been properly connected and torqued to specifications
- ☐ Have safety personnel available to verify operations
- ☐ Ensure all piping clamps and mounting brackets are permanently welded into place or secured with hardware, to torque specifications and do not interfere with piping or hose end connections
- ☐ Hook up all electrical systems on machine, that have been disconnected (Follow the manufacturer's instructions for reconnecting electrical components)
- ☐ Carefully reinstall battery and/or reconnect leads, as per the machine manufacturer's instructions
- ☐ Remove any flame-retardant cloth (rags, drop clothes, etc.) from window, cylinders, electrical components, cosmetic items, fuel and oil tank fill and vent ports and any other surfaces that may have been covered during welding

WARNING

-  **USE A GAUGE OR FLOW METER TO VERIFY FLOW/PRESSURE REQUIREMENTS (PILOT, POWER, RETURN, CASE DRAIN) BEFORE OPERATION OF ATTACHMENT**
-  **FAILURE TO DO THIS MAY VOID MACHINE, ATTACHMENT AND KIT WARRANTIES**
-  **PRESSURE RELIEF CARTRIDGES (PRC) MUST BE ADJUSTED TO SPECIFIED PRESSURE REQUIREMENTS FOR THE MACHINE AND ATTACHMENT. (REFER TO MACHINE AND ATTACHMENT SERVICE MANUALS FOR CORRECT PRESSURE SETTINGS BEFORE OPERATION OF THE ATTACHMENT)**

INITIAL STARTUP PROCEDURE AFTER KIT INSTALL



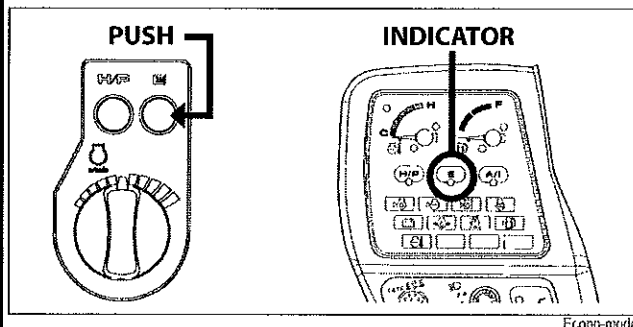
-  **CHECK OIL LEVEL**
Open access door in front of main pump. Check oil level on hydraulic tank. Oil must be between marks on gauge. If necessary, add oil.

■ CONTINUED



RECONNECT POWER SUPPLY

Insure that battery and computer have been reconnected in accordance with the excavator manufacturer's recommended procedure.



ECONOMY MODE

If machine has an Economy Mode, activate E-mode switch. Although performance will decrease, fuel consumption and noise level will also decrease.



LEAK INSPECTION

Position personnel around machine, then turn starter for 1-2 seconds, shut down and check for leaks.



HOSE INSPECTION

If no leaks were found, start machine again, allow to run at low idle for 10-15 seconds, be prepared to shut down machine, if any leaks are observed.
If no leaks were found, allow machine to run at low idle and slowly move boom, stick, and attachment through full range of motion to verify that all kit hoses are not stretched, kinked or obstructed.

SETTING PRESSURE RELIEF CARTRIDGE (PRC)

CAUTION

PRESSURE RELIEF CARTRIDGES (PRC) LIMIT THE AMOUNT OF PRESSURE ON EACH SIDE OF THE SPOOL AND ARE REQUIRED FOR ALL HYDRAULIC KITS, WHETHER INCLUDED IN KIT OR CUSTOMER SUPPLIED, THEY MUST BE INSTALLED. ONE (PRC) IS USED FOR SINGLE DIRECTION KITS, TWO (PRC'S) FOR DUAL DIRECTION KITS.



- ☐ (PRC's) get installed into same section of Main Control Valve (MCV), where (kit used) Work Ports are located.

SETTING PRESSURE RELIEF CARTRIDGES

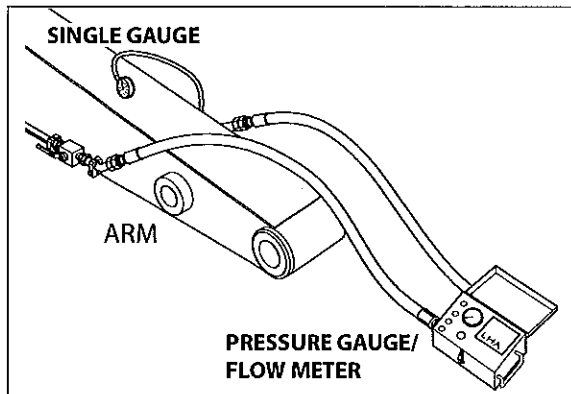
CAUTION

PRESSURE RELIEF CARTRIDGES MUST BE ADJUSTED TO ATTACHMENT SPECIFICATIONS

■ CONTINUED

-PRESSURE RELIEF CARTRIDGE (PRC)- continued

-  The easiest way to set (PRC) pressure is with two people. The first person attaches a pressure gauge/flow meter (in-line), between supply line and Attachment or between supply line and return line (in place of attachment).



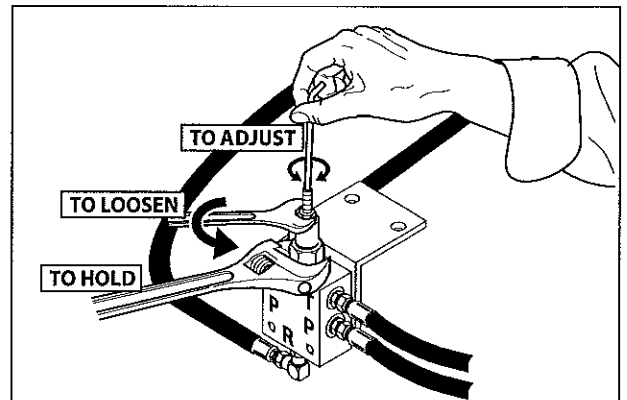
-  ☐ If using a single pressure gauge, then use a tee fitting (in-line) with gauge or (if your kit configuration included an Arm Manifold) use plugged port on Arm Manifold to connect gauge.
-  ☐ Start machine and bring engine to full RPM, monitor the pressure at pressure gauge/flow meter. Either "Dead Head" one of the functions or adjust valve on pressure gauge/flow meter to restrict flow, allowing pressure to build up, then have second person at Main Control Valve adjust (PRC) until pressure is set to Attachment specifications.
-  ☐ For dual (PRC) configuration, swap hoses at pressure gauge/flow meter or switch location of single pressure gauge to opposite side of arm, then follow the same procedure to set second (PRC).
-  ☐ If kit configuration included an Auxiliary Valve, (PRC's) have been pre-installed and will need to be adjusted to Attachment specifications.

■ SETTING PILOT VALVE AND PRESSURE REDUCING VALVE (FLOW REGULATOR) PRESSURE

CAUTION

**PRESSURE REDUCING VALVES AND PILOT VALVES MUST
BE SET AT OR BELOW THE FLOW RECOMMENDED BY
MACHINE MANUFACTURER**

-  ☐ Pilot Valves and Pressure Reducing Valves (PRV), also known as Flow Regulators, are typically installed under or behind the cab.
-  ☐ **SETUP TEST EQUIPMENT**
Insure a flow meter is connected between attachment hoses, at attachment.
-  ☐ **SET ENGINE IDLE**
Increase engine speed to high idle. The pressure should not increase by more than 200 psi.

 **ADJUSTING FLOW**

-  With engine speed at high idle, set flow to manufacturer's recommended setting, by adjusting pilot valve (flow regulator). Adjust flow meter to set recommended OPERATING pressure.

NOTICE

Note and verify that back pressure and temperature readings are at or below the manufacturer's recommendations.

[illegible]

FINALIZING INSTALLATION

POST INSTALLATION INSPECTION | INSTALLATION CLEAN-UP | DECALS | INSTALLATION AND MAINTENANCE MANUAL

POST INSTALLATION INSPECTION



LEAKS

Again, check for any minor leaks after machine has cooled. Tighten and torque fittings, if needed.

HOSE ROUTING

Check for any rubbing of hoses, adjust if needed.

CLAMPS

Make sure clamps have not loosened to where piping has shifted out of alignment. Use factory recommended Loctite on bolts that can vibrate loose.

NOTICE

TO CHECK HYDRAULIC OIL LEVEL

1. PARK MACHINE ON LEVEL GRADE.
2. WITH BUCKET CLOSED AND ARM IN, PLACE ATTACHMENT ON GRADE.
3. TURN OFF ENGINE.
4. ADD HYDRAULIC OIL AS NECESSARY TO BRING LEVEL BETWEEN TOP AND BOTTOM LINES OF SIGHT GAUGE.

Hydraulic Reservoir Oil Check



FLUID LEVELS

Cycle machine and attachment through several positions and functions, check hydraulic fluid level, then add fluid, if needed.

INSTALLATION CLEANUP



SECURING OEM COMPONENTS

After kit installation, inspection and testing, reinstall cab floor mats and replace any cable ties or brackets, which may have been loosened or removed during installation.



FOREIGN OBJECT INSPECTION

Look in and around machine for tools, rags, fasteners and extra parts, before closing covers, hatches or reinstalling panels.



SECURE MACHINE

When satisfied with kit installation, reinstall all covers, hatches and panels, which had been removed previously.



TOUCH-UP

Inspect all outer tubes, clamps, brackets and weld-on bases (if applicable) and ensure they are completely covered 100% by paint, to prevent rust and corrosion.

DECALS

The hydraulic kit on this machine was supplied by HKX, Inc.



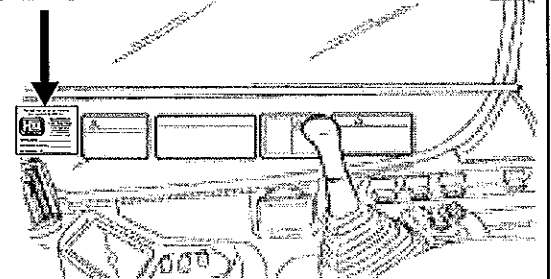
KITS available for
 Breakers · Hammers
 Thumbs · Clamps · Grapples
 Compactors · Bucket Tilt
 Custom Applications
 Multiple Functions
 Fax: 1-800-353-5736
1-800-493-5487

MODEL/MFR.: _____

EXCAVATOR Serial No.: _____

KIT NUMBER: H _____

INSIDE RIGHT CAB WINDOW



DECAL PLACEMENT AND INSTALL

Install HKX Decal for quick access to information and support, refer to the illustrations above.

! CAUTION !

PROCEDURE TO CHANGE FUNCTIONS

Tools required:
 1) One adjustable wrench
 2) One 9/16" wrench
 3) One snap ring pliers

SHUTOFF VALVES

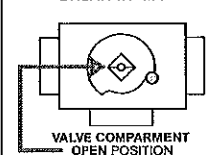
CHANGING VALVE DIRECTION

1. Remove retaining ring & stop plate.
2. Change valve orientation as desired.
3. Replace stop plate in locked position.
4. Install snap ring.

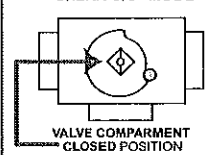
IMPORTANT

- VALVE COMPARTMENT:**
 BREAKER MODE- valve is OPEN and locked.
 SHEAR MODE- valve is CLOSED and locked.
- ARM:**
 Arm (stick) shutoff valves need to be OPEN and locked at all times while an attachment is in use.

"BREAKER" MODE



"SHEAR O/C" MODE



REV. 1-5-2001

■ CONTINUED

-ACCUMULATOR- continued



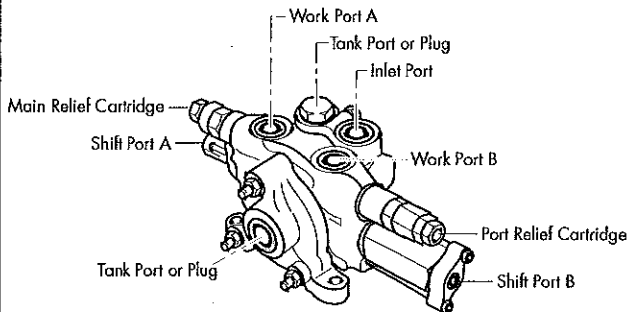
- ❑ Disconnect charge hose from charge port on Check and Charge.
- ❑ Replace high pressure cap on charge port.
- ❑ Retract plunger by unscrewing gauge counter-clockwise until it comes to a stop. Then unscrew adapter unit from charge valve.
- ❑ Remove Check and Charge from charge valve.
- ❑ Replace cap in charge valve.

■ OPERATION OF SYSTEM COMPONENTS

-AUXILIARY VALVE-



- ❑ Auxiliary Valves (AV) come in many different types and models, the following is an example of a single (AV), which shows port, plug and cartridge locations:



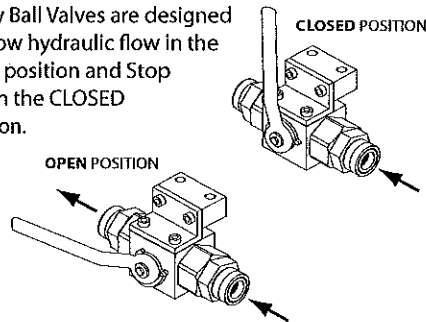
■ OPERATION OF SYSTEM COMPONENTS

-BALL VALVES-

❑ 2-WAY (LOCK OFF)



- ❑ 2-Way Ball Valves are designed to Allow hydraulic flow in the OPEN position and Stop flow in the CLOSED position.

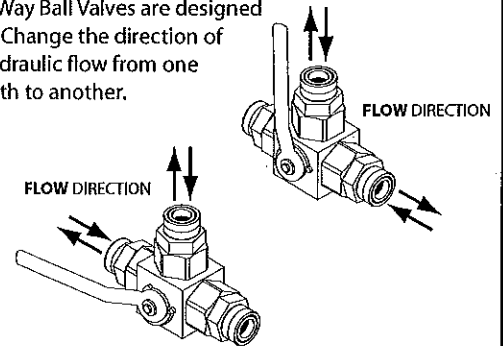


- ❑ Insure 2-way ball valve is in the OPEN position and locked into place for peak performance.
- ❑ Valve/handle direction can be changed, if needed. To do this, you will need an adjustable wrench, 9/16" wrench and snap ring pliers. Remove snap ring and stop plate, then change valve/handle orientation as desired. Replace stop plate in LOCKED position, then reinstall snap ring.

❑ 3-WAY



- ❑ 3-Way Ball Valves are designed to Change the direction of hydraulic flow from one path to another.



- ❑ Insure 3-way ball valve is locked into place for peak performance.
- ❑ Valve/handle direction can be changed, if needed. To do this, you will need an adjustable wrench, 9/16" wrench and snap ring pliers. Remove snap ring and stop plate, then change valve/handle orientation as desired. Replace stop plate in LOCKED position, then reinstall snap ring.

■ PERIODIC INSPECTIONS

CAUTION

PERIODICALLY PERFORM A WALK-AROUND, INSPECTING KIT HOSES, ADAPTER FITTINGS, VALVES AND MANIFOLDS FOR LEAKS, CRACKS AND OTHER POTENTIAL PROBLEMS

CAUTION

PERIODICALLY CHECK NITROGEN GAS LEVEL IN ANY KIT MOUNTED ACCUMULATOR

TROUBLESHOOTING CHART

Problem	Possible Cause	Check	Remedy
Cannot Obtain Required Flow	Carrier work mode setting	Carrier work mode setting	Set for maximum power
	Carrier auxiliary valve work port relief valve set below Breaker or compactor/driver operating pressure.	Relief valve (Note: setting usually must be somewhat above hammer operating pressure based on manufacturer's specification)	Reset relief pressure to Carrier and Attachment specifications
	Insufficient carrier pump flow	Carrier pump curve specifications	Contact HKX
	Optional shuttle valve pressure signal connections.	Hose routing and connections	Refer to HKX schematics
	Worn carrier pumps.	Carrier pump output.	Rebuild or replace
No flow or pressure readings at pressure line.	Auxiliary valve spool not shifting.	Pilot pressure signal to auxiliary valve pilot port.	Refer to HKX schematics.
	Pressure line connected to wrong auxiliary valve work port.	Auxiliary valve work port connections.	Reverse port connection(s)
	Shut off valve closed on pressure and/or return line.	Shut off valves.	Fully open both valves to ON position.
	Plug, orifice, or obstruction in auxiliary valve work port.	HKX Installation schematics. Auxiliary valve work port.	See Carrier Manual.
	Pilot port connections to auxiliary valve reversed.	Hose routing and connections.	Refer to HKX schematics. (Note: Connect pilot pressure to one side of auxiliary valve spool and opposite side of auxiliary valve spool to drain.)
	Pressure and return hoses reversed on installation.	Hydraulic pressure at attachment inlet port, hose routing and connections. (Note: sitting in operators seat typically the <u>pressure line</u> is on the left side and the <u>return line</u> is on the right side.)	Refer to HKX schematics. Reverse line connections.
	No pilot pump supply pressure to pilot valve.	Hose routing and connections.	Refer to HKX schematics.
	No pilot pressure signal to auxiliary valve pilot port.	Hose routing and connections. Valve solenoid wiring.	Refer to HKX schematics. Repair or replace wiring.
	No electrical power.	Foot switch, Joystick, HKX valve wiring. HKX "ON/OFF" toggle switch. HKX circuit breaker. Carrier power supply.	Repair and/or replace wiring.
	Solenoid coil operating voltage.	Solenoid coil voltage compatibility with carrier electrical system.	Replace.

TROUBLESHOOTING CHART

■ TROUBLESHOOTING CHART continued

Problem	Possible Cause	Check	Remedy
Flow delivery does not hold steady.	Low oil level in carrier reservoir.	Reservoir oil level.	Add hydraulic oil.
	Auxiliary valve spool throttling.	Pressure to auxiliary valve pilot port. (Note pressure should be at or below pilot pump pressure)	Check valve. Contact HKX.
	Reduced pressure signal to pump swash plate angle control port is connected to wrong port.	Hose routing and connection. HKX installation drawings.	Connect to correct port.
	Reduced pressure signal to pump swash plate angle control port is erratic.	Reduced pressure signal to pump swash plate angle control port. (Note pressure should steady and repeatable)	Contact HKX.
Hydraulic oil temperature is running hot.	Low oil level in carrier reservoir.	Reservoir oil level.	Add Hydraulic oil.
	Carrier auxiliary valve work port relief valve set below hammer or compactor/driver operating pressure.	Relief valve (Note: setting usually must be somewhat above hammer operating pressure based on attachment manufacturer's specification)	Reset auxiliary relief valve pressure per carrier specifications
	Shut Off valve(s) are in a partially closed position.	Shut Off valve spool position.	Fully open both valves to ON position.
	Flow setting exceeds specifications.	Flow test at load pressure with flow meter at attachment hoses and compare to attachment requirements.	Reset flow per attachment requirements
	Excessive flow for line size.	Tube and hose ID.	Call HKX
	Tube crushed or hose kinked.	All tubes and hoses.	Replace.
	Optional shuttle valve malfunction.	Shuttle valve (if present). (Note: Internal ball should move freely)	Fully open both valves to ON position.
	Dirty carrier oil or filter.	Oil cooler or filter of carrier.	Clean cooler. Change filter.

GLOSSARY

ABBREVIATION	PARTNAME	ABBREVIATION	PARTNAME
ACC	Accumulator	Kg/cm ²	Kilogram/Centimeter ²
ADP	Adapter	Kgf-m	Kilogram Force Meter
ALUM	Aluminum	LBP	Low Back Pressure
AMP	Amperage	LG	Long/Length
AP	Auxiliary Pump	LN	Lock Nut
ASSY	Assembly	M	Male
AV	Auxiliary Valve	MAN	Manifold
BH	Bulk Head	MCV	Main Control Valve
BRKT	Bracket	MET	Metric
BSPP	British Standard Pipe Parallel	MM	Millimeters
BSPT	British Standard Pipe Tapered	MRC	Main Relief Cartridge
BV2	2-way Ball Valve (Lockoff Valve)	MTG	Mounting
BV3	3-way Ball Valve	NPT	National Pipe Tapered
CB	Circuit Breaker	OC	Open/Close
CCW	Counter Clockwise	OCR	Open/Close & Rotate
CD	Case Drain	OD	Outside Diameter
CD61	Code 61	OEM	Original Equipment Manufacturer
CD62	Code 62	ORB	O-ring Boss
CDSET	Cordset	ORFS	O-ring Face Seal
CNV	Conversion	PFD	Priority Flow Divider
CONN	Connector	PR	Pilot Return
CS	Center Section (Boom)	PRC	Pressure (Port) Relief Cartridge
CW	Clockwise	PRM	Port Relief Manifold
CYLD	Cylinder	PRP	Pressure Reducing Port
° or D	Degree	PRV	Pressure Reducing Valve
DBL	Double	PS	Pilot Supply
DC	Direct Current	PSI	Pounds per Square Inch
DF	Dual Function	PSRA	Pilot Supply & Return Adapters
DFH	Dual Function House	PSV	Pilot Signal Valve
ELB	Elbow	PSW	Pressure Switch
ELEC	Electric	PV	Pilot Valve
EPC	Electronic Pilot Control	RED	Reducer
ERGO	Ergonomic	RES	Restrictor
ESH	End Section House (Boom)	RF	Return Filter
ESS	End Section Stick (Boom)	RL	Return Line
F	Female	RPA	Return Port Adapter
FC	Fluid Controls	RPM	Revolutions Per Minute
Fig	Figure	RT	Rotate
FIT	Fitting	RV	Relief Valve
FL	Fluid Lines	SBP	Standard Back Pressure
FLG	Flange	SF	Split Flange
FP	Foot Pedal	SGL	Single
FS	Foot Switch	SHC	Socket Head Cap
G	Grade	SK	Subkit
G1	Boom Group	SLND	Solenoid
G2	Arm Group	SP	Standard Pressure
G3	Valve Group	SPA	Shift Port Adapters
G4	Controls Group	SS	Spare/service spool (accessory, option)
GA	Gauge	STD	Standard
GPM	Gallons Per Minute	SV	Shuttle Valve
HF	High Flow	TRPL	Triple
HHC	Hex Head Cap	TS	Terminal Strip
HP	High Pressure	TSW	Toggle Switch
HPA	Hard Plumbed Adapter	V	Volt
HYD	Hydraulic	VLV	Valve
ID	Inside Diameter	WPA	Work Port Adapter
JIC	Joint Industrial Conference	X	Swivel
JS	Joystick	XHF	Extra High Flow

WARRANTY POLICY

■ KIT WARRANTY

HKX, INCORPORATED ("HKX") warrants any new hydraulic kits sold (except electrical components) by HKX, will be free from defects in material and workmanship for a period of one (1) year from the date of shipment to the buyer, or 2,000 hours of use, whichever expires first, if installed as per HKX installation manual. The HKX installation kit warranty does NOT cover labor, incidental costs or travel expenses.

THIS WARRANTY DOES NOT APPLY TO:

Installation on carrier other than specified on the kit Bill of Materials.

■ HKX RESPONSIBILITY

HKX will, at its discretion, repair or replace with a new or reconditioned part, any warranted part that fails by reason of defective material or workmanship, free of charge.

NOTE: Parts replaced under warranty become the property of HKX.

■ USER RESPONSIBILITY

- The installer, user, operator, repairer, assumes responsibility to READ, UNDERSTAND and COMPLY with HKX's written INSTALLATION, OPERATION, SAFETY, PREPARATION, TESTING and SERVICE INSTRUCTIONS.
- If the hydraulic kit has been in your inventory for over 6 months, call HKX for upgrade information before starting installation.
- All labor costs.
- Any expense incurred by field repair.
- Returning completed Installation Feedback Form to HKX after installation of kit.
- Perform post-installation inspection within 20 hours of operation or 30 days from date of first use, whichever occurs first, and make adjustments as necessary.

■ THESE WARRANTIES DO NOT COVER FAILURES RESULTING FROM:

- Installation, alteration, modification, operation, maintenance, repair or storage which HKX judges improper.
- Not performing DAILY VISUAL INSPECTIONS and RETIGHTENING as specified in the HKX installation manual.
- Operation after discovery of defective or worn parts.
- Unreasonable delay in making a repair after being notified of a potential product problem.

■ THESE WARRANTIES SPECIFICALLY EXCLUDE:

- Operation of products not sold by HKX.
- Installations not approved by HKX.
- Replacement due to normal wear.
- Use of parts not sold by HKX.
- Parts shipping charges in excess of those which are usual and customary.
- Duties and local taxes.

■ LIMITATION AND EXCLUSIONS

Violation of any federal, provincial, state or local laws, ordinances, rules or regulations, or removal or alteration of product serial numbers void HKX's written product warranties. **Application for warranty must be made within 60 days of failure.**

The written product warranties made by HKX set forth HKX's only obligations with respect to any claims of failure, defects or deficiencies in products sold by HKX. **HKX MAKES NO OTHER WARRANTIES OR REPRESENTATIONS WHATSOEVER, EXPRESS OR IMPLIED, OF THE QUALITY, PERFORMANCE, DURABILITY, MATERIALS, WORKMANSHIP, SUITABILITY, CONDITION, DESIGN OR UTILITY OF PRODUCTS SOLD BY HKX, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, ALL SUCH OTHER WARRANTIES AND REPRESENTATIONS BEING HEREBY EXPRESSLY EXCLUDED. HKX SHALL NOT BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, WITHOUT LIMITATION, COSTS, LOSSES OR LIABILITIES ON ACCOUNT OF DELAY OR DOWNTIME.**

■ DISCLAIMER REGARDING OTHER REPRESENTATIONS OR WARRANTIES

No person is authorized to grant any other warranties or to assume any other liability on HKX's behalf unless made or assumed in writing by an officer of HKX. No person is authorized to grant any warranties or to assume any liabilities on the seller's behalf unless made or assumed in writing by the seller.

IMPORTANT: MODIFICATIONS, ALTERATIONS, CHANGES, IMPROPER USAGE AND/OR USE OF PARTS NOT SOLD OR AUTHORIZED BY HKX WILL VOID ANY AND ALL HKX WARRANTIES. PRIOR WRITTEN AUTHORIZATION MUST BE OBTAINED FROM HKX FOR ANY OF THE ABOVE. PLEASE READ THE WARRANTY, RETURN & CANCELLATION PROCEDURES OR CONTACT A HKX WARRANTY COORDINATOR AT 1-800-493-5487.

As used in this warranty the term HKX means HKX, Incorporated, 17404-147th Street SE, Suite A, Monroe, WA 98272, USA.

WARRANTY CANCELLATION & RETURN PROCEDURES

Call a HKX Warranty Coordinator at **800-493-5487** immediately upon learning of a potential warranty claim, cancellation or return. **Prior approval** by HKX is required for all warranty claims, cancellations and/or returns.

IMPORTANT: ANY MODIFICATIONS, ALTERATIONS, CHANGES, IMPROPER USAGE AND/OR USE OF PARTS NOT SOLD OR AUTHORIZED BY HKX **WILL VOID** ANY AND ALL HKX WARRANTIES. **PRIOR WRITTEN AUTHORIZATION** MUST BE OBTAINED FROM HKX FOR ANY OF THE AFOREMENTIONED.

■ WARRANTY CLAIMS

In response to your warranty claim, the Warranty Coordinator will, in a timely manner:

- Collect all pertinent information, including photos, if necessary.
- Evaluate the problem and promptly advise you verbally, and in writing:
 - What repairs are necessary
 - The repair procedure
 - Parts required for repair
 - Time allowance for repairs
- Or, in certain instances, the Warranty Coordinator may request the return of the product to HKX for repairs. In the event where an HKX product or component must be returned, HKX will send/fax a Return Goods Authorization (RGA) to claimant. Please refer to the RGA number on all shipping documents and future correspondence.
- Where applicable, the Warranty Coordinator will immediately provide replacement parts, as required, billing the claimant for the parts pending return and evaluation of the defective parts (also requiring an RGA). If the returned parts are deemed defective, a credit will be issued against the parts invoice. All defective parts must be returned to HKX freight prepaid.
- Approved dealer labor expense at a rate of \$25.00 per hour, including freight (where applicable) will be reimbursed with a credit memo against future business with HKX.

IMPORTANT: Claims submitted 60 days past the repair date will not be considered for warranty.

■ CANCELLATIONS

Please call HKX immediately, prior to shipment, for cancellation of order.

Cancellation of a Standard Kit will have a 10% processing and restock fee, if cancelled prior to being shipped.

Cancellation of any Custom Kit will have a 25% processing and restock fee, plus freight if applicable. If a Custom Kit is cancelled within 24 hours of being ordered, the fee will be voided.

■ RETURNS

Return of any kit(s) requires **PRIOR** approval and a Return Goods Authorization (RGA). Policy below applies to complete kits. Partial kit returns are not authorized.

- HKX, Inc. will evaluate requests for returns on current design kits with a 35% restocking charge, for parts that are unused. An additional fee will be charged for any items that need excessive cleaning, painting, repackaging or any labor-intensive actions required making the return into a new re-sellable condition.
- Kits for noncurrent models may be allowed, with a restocking charge as determined on an individual basis, except for custom components made specifically to order for the kit. Those restocking charges will be based on 100% of whatever amount our component suppliers will allow.
- Non-kit components in a new, clean, re-sellable condition in the original package may be allowed a 10% restocking charge.
- No kit or component will be approved for return after 90 days from the date of shipment.

■ LEGAL STATEMENT

Any disagreements will have to be submitted to an arbitration company agreed upon by the buyer and seller, and a neutral arbitrator will resolve disputes in an informal private proceeding.



