



*Zimmerman*

MODEL SS2000

COMMERCIAL ROOFING MACHINE

OPERATING MANUAL

*Zimmerman Metals, Inc*

*Over 60 Years of Quality Workmanship and Service*

201 East 58<sup>th</sup> Avenue, Denver, Colorado 80216

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## SECTION 2 HYDRAULIC COMPONENTS INFORMATION

## **WARRANTY**

ZIMMERMAN METALS, INC. WARRANTS TO THE ORIGINAL PURCHASER THAT ALL PARTS MANUFACTURED BY ZIMMERMAN METALS, INC. WILL REMAIN FREE OF DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF TWELVE MONTHS FROM THE DATE OF PURCHASE. THIS WARRANTY DOES NOT COVER MISUSE, ABUSE, OR WEAR AND TEAR CAUSED BY NEGLIGENCE.

ALL PARTS NOT MANUFACTURED BY ZIMMERMAN METALS, INC. ARE COVERED BY THEIR OWN MANUFACTURER'S WARRANTY.

ZIMMERMAN'S OBLIGATION IS TO REPAIR OR REPLACE, AT OUR OPTION, ANY PARTS MANUFACTURED BY ZIMMERMAN METALS, INC. FOUND TO BE DEFECTIVE BY OUR INSPECTION AT NO COST TO THE ORIGINAL PURCHASER. ALL PARTS RETURNED UNDER WARRANTY MUST BE APPROVED AND MUST ARRIVE AT ZIMMERMAN METALS, INC. FREIGHT PREPAID. REPLACEMENT OR REPAIRED PARTS WILL BE RETURNED TO THE PURCHASER VIA NORMAL GROUND SERVICE FREIGHT PREPAID.

ZIMMERMAN METALS, INC. SHALL NOT BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, PUNITIVE DAMAGES OR OTHER LOSSES.

THE ABOVE WARRANTY IS EXCLUSIVE AND ZIMMERMAN METALS, INC. DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

## **MACHINE SPECIFICATIONS**

<b>PANEL MACHINE</b>	LENGTH 120"
	HEIGHT 25"
	WIDTH 44"
	WEIGHT- 2550 LBS
	POWER-13 HP GASOLINE ENGINE
	DRIVE-HYDRAULIC / GEAR & CHAIN
	SHEAR-HYDRAULIC
	SPEED-APPROX. 60 FT. PER MINUTE
	MATERIAL WIDTH-18"-30"
	MATERIAL TYPES-STEEL, 24GA.-22GA. ALUMINUM TO .040
<b>UNCOILER</b>	SPOOL & STAND W/ BRAKE, 4000 LB. CAPACITY
<b>TRAILER</b>	LENGTH-19 FT
	HEIGHT-50" WITH MACHINE, SPOOL & STAND
	WIDTH-91"
	AXLES-2 @ 6000 LB. W/ ELECTRIC BRAKE
	HITCH-2 5/16" BALL
	TONGUE WEIGHT-APPROX. 550 LB
	TOTAL WEIGHT-5500 LB

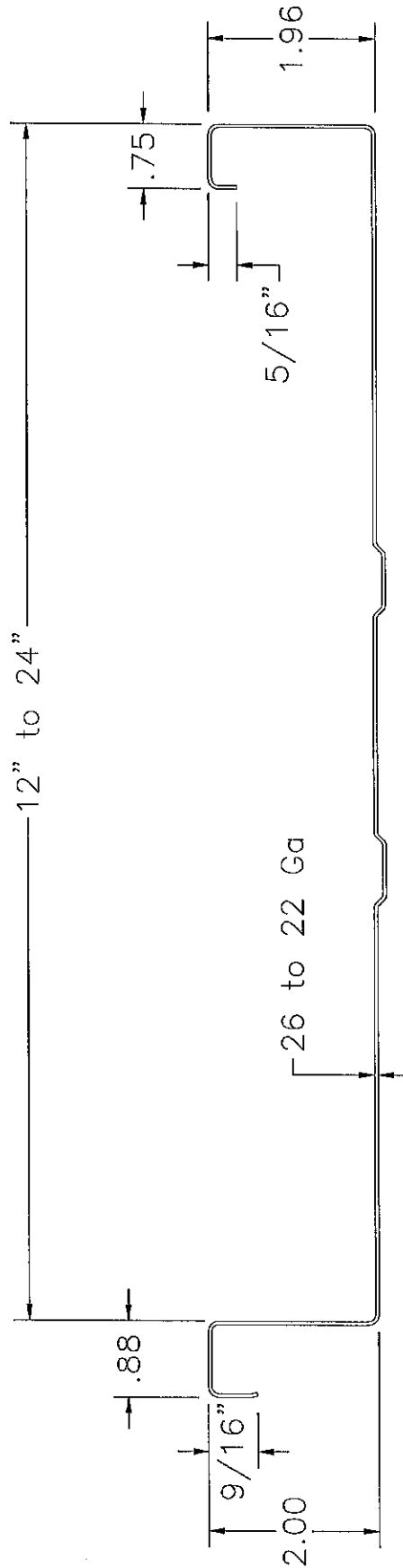
## **GENERAL SAFETY PRECAUTIONS**

1. BEFORE ATTEMPTING OPERATE THE MACHINE, READ THIS MANUAL COMPLETELY. THIS MANUAL IS PREPARED FOR YOUR SAFETY AND EASE OF OPERATION. FAILURE TO FOLLOW SAFE PROCEDURES AND OPERATING INSTRUCTIONS MAY RESULT IN INJURY OR DAMAGE TO THE MACHINE.
2. NEVER ATTEMPT TO ADJUST, CLEAN, OR REPAIR THIS EQUIPMENT WITH THE ENGINE RUNNING. USE CARE THAT NO ONE ATTEMPTS TO START THE MACHINE WHILE IT IS BEING WORKED ON.
3. USE CARE WHEN HANDLING COIL STOCK AND PANELS. EDGES MAY BE VERY SHARP AND PROPER HAND PROTECTION IS ADVISED.
4. DO NOT WEAR LOOSE CLOTHING, JEWELRY, ECT., WHILE OPERATING THIS MACHINE OR SEAMING MACHINES.
5. NEVER ATTEMPT TO FORM OR INSTALL PANELS IN HIGH WIND CONDITIONS.
6. WHEN LIFTING MACHINE, COILS, OPTIONAL TRAILER, OR ANY RELATED EQUIPMENT, DO NOT EXCEED THE RATED LIMITS OF ANY LIFTING DEVICE.
7. BE AWARE THIS EQUIPMENT IS A VIRTUAL CONVEYOR AND MAY CAUSE INJURY OR DAMAGE TO THE MACHINE BY ALLOWING FOREIGN OBJECTS TO TRAVEL ON THE COIL INTO THE MACHINE.
8. DO NOT ALLOW ANYONE TO OPERATE THIS EQUIPMENT WITHOUT PROPER INSTRUCTION OR TRAINING.
9. ALWAYS FOLLOW AND ADHERE TO ALL LOCAL AND NATIONAL SAFETY CODES CONCERNING OPERATION OF THIS AND ALL RELATED EQUIPMENT.
10. NEVER OPERATE THIS MACHINE WITHOUT GUARDS AND SAFETY COVERS IN PLACE.

**SAFETY IS COMMON SENSE-PLEASE BE CAREFUL**

## MAINTENANCE AND GENERAL INFORMATION

1. ALWAYS KEEP LIDS AND SAFETY COVERS ON DURING OPERATION AND STORAGE.
2. AVOID STORAGE OF THE MACHINE OUTDOORS FOR LONG PERIODS OF TIME. IF YOU COVER YOUR MACHINE WITH A TARP FOR OUTSIDE STORAGE, BE SURE TO PROVIDE GOOD VENTILATION TO PREVENT CONDENSATION.
3. ALWAYS KEEP THE MACHINE CLEAN. THIS WILL INSURE CONSISTENT QUALITY OF THE PRODUCT AND INCREASE THE LIFE OF THE MACHINE.
4. THE MAIN DRIVE CHAIN ON THE HYDRAULIC MOTOR SHOULD BE CHECKED PERIODICALLY FOR TENSION AND WEAR. TO ADJUST THE TENSION, LOOSEN THE 4 BOLTS IN THE MOTOR MOUNT AND USE THE JACK BOLTS TO TAKE UP THE SLACK. **DO NOT OVER TIGHTEN.**
5. ALL BEARINGS IN THE MACHINE ARE LIFETIME SEALED AND REQUIRE NO MAINTENANCE.
6. THE SHEAR BLADE AND DIES SHOULD BE LUBRICATED ON A REGULAR BASIS. USE A LIGHT- WEIGHT OIL OR SPRAY LUBRICANT. DO NOT USE A SILICONE BASE LUBRICANT. SILICONE HAS A TENDENCY TO BUILD UP AND CAUSE BINDING IN THE SHEAR.
7. THE CHAINS AND GEARS IN THE MACHINE WILL REQUIRE OCCASIONAL LUBRICATION. DO NOT APPLY TOO MUCH LUBRICANT AS IT WILL ATTRACT DIRT WHICH COULD BE TRANSFERRED TO THE PANEL. A LIGHT SYNTHETIC GREASE IS RECOMMENDED.
8. DO NOT USE SOLVENTS TO CLEAN THE POLYURETHANE COATED DRIVE ROLLERS. USE ONLY MINERAL SPIRITS.
9. A LIGHT OIL APPLIED TO THE SPOOL SHAFT WILL KEEP SPOOL SECTIONS EASY TO MOVE TO THE PROPER LOCATION.
10. GALVANIZE OR GALVALUME MATERIAL MUST BE PRE-OILED TO PREVENT BUILD-UP ON THE FORMING ROLLERS. SPECIFY LIGHT OIL ON COIL WHEN ORDERING. APPLICATION OF MINERAL OIL ON THE TOP AND BOTTOM FORMING ROLLERS, BEFORE RUNNING EACH COIL, WILL HELP PREVENT BUILD-UP. IF BUILD-UP OCCURS USE "GALV-OFF" OR SIMILAR PRODUCT TO REMOVE.
11. INSPECT MACHINE FOR FOREIGN OBJECTS AND LOOSE BOLTS EACH TIME THE MACHINE IS TRANSPORTED.
12. CHECK THE LEVEL OF THE HYDRAULIC OIL AT THE SIGHT GAUGE LOCATED ON THE RIGHT SIDE OF THE MACHINE. IF IT IS LOW, ADD MOBILE DTE25 OR EQUIVALENT. THE HYDRAULIC OIL SHOULD BE CHANGED AFTER 2000 HOURS OF OPERATION.
13. CHECK WHEEL LUGS, TIRE PRESSURE, BRAKES AND ALL LIGHTS BEFORE TRANSPORTING TRAILER TO JOB SITE.
14. REFER TO HONDA ENGINE OWNERS MANUAL FOR MAINTENANCE AND INFORMATION ON THE ENGINE.



## MODEL SS-2000

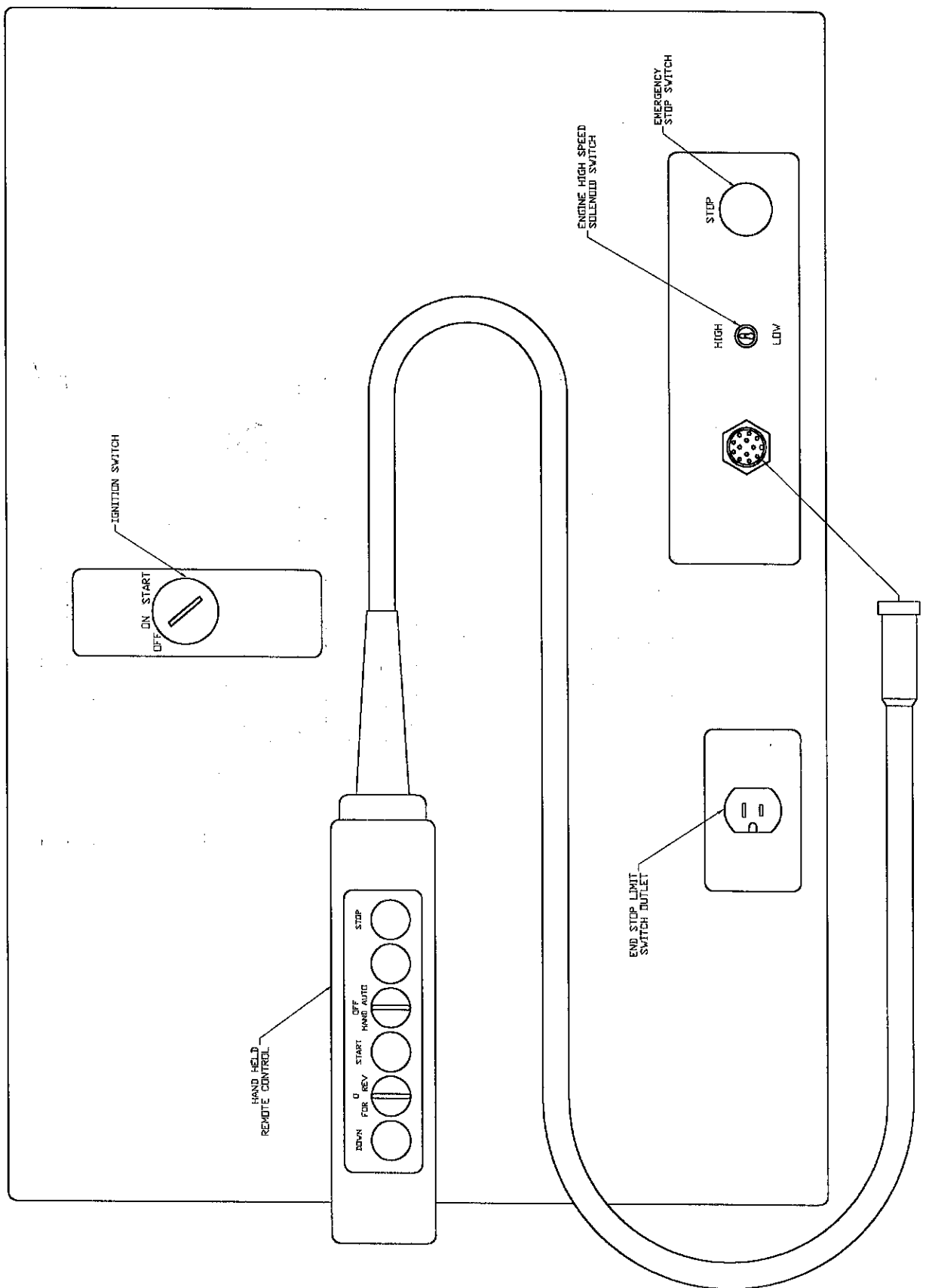


## OPERATING THE MACHINE

1. PLUG HAND HELD REMOTE CONTROL INTO THE 12 PIN CONNECTOR ON THE CONTROL PANEL.
2. CHECK THE THREE EMERGENCY STOP SWITCHES, ENTRY END OF THE MACHINE-CONTROL PANEL-HAND HELD REMOTE CONTROL, TO BE SURE THEY ARE ALL PULLED OUT.
3. MOVE THE FUEL VALVE LEVER TO THE ON POSITION. FOR COLD START, MOVE THE CHOKE LEVER TO THE CLOSED POSITION. (TO RE-START A WARM ENGINE, LEAVE THE CHOKE IN THE OPEN POSITION.) TURN THE KEY TO THE START POSITION AND HOLD UNTIL THE ENGINE STARTS. WHEN THE ENGINE STARTS, RELEASE THE KEY, ALLOWING IT TO RETURN TO THE ON POSITION. MOVE THE CHOKE LEVER TO THE OPEN POSITION AS THE ENGINE WARMS UP. *(READ HONDA ENGINES OWNER'S MANUAL BEFORE ATTEMPTING TO START.)*
4. TURN THE ENGINE HIGH SPEED SOLENOID SWITCH TO THE HIGH POSITION.
5. FOR MANUAL OPERATION PLACE THE HAND-OFF-AUTO SWITCH IN THE HAND POSITION. YOU MAY NOW JOG THE MACHINE FORWARD OR REVERSE USING THE FOR-O-REV SWITCH. THE SHEAR WILL OPERATE USING THE DOWN BUTTON.
6. FOR AUTOMATIC OPERATION, PLACE THE HAND-OFF-AUTO SWITCH IN THE AUTO POSITION. PLUG YOUR EXTENSION CORD INTO THE END STOP LIMIT SWITCH OUTLET AND PLUG THE END STOP LIMIT SWITCH INTO THE CORD. DEPRESS THE START BUTTON. A PANEL WILL RUN OUT UNTIL IT HITS THE END STOP LIMIT SWITCH. DEPRESS THE DOWN BUTTON TO ACTIVATE THE SHEAR CYCLE. WHEN THE PANEL IS REMOVED FROM THE END STOP LIMIT SWITCH, THE MACHINE WILL AUTOMATICALLY RUN ANOTHER PANEL.
7. **DEPRESSING ANY ONE OF THE THREE RED EMERGENCY STOP BUTTONS WILL STOP ALL OPERATIONS OF THE MACHINE.**
8. THE ENGINE MAY BE STOPPED BY TURNING THE KEY TO THE OFF POSITION.
9. IN THE EVENT OF A BATTERY FAILURE, THE ENGINE MAY BE STARTED USING THE RECOIL STARTER.

**REFER TO CONTROLS DIAGRAM NEXT PAGE.**

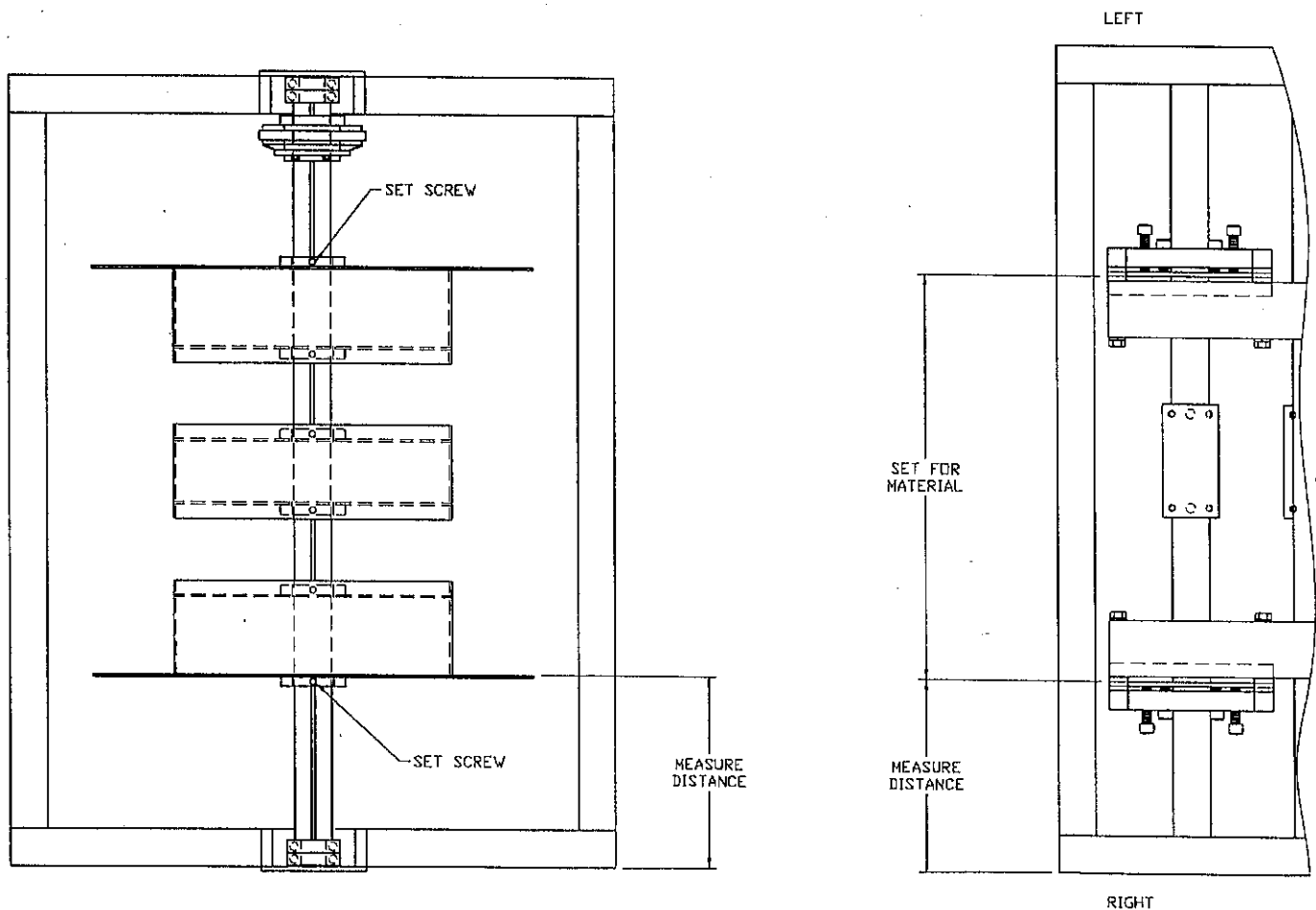




## ALIGNMENT OF THE SPOOL

ALIGNMENT OF THE COIL FEEDING INTO THE ENTRY GUIDES IS FAIRLY CRITICAL. TO OBTAIN PROPER ALIGNMENT, MEASURE THE DISTANCE FROM THE INSIDE OF THE RIGHT ENTRY GUIDE TO THE OUTSIDE OF THE MACHINE. (NOTE: THIS MEASUREMENT WILL ONLY BE ACCURATE AFTER THE MACHINE HAS BEEN SET FOR THE WIDTH OF MATERIAL TO BE RUN.)

SET THE RIGHT SIDE OF THE SPOOL TO THE SAME DIMENSION AS MEASURED IN THE MACHINE. USE THE SET SCREWS TO LOCK IN PLACE. LOCATE THE CENTER SECTION OF THE SPOOL APPROXIMATELY IN THE MIDDLE OF THE SPOOL SHAFT. IF YOU ARE USING THE EXPANDABLE SPOOL, LOCATE THE RIGHT EDGE OF THE COIL AT THE ENTRY GUIDE DIMENSION.



## **LOADING THE COIL**

AFTER THE RIGHT SIDE OF THE SPOOL IS PROPERLY LOCATED ON THE SPOOL SHAFT, REMOVE THE LEFT SPOOL SIDE AND SLIDE THE SPOOL ASSEMBLY THROUGH THE CENTER OF THE COIL.

REMEMBER TO LOCATE THE END OF THE COIL TO BE SURE THE MATERIAL IS COMING OFF THE ROLL IN THE PROPER DIRECTION FOR FEEDING INTO THE MACHINE.

AT TIMES THROUGH HANDLING OR TURNING THE COIL THE COIL BECOMES SLIGHTLY EGG SHAPED. IF THIS OCCURS, PLACE A STRAP AROUND THE COIL AND LIFT IT JUST ENOUGH TO CAUSE IT TO BECOME ROUND.

PLACE THE LEFT SPOOL SIDE AND BRAKE ASSEMBLY ON THE SHAFT AND FIX IN LOCATION.

THE SPOOL ASSEMBLY HAS CUT OUTS THROUGH THE SIDES TO ALLOW YOU TO USE A FORK LIFT OR A STRAP TO LIFT THE COIL INTO THE SPOOL STAND.

A LIFTING DEVICE ALSO HAS BEEN SUPPLIED TO ASSIST YOUR LOADING. TO USE THE LIFTING DEVICE PLACE THE HOOKS INTO THE CUT-OUTS OF THE SPOOL SIDES. THE MAXIMUM LOAD FOR THE COIL LIFTING DEVICE IS 4000 LBS.

WHEN PLACING THE COIL INTO THE SPOOL STAND, BE SURE THE BEARINGS ON THE END OF THE SPOOL SHAFT ARE IN PLACE. ALSO BE SURE THE BRAKE AND THE STOP BOLT FOR THE BRAKE WILL NOT INTERFERE AS IT IS LOWERED.

AFTER THE COIL IS LOADED INTO THE SPOOL STAND, SLIDE THE BRAKE ASSEMBLY OUT AGAINST THE SPOOL STAND. PLACE THE STOP BOLT INTO THE BRAKE PLATE, BETWEEN THE UPRIGHTS ON THE SPOOL STAND.

THE BRAKE ASSEMBLY IS ADJUSTABLE TO MAINTAIN THE PROPER AMOUNT OF TENSION ON THE COIL AS IT FEEDS THROUGH THE MACHINE. THERE SHOULD BE ENOUGH TENSION ON THE BRAKE TO KEEP THE COIL FROM UNWINDING AFTER THE MACHINE HAS STOPPED.

TO ADJUST THE BRAKE, USE THE THREE ADJUSTMENT SCREWS. TIGHTEN THE SCREWS FOR MORE TENSION AND LOOSEN THEM FOR LESS TENSION.

**REFER TO DIAGRAMS NEXT PAGE**



## SETTING THE WIDTH OF THE MACHINE

THE MACHINE IS DESIGNED TO RUN FROM 18" TO 30" WIDE MATERIAL. THE SUPPLIED CRANK HANDLE INSERTED INTO THE LEFT SIDE OF THE MACHINE AND ROTATED WILL CHANGE THE WIDTH OF THE MACHINE.

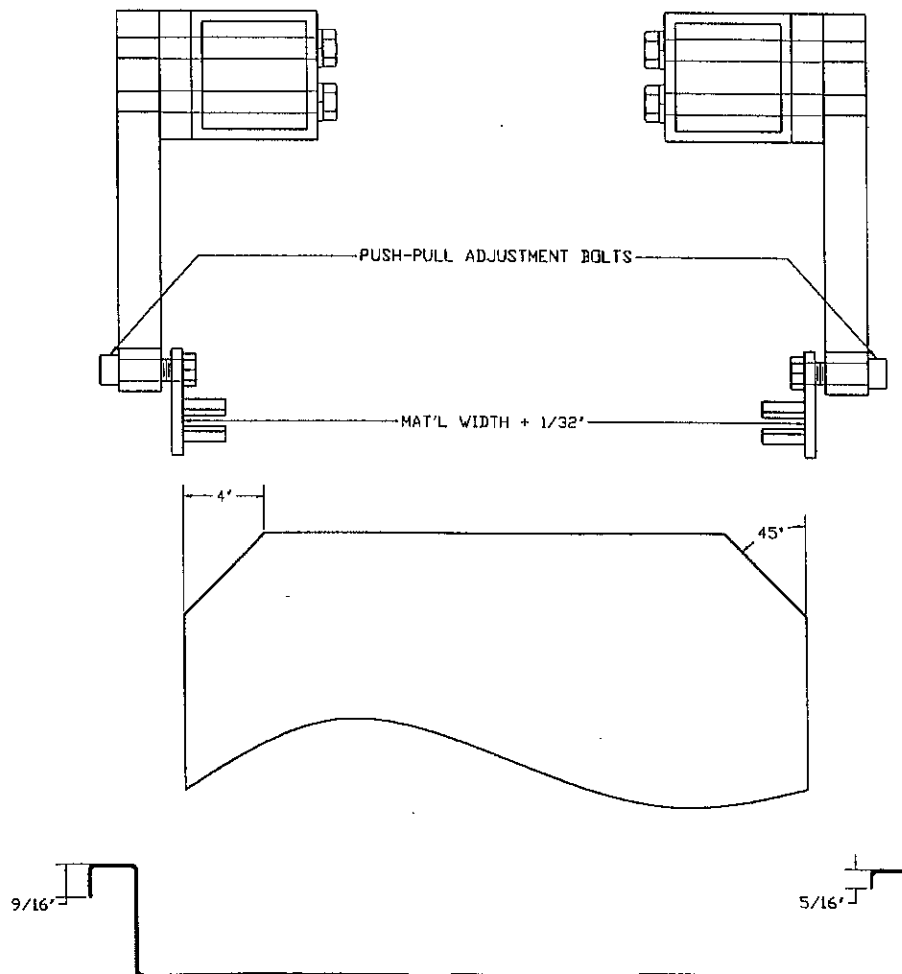
INSERT A SHORT PIECE OF COIL INTO THE ENTRY GUIDES AND ROTATE THE CRANK HANDLE TO SET THE MACHINE AS SHOWN.

USE THE PUSH-PULL ADJUSTMENT BOLTS TO ACHIEVE THE NOTED DIMENSIONS SHOWN ON THE PANEL. MOVING THE ENTRY GUIDES OUT WILL INCREASE THE LENGTH OF THE LEG AND MOVING THE ENTRY GUIDES IN WILL SHORTEN THE LEG. ANY ADJUSTMENT OF THE ENTRY GUIDES WILL REQUIRE RESETTING THE WIDTH OF THE MACHINE.

THE PANEL MAY BE RUN WITHOUT THE 5/16" DOWN RETURN ON THE MALE LEG OF THE PANEL. TO ACCOMPLISH THIS, MOVE THE RIGHT HAND ENTRY GUIDE IN APPROXIMATELY 5/16" AND RESET THE WIDTH OF THE MACHINE.

BE AWARE THAT DIFFERENT COIL TYPES AND GAUGES MAY REQUIRE A SMALL ADJUSTMENT TO MAINTAIN THE DIMENSIONS NOTED ON THE PANEL. BE SURE TO RUN OUT SOME SHORT SAMPLES AND CHECK FOR PANEL QUALITY AND A GOOD FIT WHEN PANELS ARE LAPPED TOGETHER.

TRIM THE LEADING CORNERS OF THE COIL AS SHOWN BEFORE FEEDING MATERIAL INTO THE MACHINE.



## STIFFENING RIBS

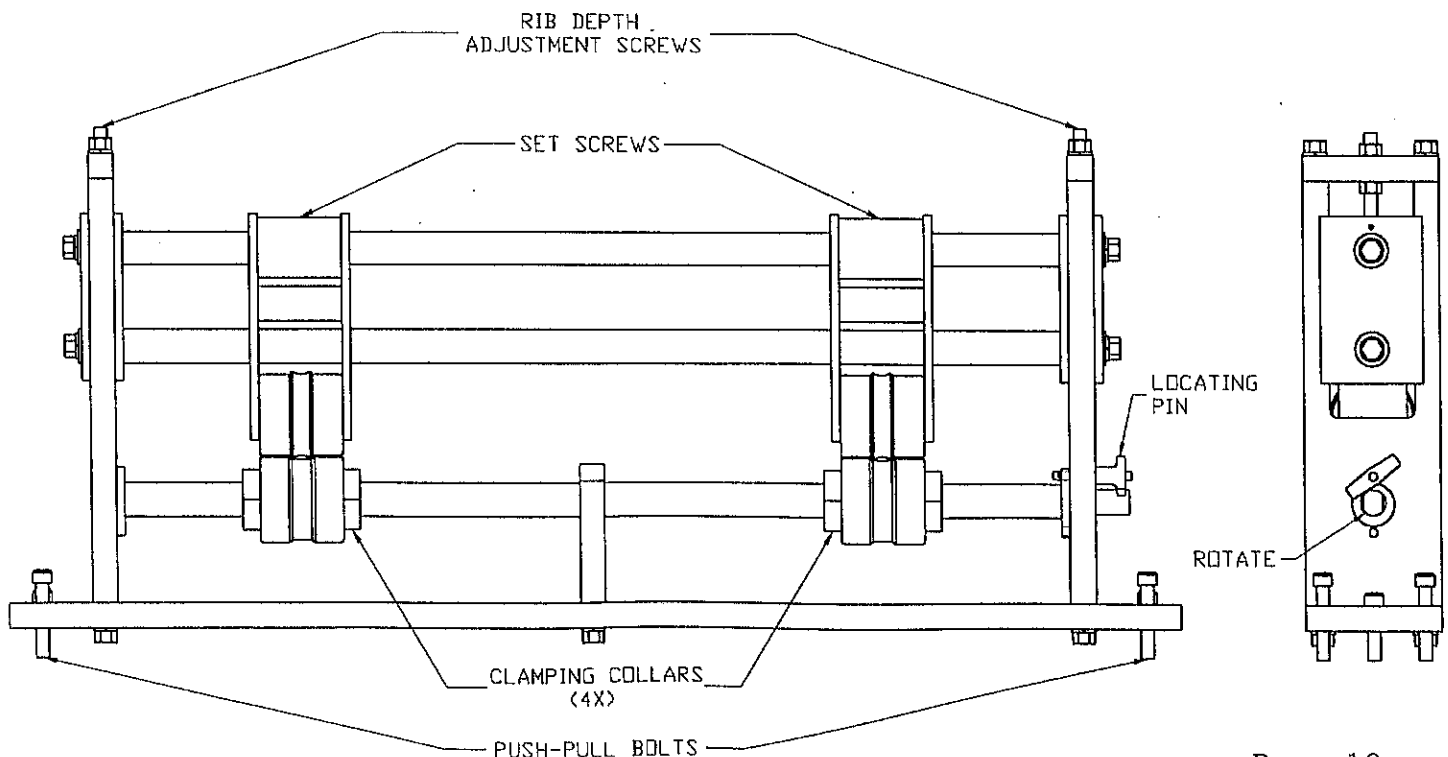
A STIFFENING RIB UNIT IS STANDARD EQUIPMENT ON THIS MACHINE. THE RIB ROLLER ASSEMBLY IS LOCATED AT THE EXIT END OF THE MACHINE BETWEEN THE LAST FORMING ROLLERS AND THE SHEAR ASSEMBLY.

THE PANEL MAY BE RUN WITH OR WITHOUT RIBS. TO ENGAGE RIB ROLLERS REMOVE THE LOCATING PIN IN LEFT SIDE OF THE RIB ROLLER ASSEMBLY. USE A 9/16" OPEN END WRENCH TO ROTATE THE BOTTOM SHAFT 180 DEGREES. REPLACE THE LOCATING PIN TO LOCK THE BOTTOM SHAFT IN PLACE. TO DISENGAGE THE RIBS, REVERSE THIS PROCEDURE.

THE RIB ROLLERS ARE ADJUSTABLE FROM LEFT TO RIGHT FOR THE DESIRED PLACEMENT IN DIFFERENT PANEL WIDTHS. TO LOCATE THE RIB ROLLERS IN THE DESIRED POSITION ON THE PANEL, DISENGAGE THE RIBS. LOOSEN THE ALLEN HEAD SCREW IN THE CLAMPING COLLARS ON EITHER SIDE OF THE ROLLERS ON THE BOTTOM SHAFT. SLIDE THE ROLLERS TO THE DESIRED LOCATION AND TIGHTEN THE CLAMPING COLLARS. LOOSEN THE SET SCREWS IN THE TOP RIB ROLLER UNITS AND LOCATE IN POSITION DIRECTLY ABOVE THE BOTTOM RIB ROLLERS AND TIGHTEN THE SET SCREWS. ENGAGE THE RIB ROLLERS AND CHECK TO BE SURE THERE IS NO INTERFERENCE BETWEEN THE TOP AND BOTTOM RIB ROLLERS. BE AWARE IF THE TOP AND BOTTOM RIB ROLLERS ARE IMPROPERLY ALIGNED AND THEN ENGAGED, DAMAGE MAY OCCUR TO THE ROLLERS.

THE RIB ROLLER ASSEMBLY IS ADJUSTABLE TO MATCH THE PASS LINE OF THE PANEL. USE THE PUSH-PULL BOLTS TO ADJUST TO THE PROPER LOCATION. THE HEIGHT SHOULD BE SET WHERE THE BOTTOM RIB ROLLER JUST TOUCHES THE PANEL WHEN THE RIB ROLLER ARE DISENGAGED.

THE DEPTH OF THE RIB MAY BE ADJUSTED USING THE ADJUSTMENT SCREWS ON THE TOP OF THE UNIT. DO NOT OVER TIGHTEN. ATTEMPTING TO PUT THE RIBS IN TOO DEEP MAY CAUSE DISTORTION IN THE PANEL.



## SETTING THE SHEAR

**DO NOT ATTEMPT TO MAKE ANY ADJUSTMENTS WITH THE ENGINE RUNNING OR THE POWER SOURCE CONNECTED!**

THE SHEAR DIE INSERTS NEED TO BE SET WHEN CHANGING WIDTH OF COIL OR ANYTIME A CHANGE IS MADE IN THE WIDTH ADJUSTMENT ASSEMBLY.

TO SET THE SHEAR DIE INSERTS, REMOVE THE 3/8" MOUNTING BOLTS (8 TOTAL) ON THE ENTRY AND EXIT SIDES OF THE SHEAR. SLIDE THE DIE INSERTS TO THE OUTSIDE OF THE MACHINE. CAREFULLY JOG THE PANEL UP TO THE SHEAR ASSEMBLY. ALIGN THE SHEAR DIE INSERTS WITH THE PANEL AND REPLACE THE MOUNTING BOLTS FINGER TIGHT. JOG THE PANEL THROUGH THE SHEAR ASSEMBLY. FINE ADJUST THE SHEAR DIE INSERTS AS CLOSE TO THE PANEL AS POSSIBLE WITHOUT TOUCHING. TIGHTEN ALL 8 MOUNTING BOLTS.

JOG A SHORT PANEL OUT OF THE MACHINE AND ACTIVATE THE SHEAR CYCLE. INSPECT THE PANEL FOR ANY MARKING OR DEFORMATION AND MAKE THE NECESSARY ADJUSTMENTS.

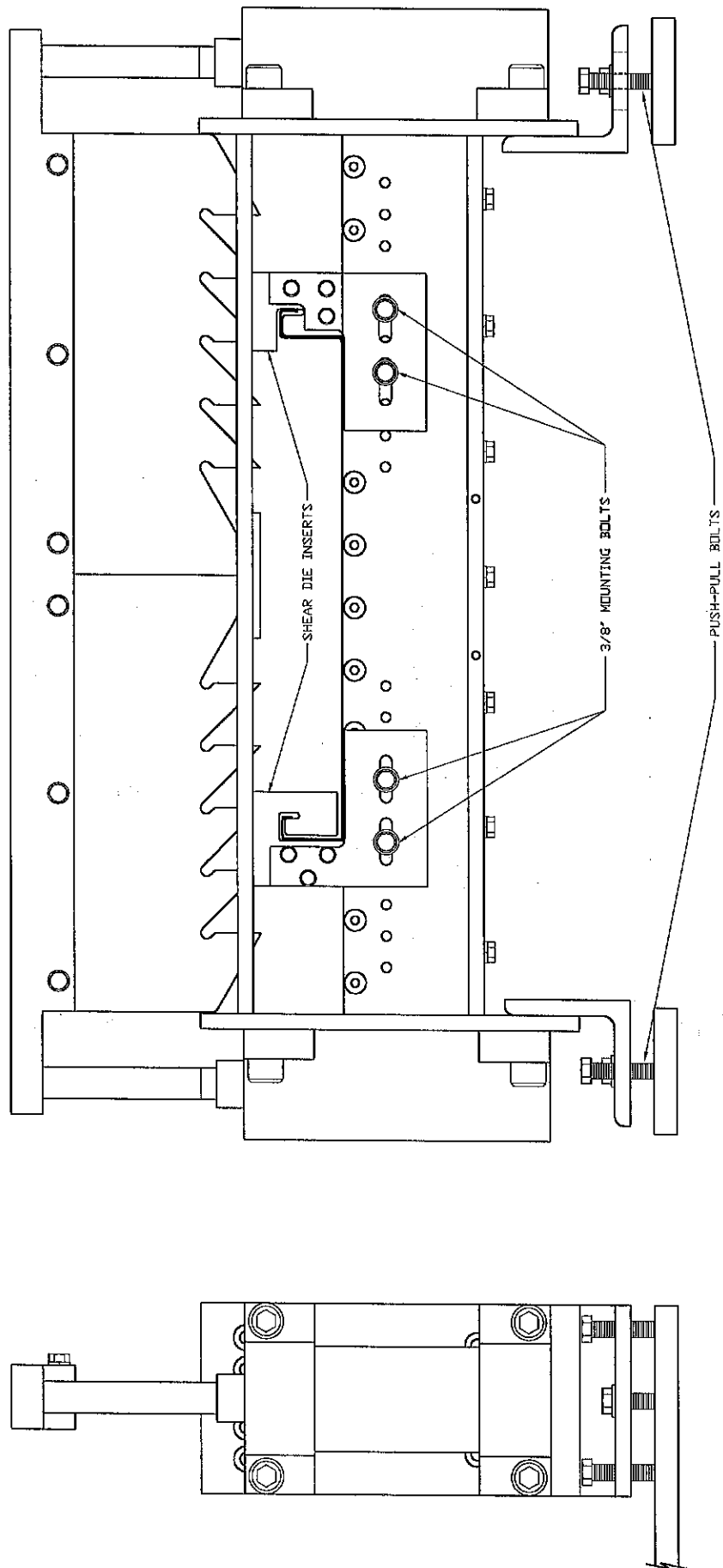
IF THE WIDTH OF THE MATERIAL YOU ARE USING CAUSES THE POINT OF THE SHEAR BLADE TO HIT DIRECTLY ON TOP OF ONE OF THE PANEL LEGS, THE SHEAR ASSEMBLY MAY NEED TO BE ADJUSTED Laterally. TO DO THIS, LOOSEN THE CENTER BOLTS IN THE SHEAR MOUNTING ANGLE. MOVE THE SHEAR TO THE LEFT OR RIGHT TO POSITION THE POINT OF THE BLADE OFF THE LEG OF THE PANEL AND TIGHTEN THE BOLTS. THE SHEAR CANNOT BE MOVED LEFT OR RIGHT WITHOUT RESETTNG THE SHEAR DIE INSERTS.

THE HEIGHT OF THE SHEAR ASSEMBLY IS ADJUSTABLE BY USE OF THE PUSH-PULL BOLTS IN THE SHEAR MOUNTING ANGLES. TO RAISE THE SHEAR ASSEMBLY, LOOSEN THE CENTER BOLT AND TIGHTEN THE TWO OUTSIDE BOLTS. REVERSE THIS PROCEDURE TO LOWER THE SHEAR ASSEMBLY. SET THE HEIGHT OF THE SHEAR TO JUST CLEAR THE BOTTOM OF THE PANEL.

A SHEAR ASSEMBLY ADJUSTED IMPROPERLY WILL AFFECT THE STRAIGHTNESS AND QUALITY OF THE PANEL.

**REFER TO SHEAR ASSEMBLY DIAGRAM NEXT PAGE**

VIEW FROM EXIT END



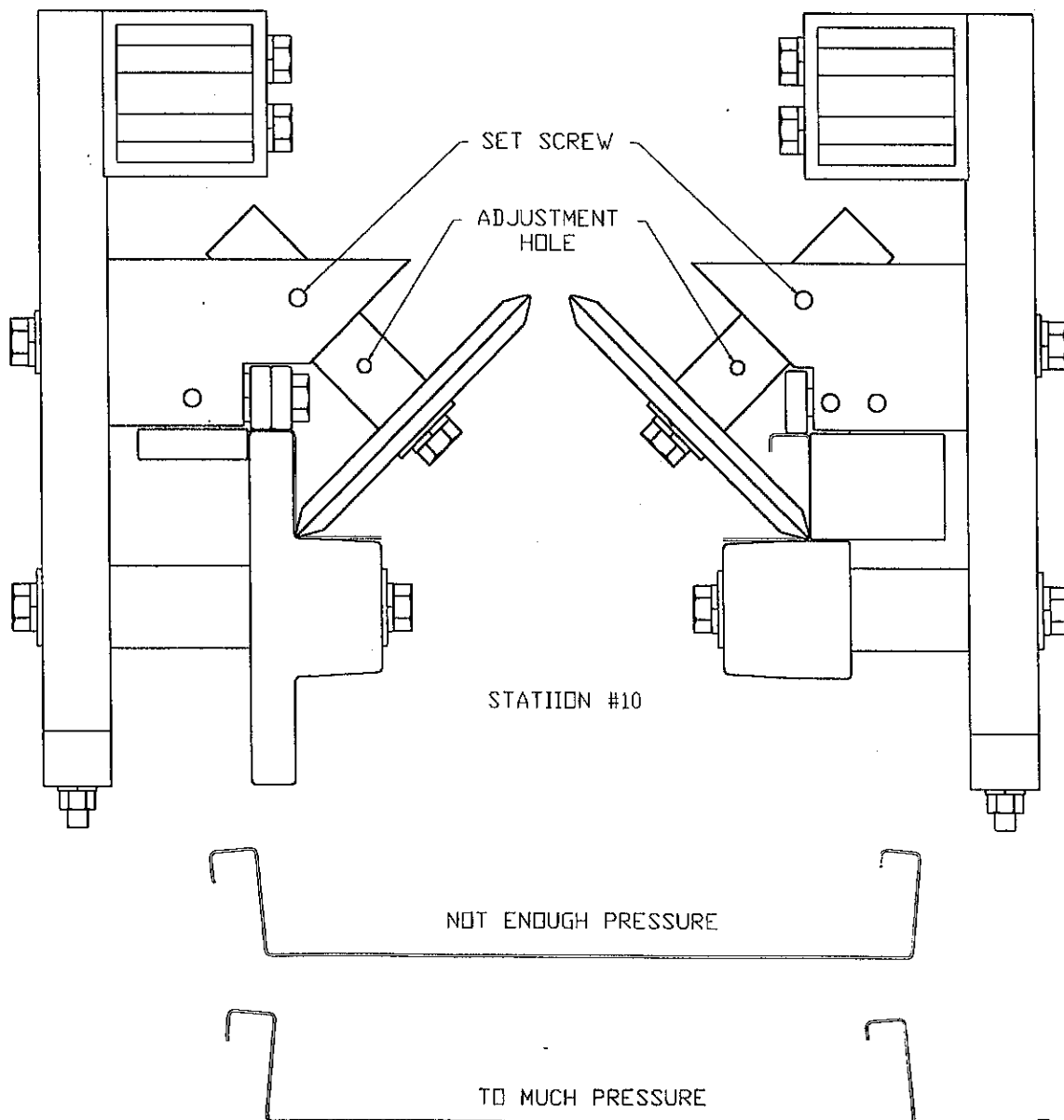


## PROFILE ADJUSTMENTS

STATION #10, LEFT AND RIGHT, HAVE TOP ROLLERS MOUNTED ON AN ECCENTRIC SHAFT AT AN ANGLE TO THE BOTTOM OF THE PANEL. THESE STATIONS ARE USED TO HELP MAINTAIN 90 DEGREES ON THE VERTICAL LEGS OF THE PANEL.

TO ADJUST LOOSEN THE SET SCREW IN THE ANGLE BLOCK AND INSERT THE 3/16" ALLEN WRENCH IN THE DRILLED HOLE IN THE ECCENTRIC SHAFT AND ROTATE THE SHAFT. MAKE THIS ADJUSTMENT WITH MATERIAL IN THE MACHINE TO INSURE THE ANGLE ROLLER IS SET IN THE CORNER OF THE PANEL.

MAKE THIS AND ALL ADJUSTMENTS IN SMALL INCREMENTS. BE AWARE THAT OVER ADJUSTING MAY HAVE A NEGATIVE EFFECT ON THE PANEL OR MAY CAUSE DAMAGE TO THE MACHINE.



## CURVATURE ADJUSTMENTS

STATION #9 AND STATION #10 IN THE MACHINE ARE ADJUSTABLE TO INSURE THE PANEL WILL RUN WITHOUT UPHILL OR DOWNHILL CURVATURE.

UPHILL CURVATURE IS WHEN BOTH ENDS OF A PANEL RISE UP FROM A FLAT SURFACE WHILE THE CENTER TOUCHES. DOWNHILL CURVATURE IS WHEN BOTH ENDS OF A PANEL TOUCH A FLAT SURFACE AND THE CENTER IS RAISED UP.

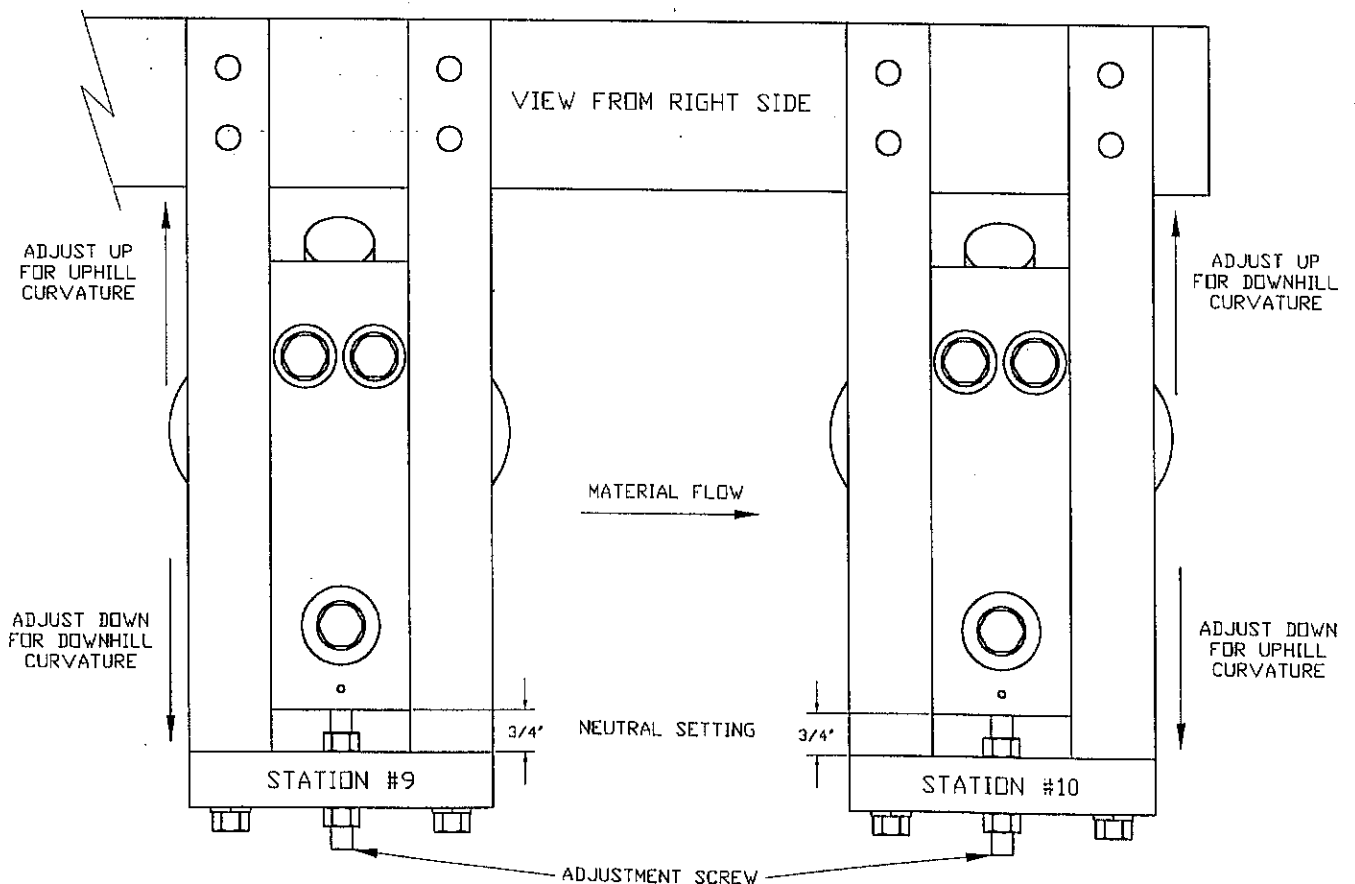
IF A PANEL HAS UPHILL CURVATURE, ADJUST STATION #9 UP. THE PANEL SHOULD REACT TO A SMALL AMOUNT OF ADJUSTMENT. MAKE THE ADJUSTMENTS IN  $\frac{1}{4}$  TO  $\frac{1}{2}$  TURN INCREMENTS. JOG THE MACHINE FORWARD PAST THE ADJUSTMENT AND CUT. RUN A PANEL LONG ENOUGH TO SEE IF THE DESIRED RESULT WAS ACHIEVED. IF THE PANEL STILL HAS UPHILL CURVATURE, ADJUST STATION #10 DOWN. AT NO TIME SHOULD MORE THAN  $1 \frac{1}{2}$  TURNS OF EACH ADJUSTMENT SCREW BE REQUIRED.

IF ADJUSTMENTS ARE MADE AND THE RESULTS ARE NOT SATISFACTORY, RESET STATION #9 AND STATION #10 AT THE NEUTRAL POSITION, AND ATTEMPT THE PROCEDURE AGAIN.

IF THE PANEL HAS DOWNHILL CURVATURE REVERSE THE ABOVE ADJUSTMENT PROCEDURE.

THE SAME ADJUSTMENT PROCEDURE IS USED FOR BOTH THE MALE AND FEMALE LEGS OF THE PANEL.

IF ADJUSTMENTS ARE MADE TO STATION #10, THE HEIGHT OF THE SHEAR MAY NEED TO BE RESET.



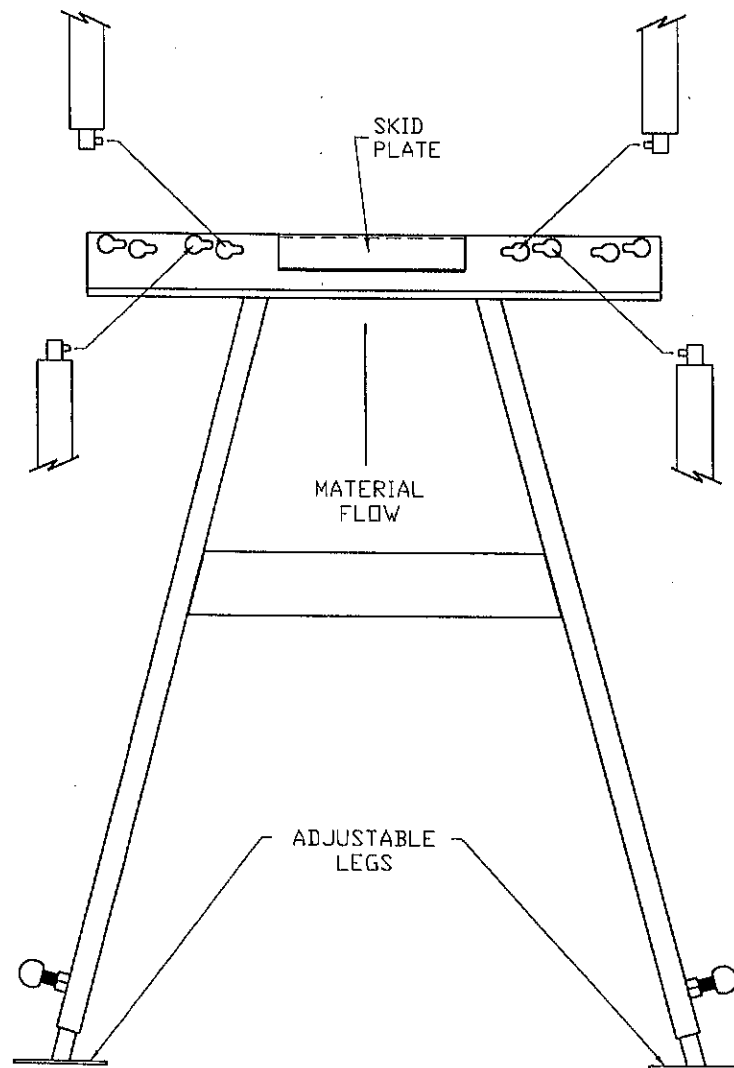
## THE RUN-OUT STANDS

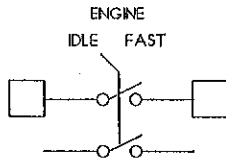
THE RUN-OUT STANDS HAVE KEYED HOLES FOR MOUNTING THE RUN-OUT POLES. THESE KEYED HOLES HAVE TWO DIFFERENT HEIGHTS.

TO PROPERLY SET UP THE RUN-OUT STANDS THE RUN-OUT POLES MUST BE MOUNTED IN THE HIGHEST HOLES ON THE ENTRY SIDE OF THE RUN-OUT STAND AND IN THE LOWEST HOLES ON THE EXIT SIDE OF THE RUN-OUT STAND. THE STAND MUST ALSO BE PLACED WITH THE SKID PLATE TOWARD THE ENTRY END. IF THE STANDS ARE SET UP IN THIS MANNER, THE PANEL WILL RUN OUT WITH OUT CATCHING ON THE STANDS.

THE END STOP LIMIT SWITCH IS MOUNTED BY SLIDING IT ON THE RUN-OUT POLE AND LOCKING IT IN THE DESIRED LOCATION WITH THE THUMB SCREW.

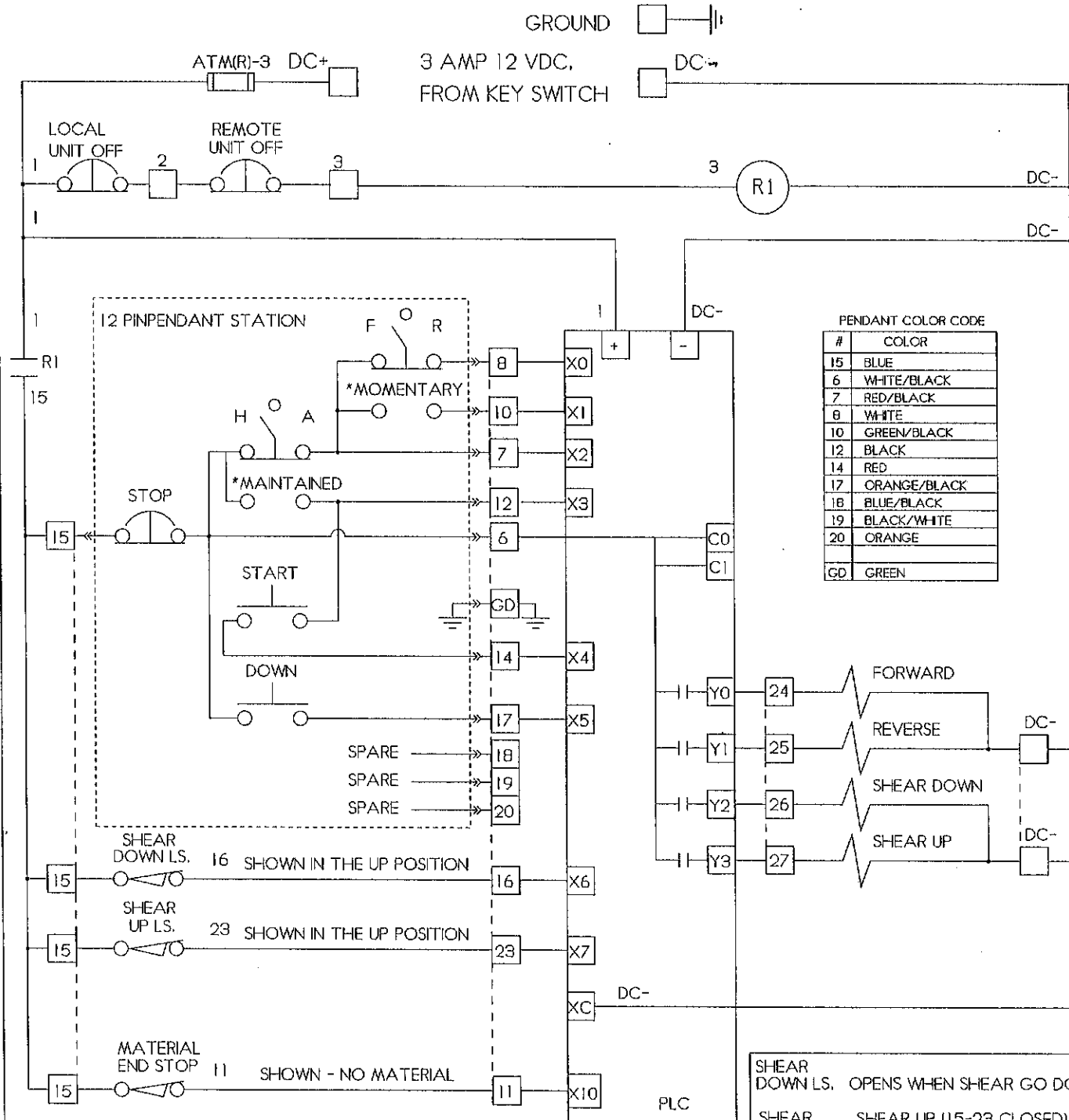
USE THE ADJUSTABLE LEGS TO MAKE SURE THE STANDS ARE LEVEL WITH THE MACHINE.





GROUND

3 AMP 12 VDC,  
FROM KEY SWITCH



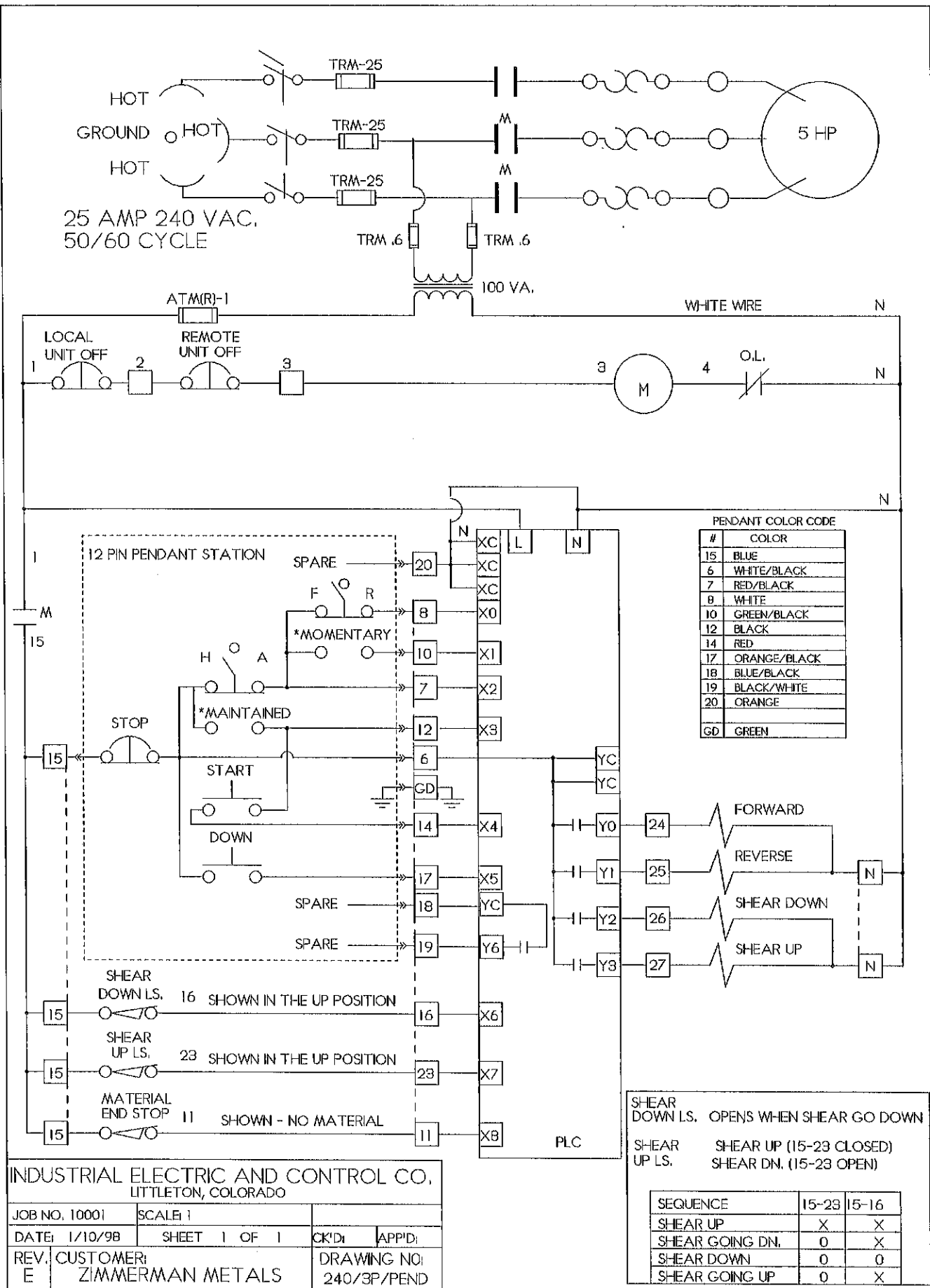
INDUSTRIAL ELECTRIC AND CONTROL CO.  
LITTLETON, COLORADO

JOB NO. 10001	SCALE: 1	
DATE: 2/3/98	SHEET 1 OF 1	CK'D: APP'D:
REV. E	CUSTOMER: ZIMMERMAN METALS	DRAWING NO: MAIN_DC_12

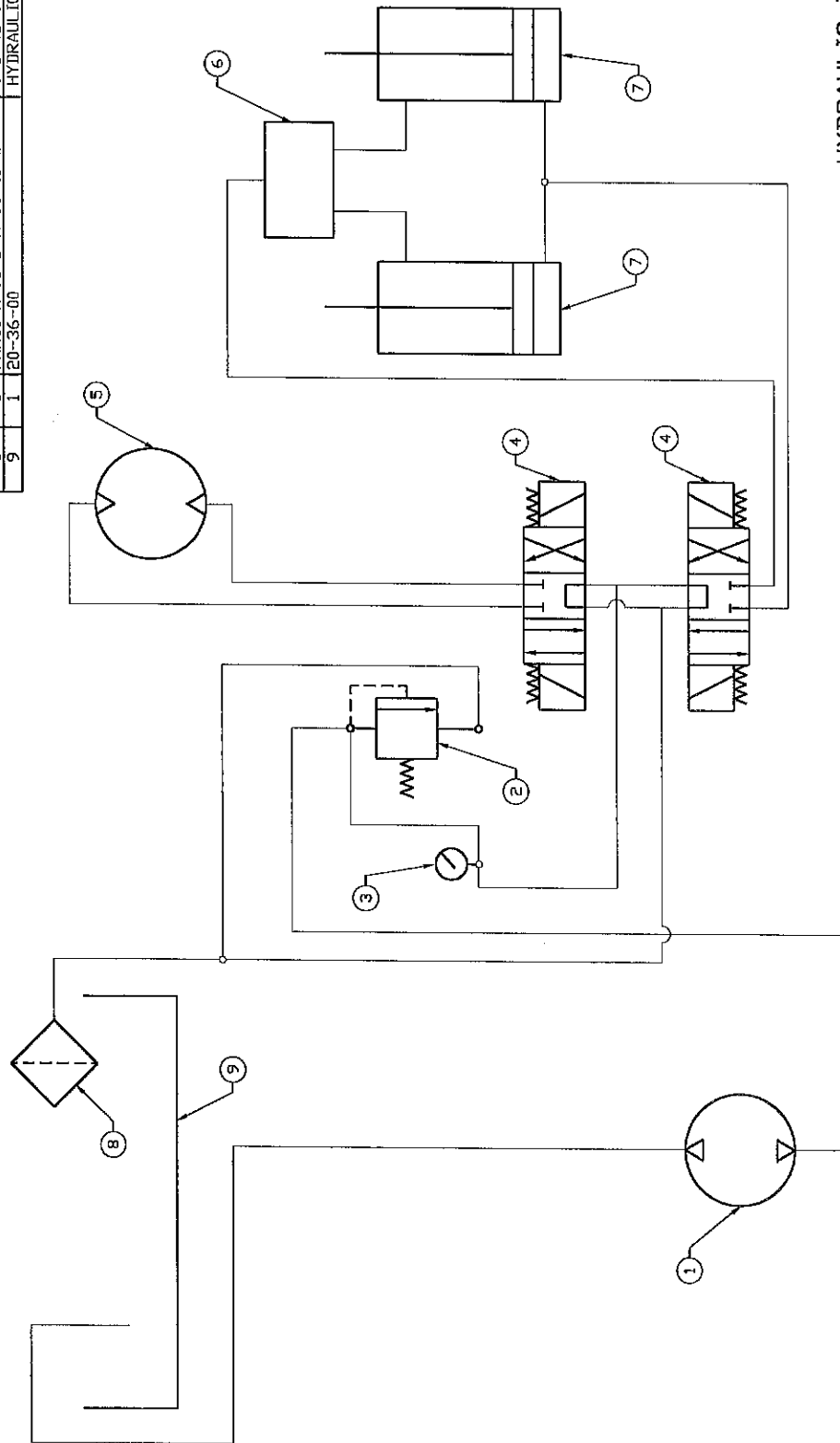
SHEAR DOWN LS. OPENS WHEN SHEAR GO DOWN

SHEAR UP LS. SHEAR UP (15-23 CLOSED) SHEAR DN. (15-23 OPEN)

SEQUENCE	15-23	15-16
SHEAR UP	X	X
SHEAR GOING DN.	0	X
SHEAR DOWN	0	0
SHEAR GOING UP	0	X



ITEM	QTY	PART NO.	DESCRIPTION
1	1	1300635	BARNES 'S' SERIES PUMP
2	1	PI2S-RP-300-G-S-B	CONTINENTAL RELIEF VALVE
3	1	CF1P-210A	PDI PRESSURE GAUGE
4	2	VS12M-3L-GB-75-H	CONTINENTAL SLEENOID VALVE
5	1	103-1013-010	CHAR-LYNN HYD MOTOR
6	1	1300635	BARNES FLOW DIVIDER
7	2	H-02S-SL-0100-1-NC-S-P-5.00	ATLAS HYD CYLINDER
8	1	FRA31-N-06-B-N-CC-01-W	UFI RETURN LINE FILTER
9	1	20-36-00	HYDRAULIC TANK



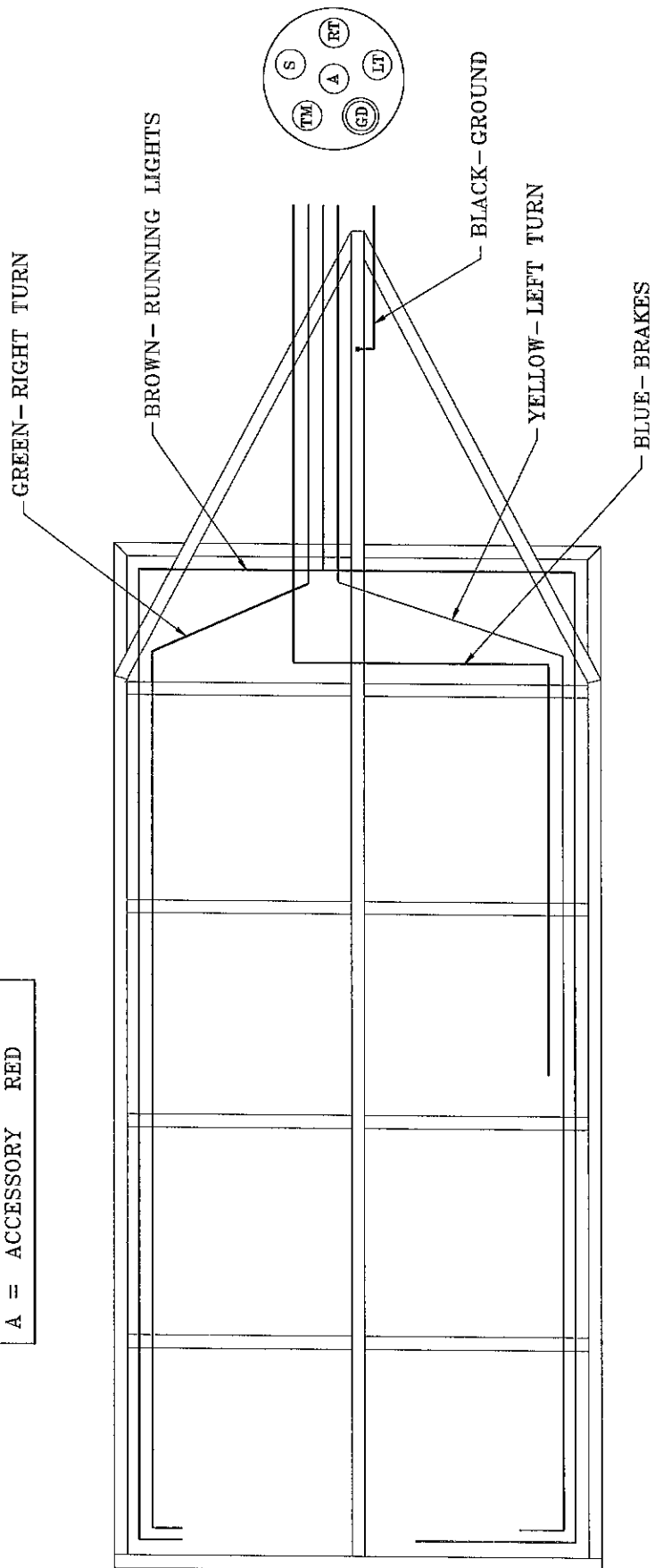
HYDRAULIC DIAGRAM

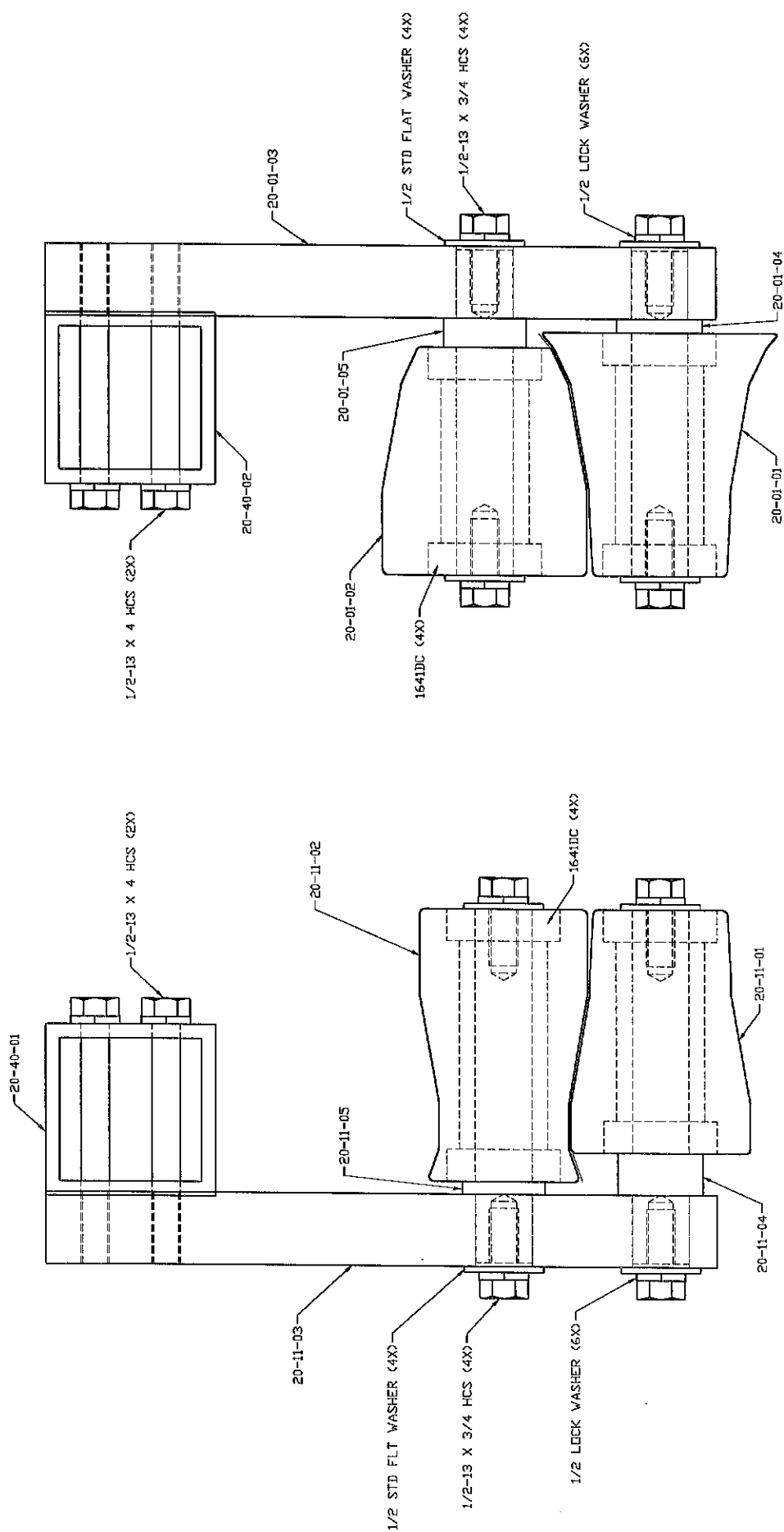
PART NO.	20-00-36
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	

24-90-WD

# TRAILER WIRING DIAGRAM

TM=	TAIL LIGHTS	BROWN
GD=	GROUND	BLACK
LT=	LEFT TURN	YELLOW
RT=	RIGHT TURN	GREEN
S =	BRAKES	BLUE
A =	ACCESSORY	RED

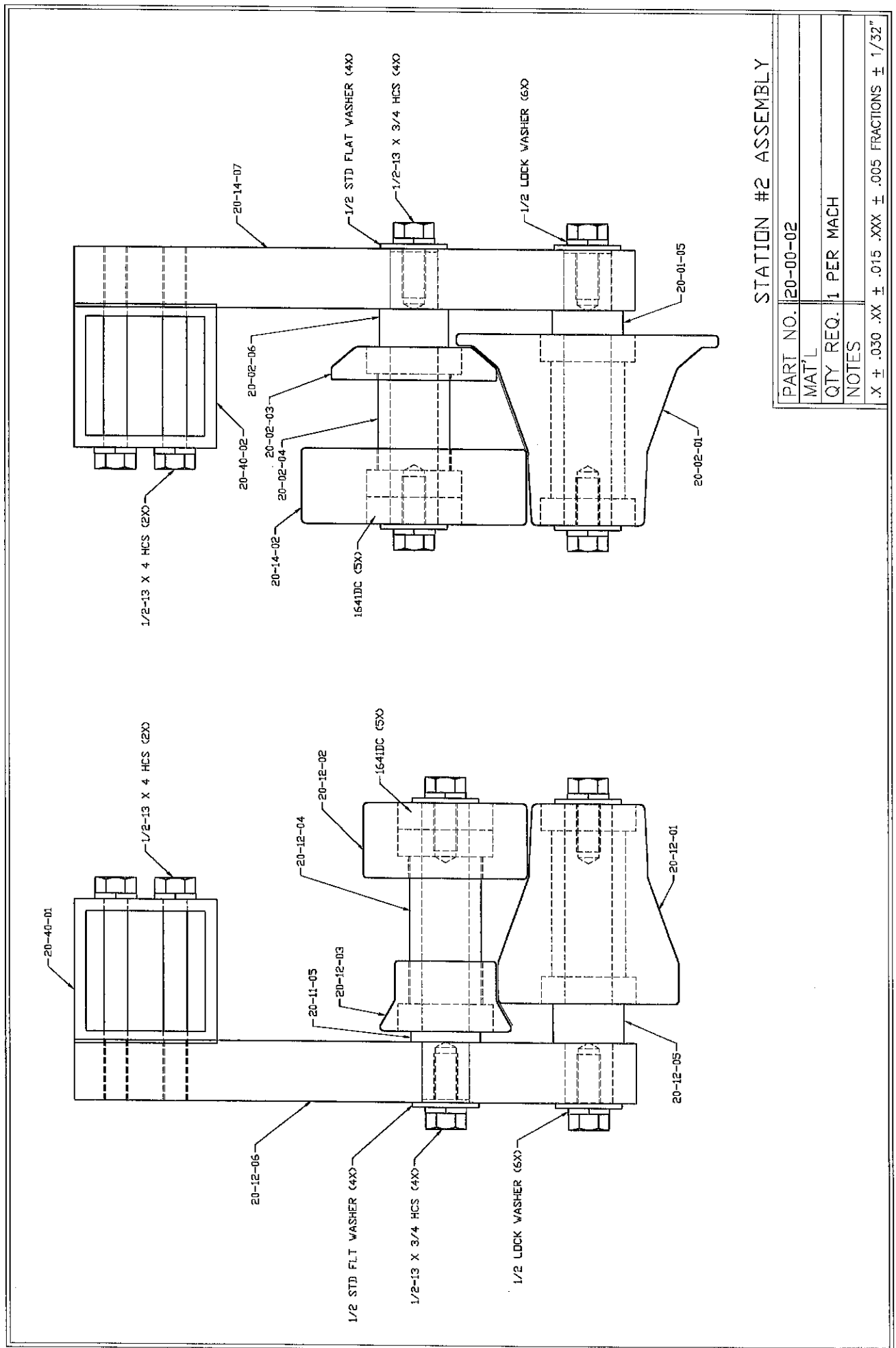




# STATION #1 ASSEMBLY

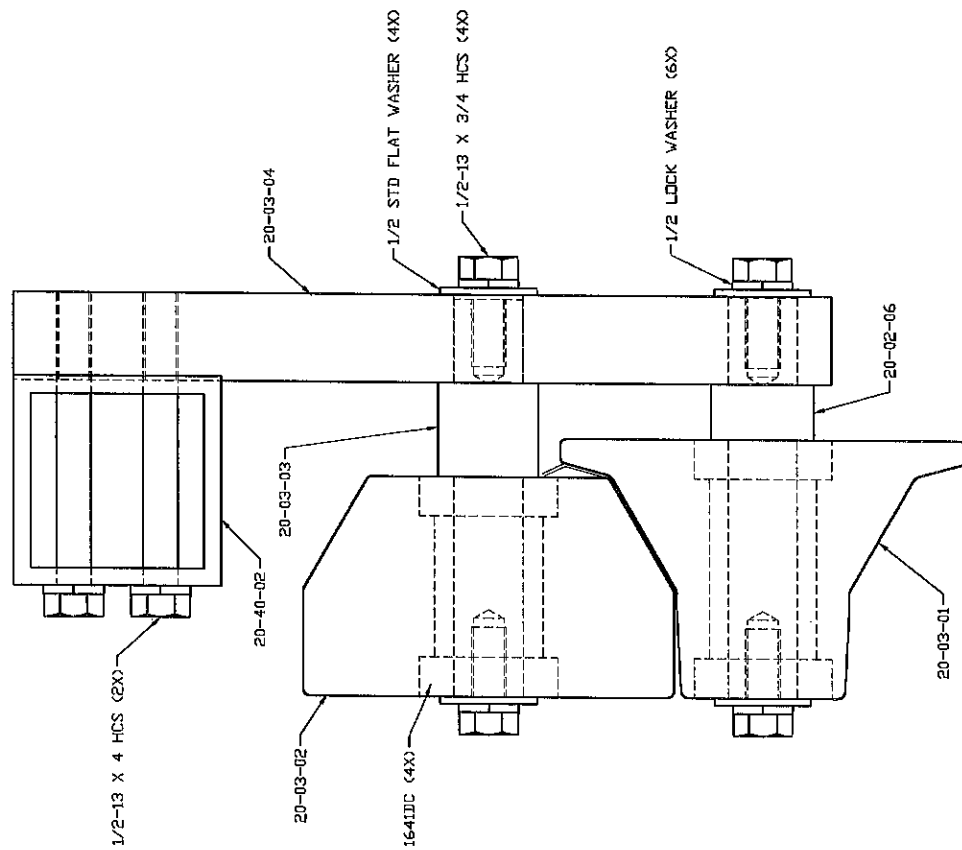
PART NO.	20-00-01
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	





# STATION #2 ASSEMBLY

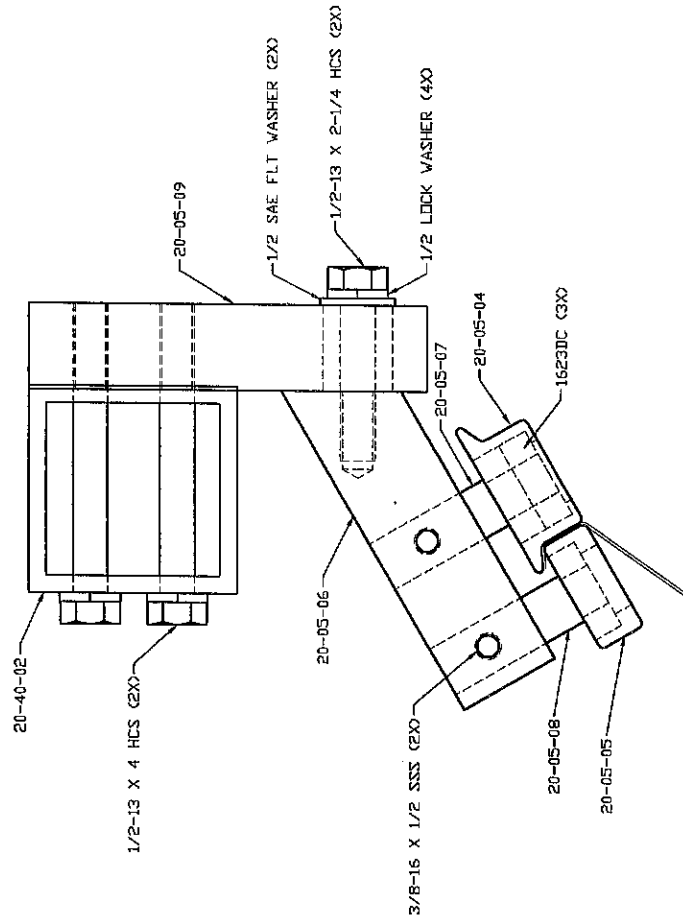
PART NO.	20-00-02
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	



PART NO.	20-00-03
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	

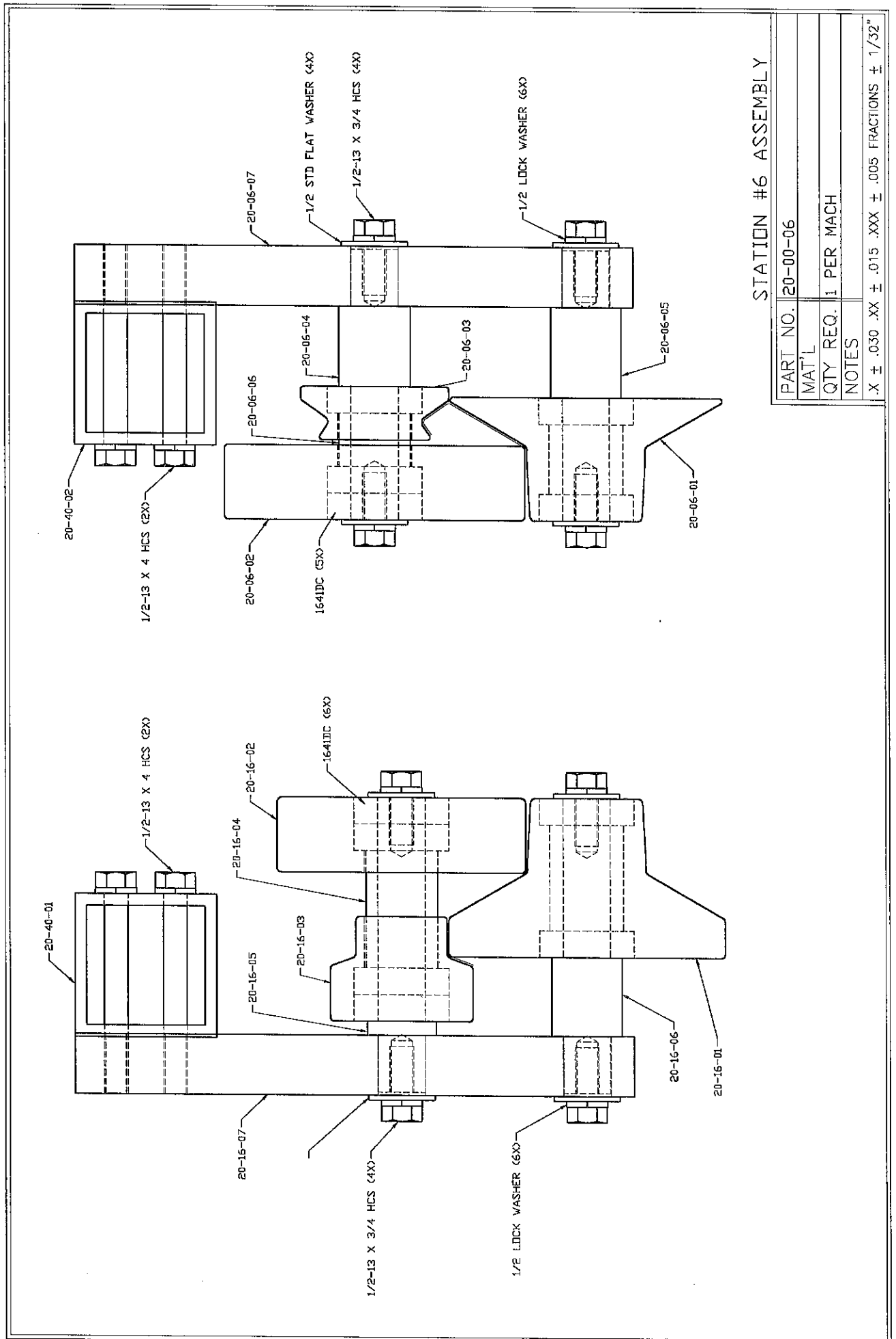






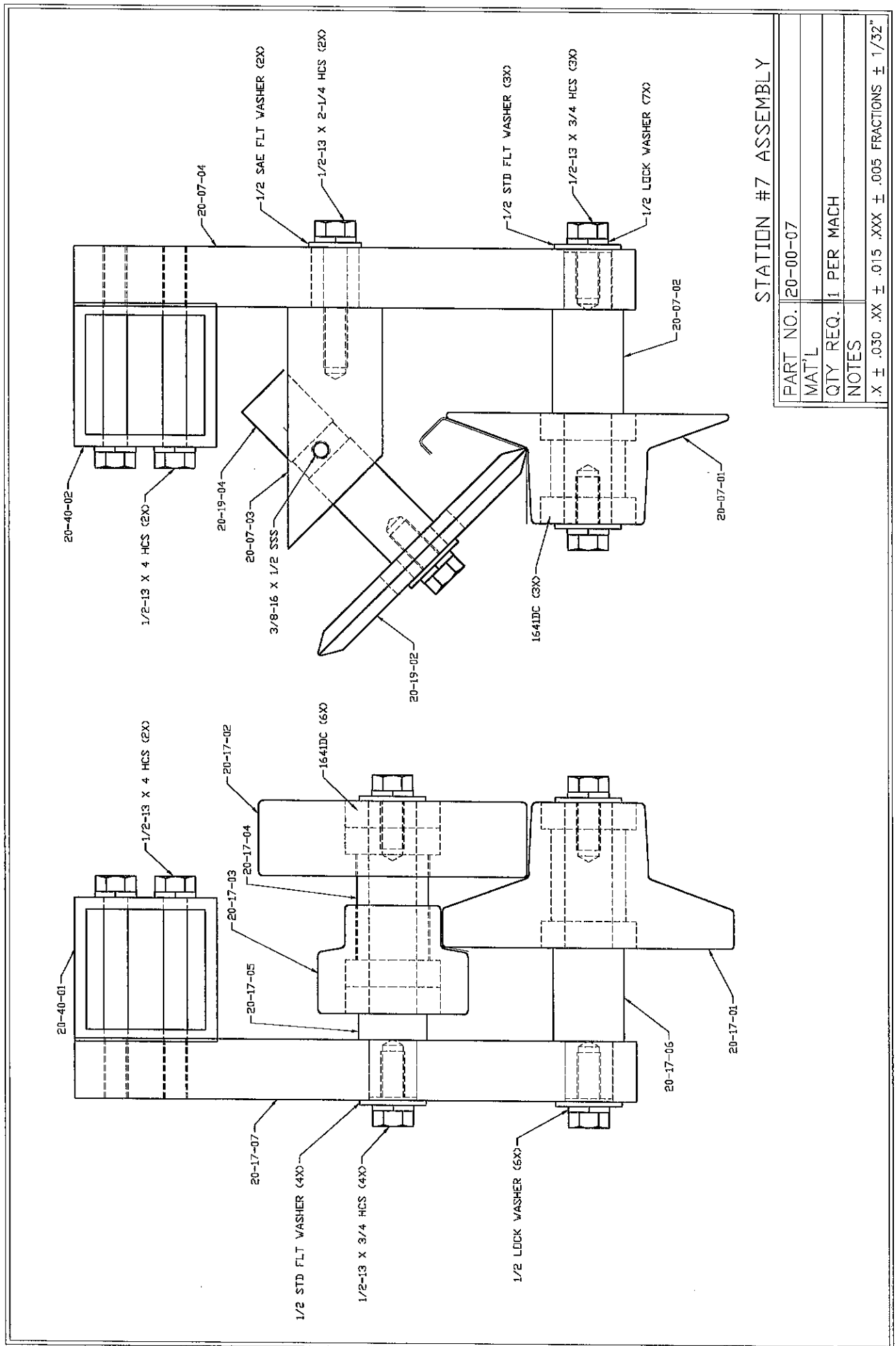
# STATION #5A ASSEMBLY

PART NO.	20-00-05A
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	



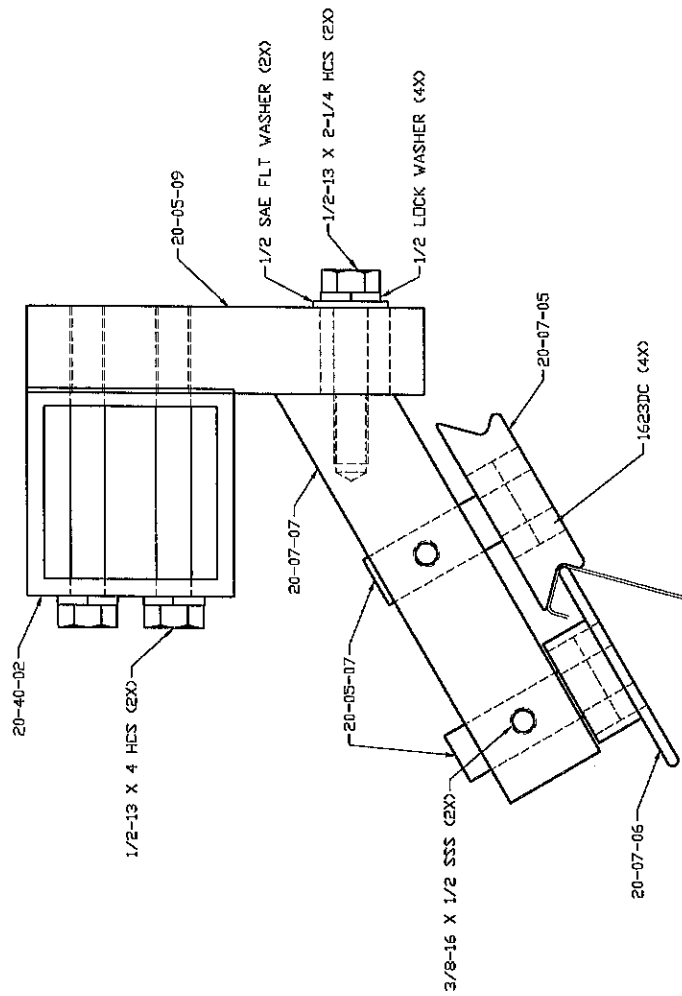
# STATION #6 ASSEMBLY

PART NO.	20-00-06
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	



# STATION #7 ASSEMBLY

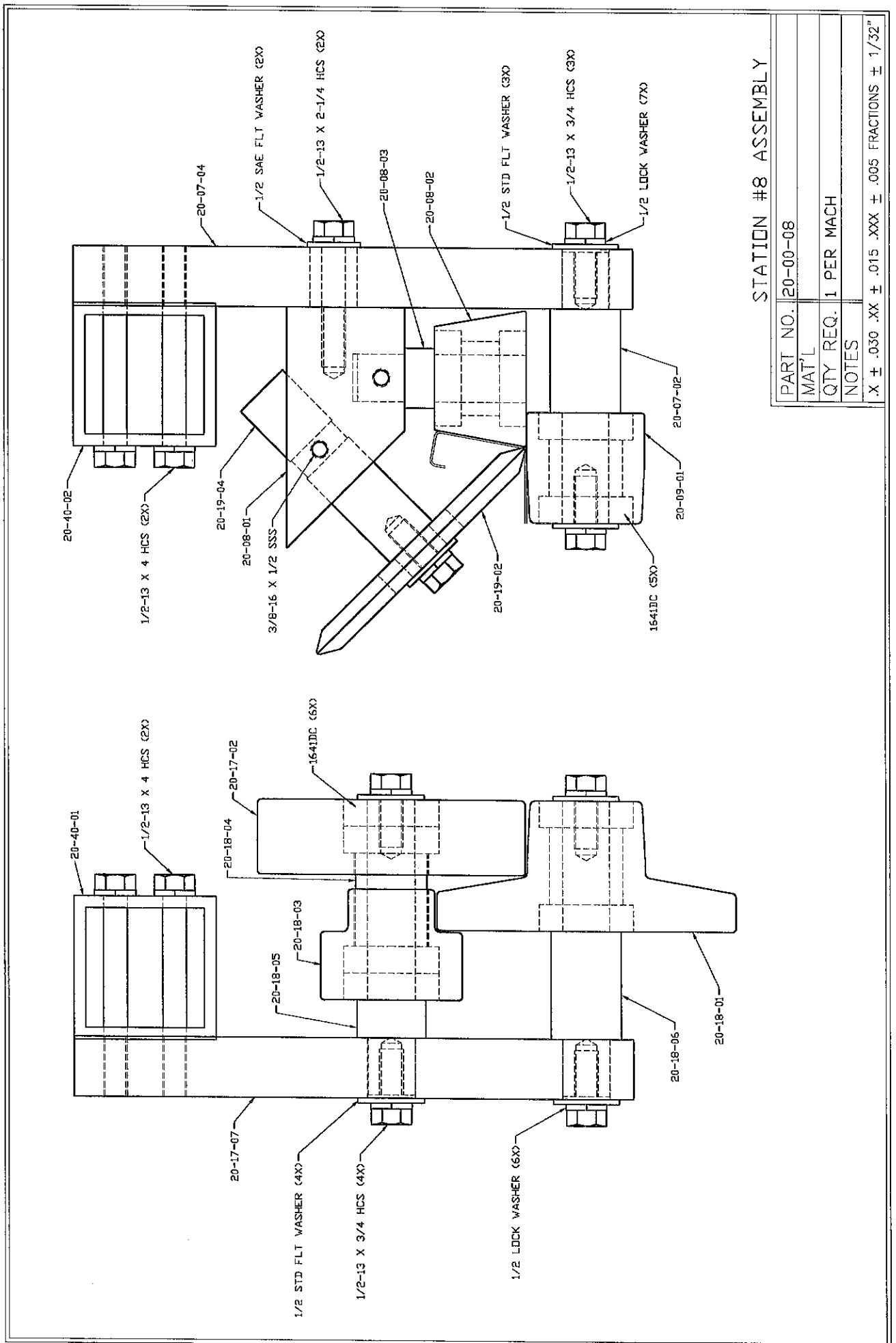
PART NO.	20-00-07
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	



# STATION #7A ASSEMBLY

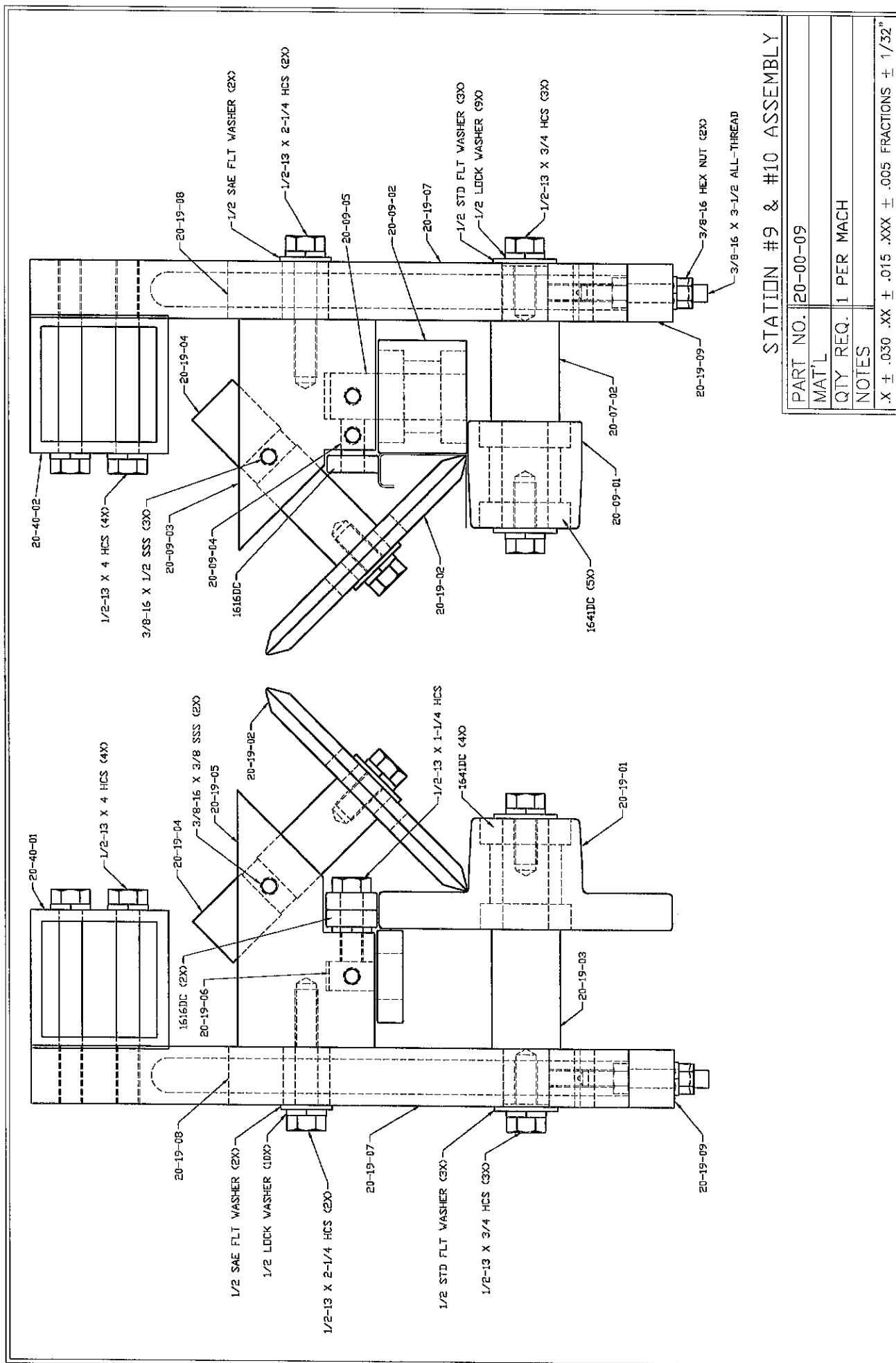
PART NO.	20-00-07A
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	





# STATION #8 ASSEMBLY

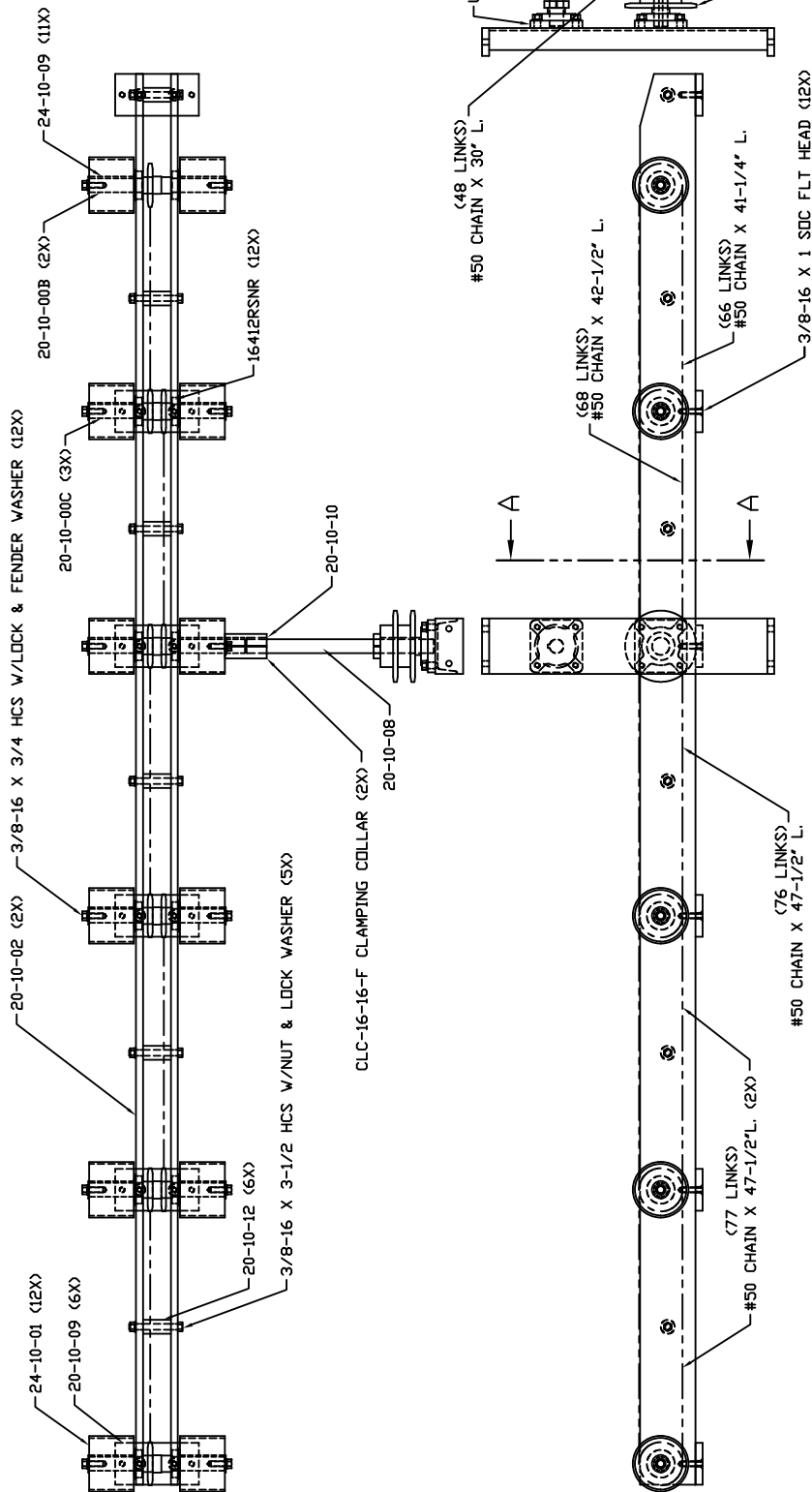
PART NO.	20-00-08
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	



# STATION #9 & #10 ASSEMBLY

PART NO.	20-00-09
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
	.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"

DATE	REV	REVISIONS	BY
11/20/99	A	MOVED TOP DRIVE SHAFT UP 3/8"	-
4/19/16	B	REVISED UPPER GEAR BEARING BLOCK MOUNTING DESIGN	CEL
11/29/16	C	REVISED PART NUMBERS 20-10-18, 19, -20	RCV



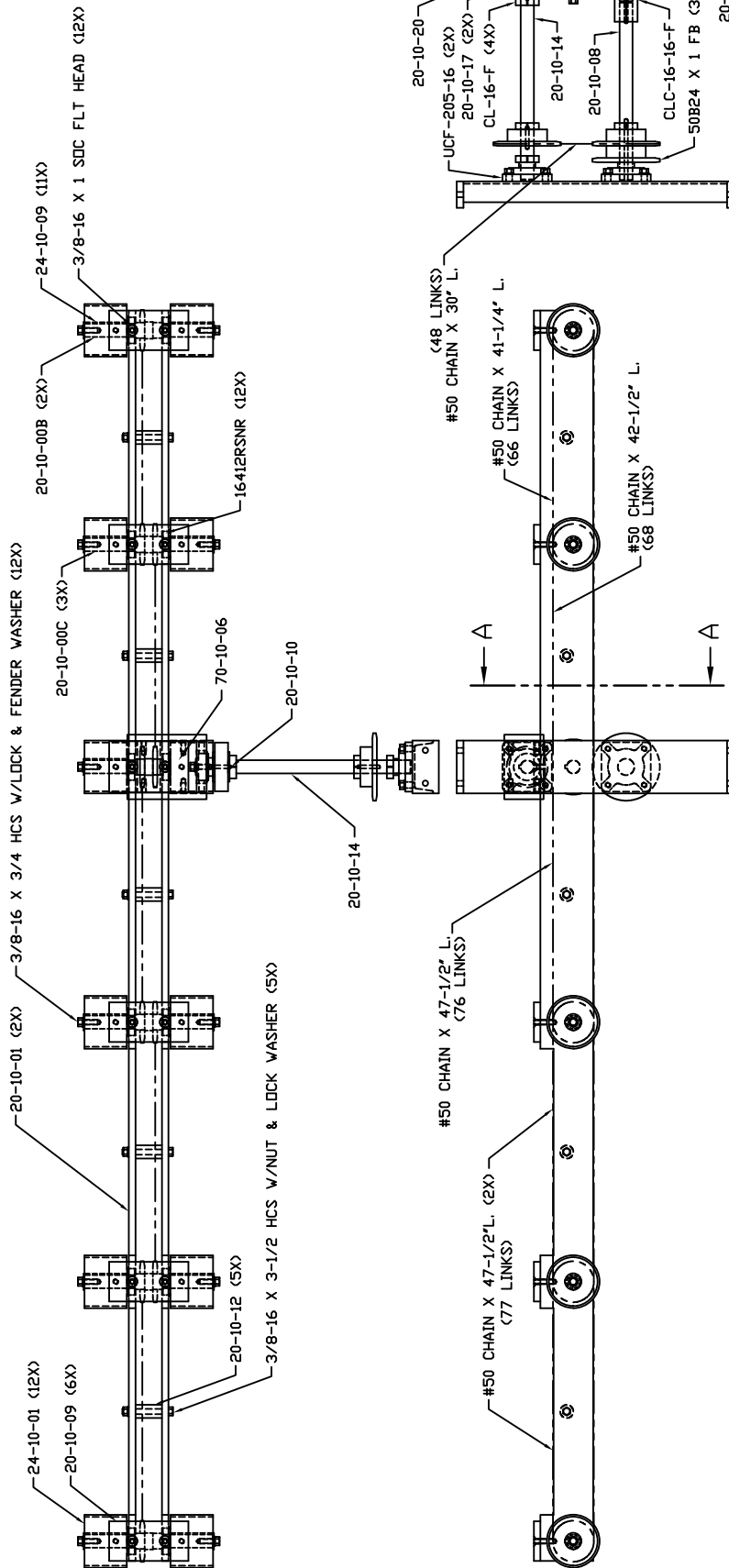
SECTION A-A

# BOTTOM SKATE DRIVE ASSEMBLY

PART NO.	20-10-00BOT
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	

NOTE: 1) TOP SKATE SHOWN ON END VIEW FOR GEAR & SPROCKET LOCATIONS

DATE	REV	REVISIONS	BY
11/20/99	A	MOVED TOP DRIVE SHAFT UP 3.5"	-
4/19/16	B	REVISED UPPER GEAR BEARING BLOCK MOUNTING DESIGN	CEL
11/29/16	C	UPDATED PART NUMBERS 20-10-18, -19, -20	RCV

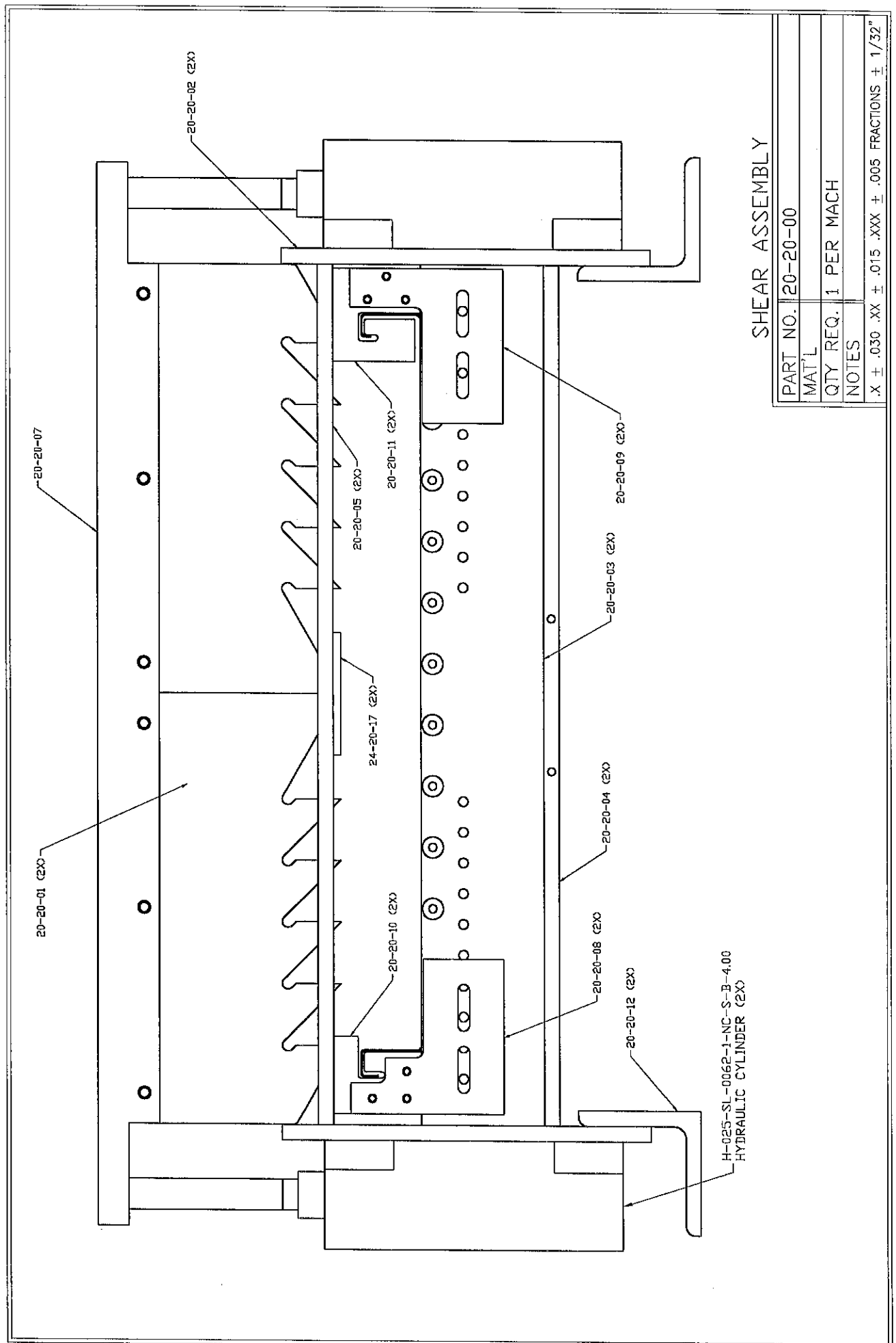


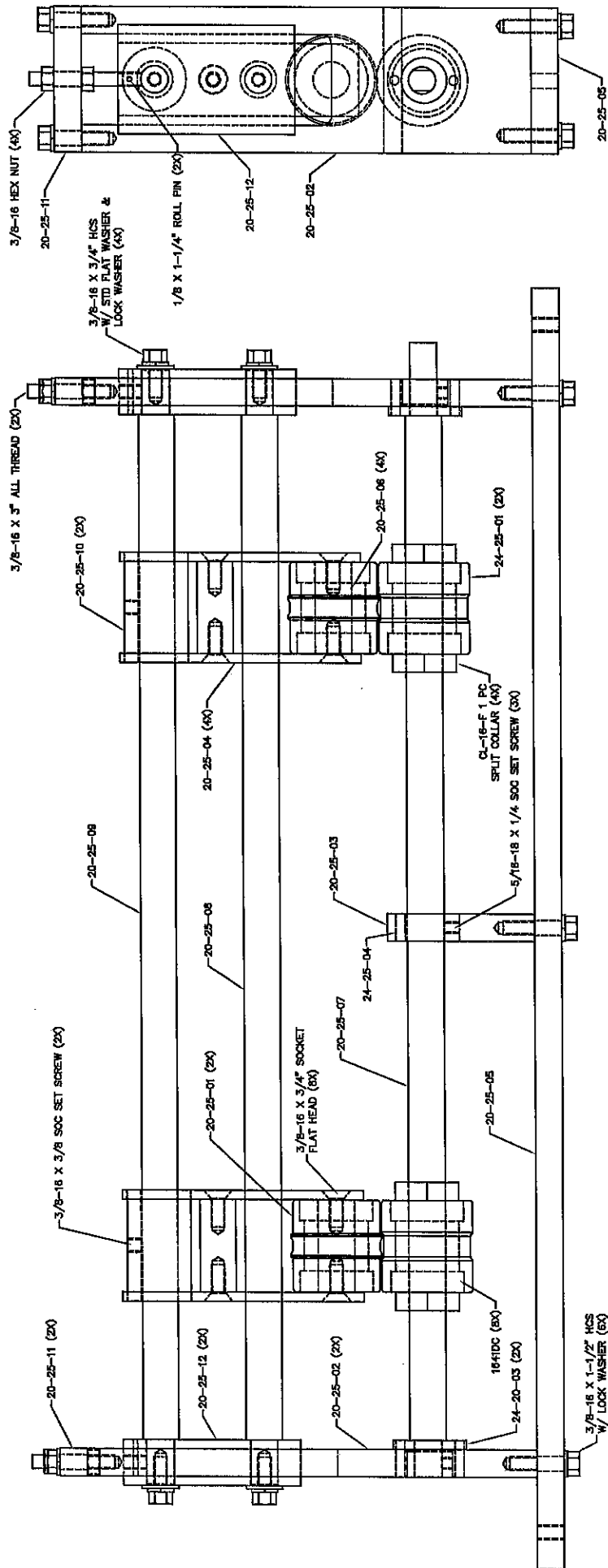
SECTION A-A

TOP SKATE DRIVE ASSEMBLY

PART NO.	20-10-00TDP
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	

NOTE: 1) BOTTOM SKATE SHOWN ON END VIEW FOR GEAR & SPROCKET LOCATIONS





# RIB ROLLER ASSEMBLY

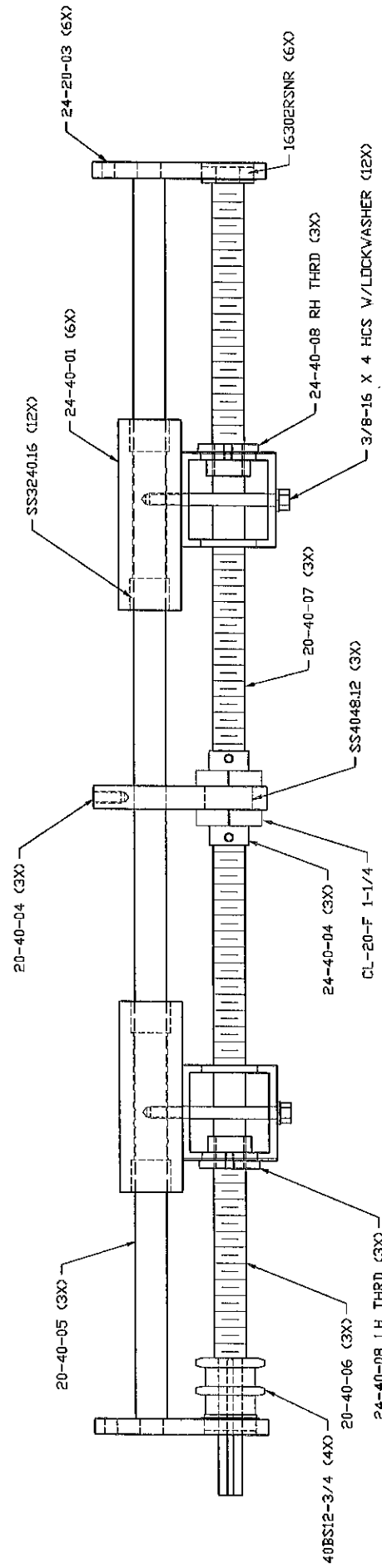
PART NO. 20-25-00

MAT'L

QTY REQ. 1 PER MACH

NOTES

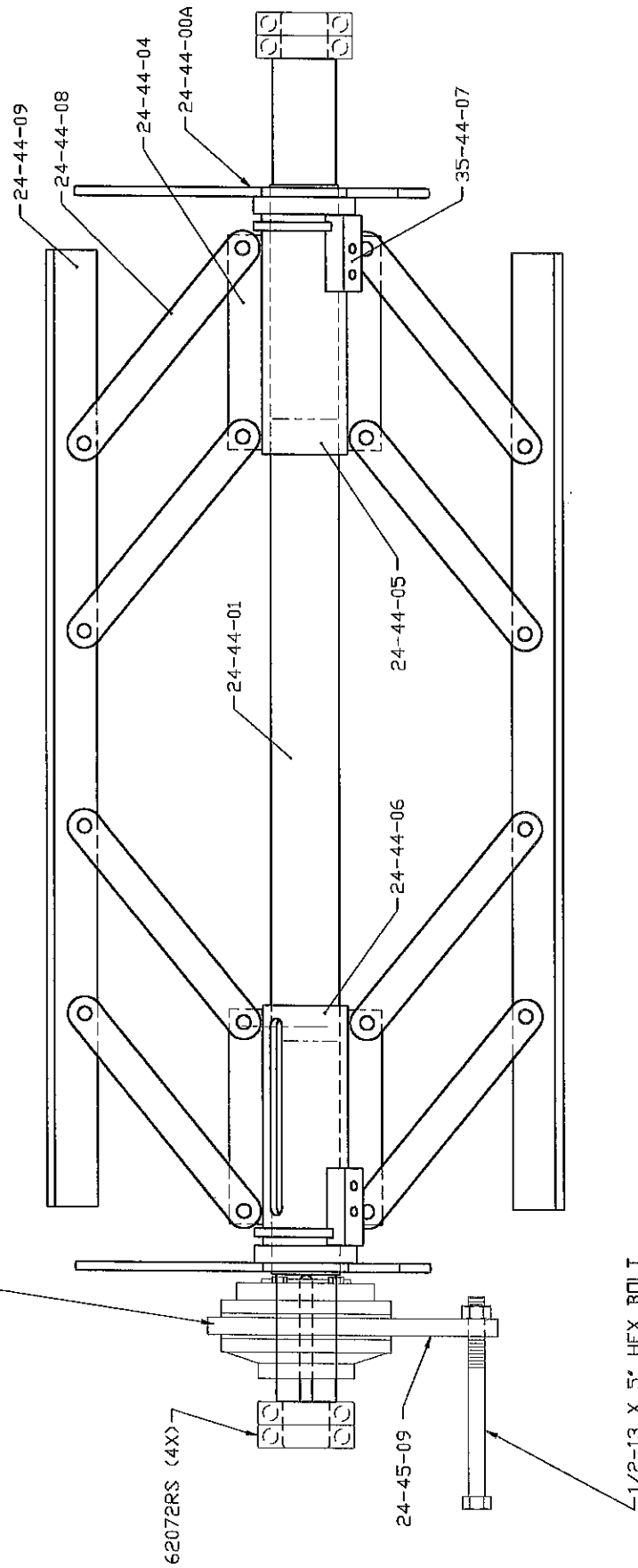
X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"



# WIDTH ADJUST ASS'Y

PART NO.	20-40-00
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
.X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	

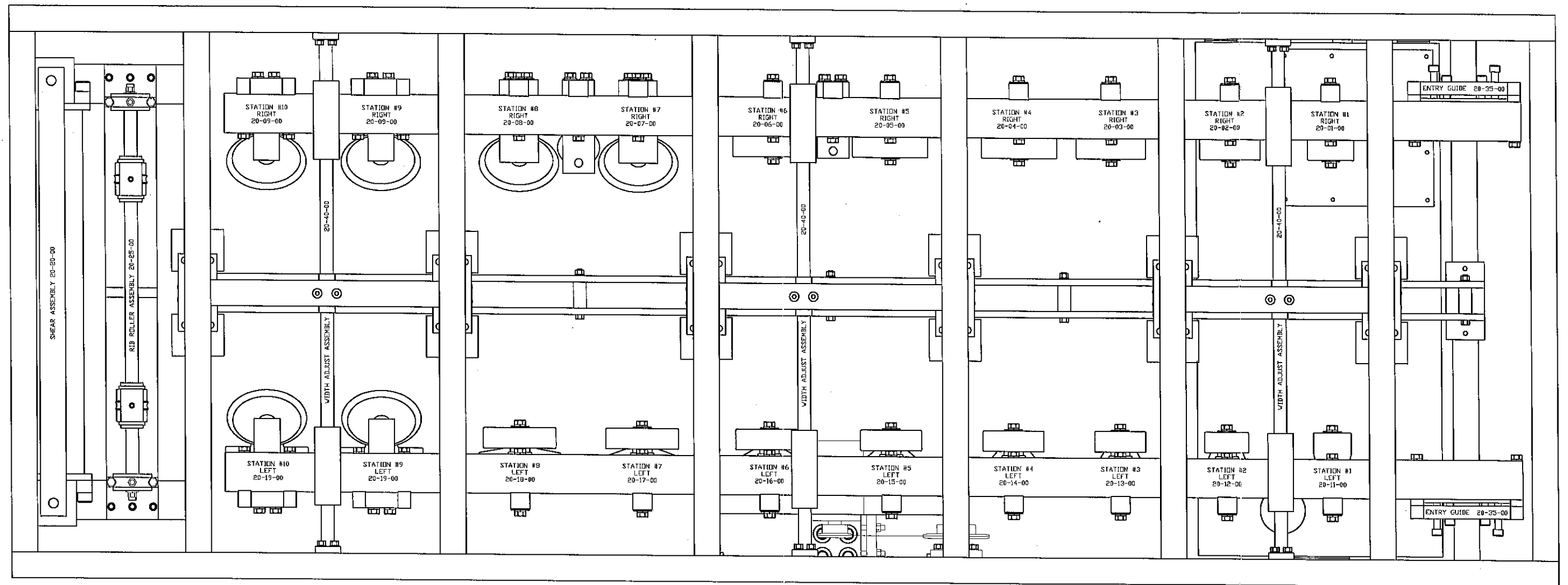
TT50BSX2" TORQUE LIMITER  
BORE TO 1.752/1.753 ID w/ 3/8" STD KEYWAY



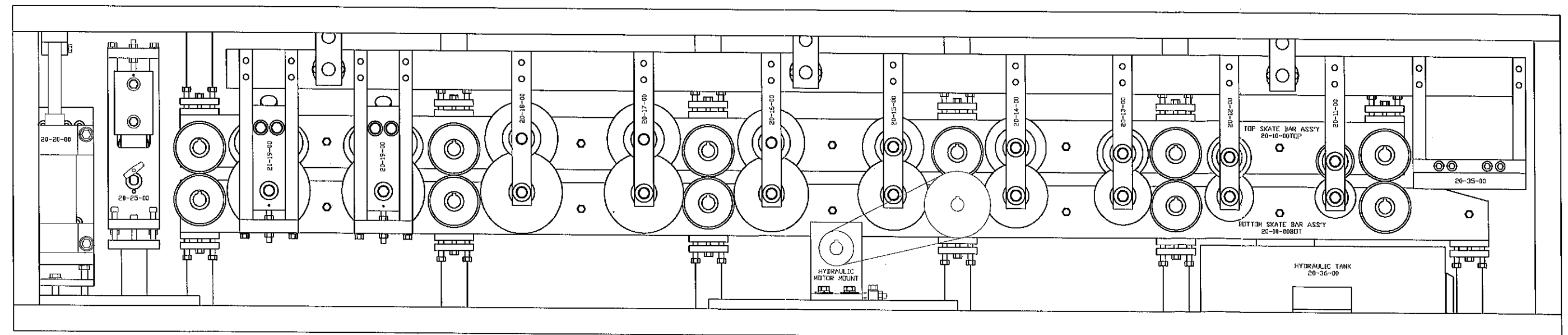
# EXPANDABLE SPOOL ASSEMBLY

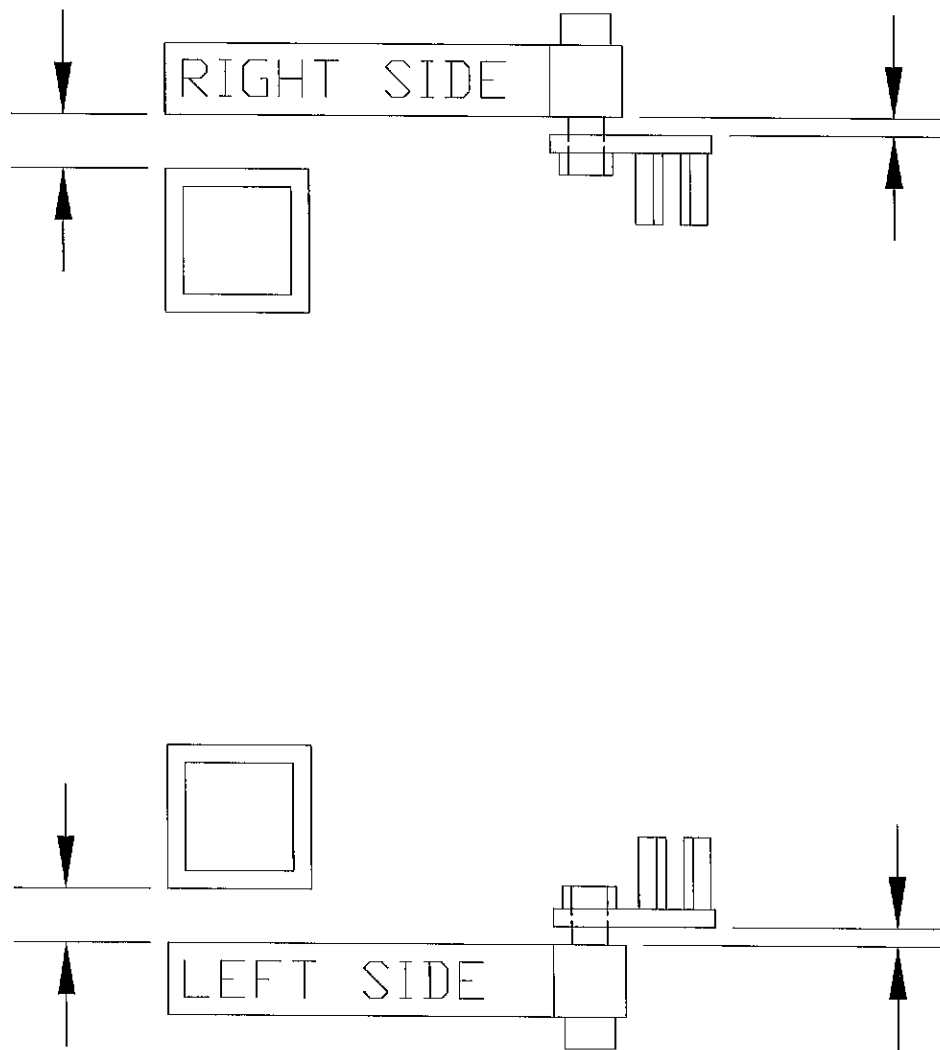
PART NO.	24-44-00
MAT'L	
QTY REQ.	1 PER MACH
NOTES	
X ± .030 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32"	





## MACHINE GENERAL LAYOUT





FACTORY ENTRY GUIDE SETTINGS  
SS2000 PANEL PROFILE

## SECTION 2

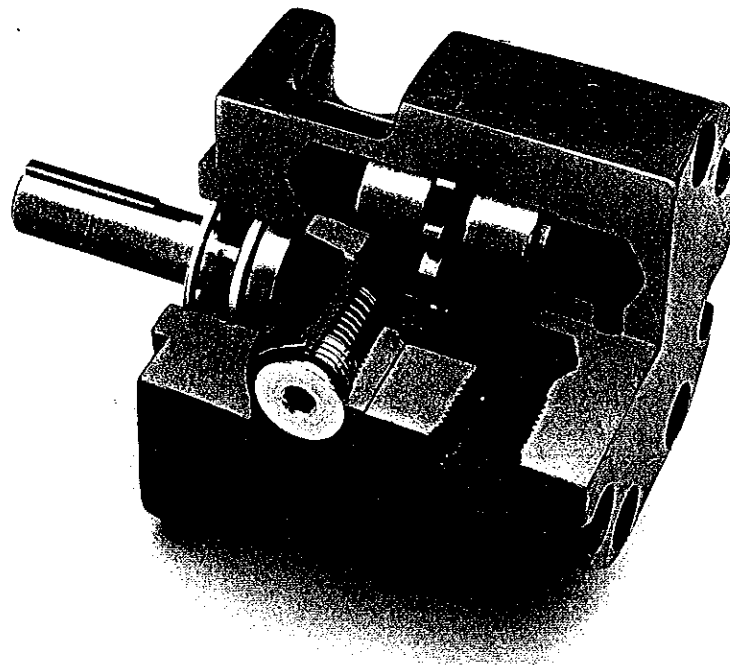
# G.C. Series Hydraulic Pumps

John S. Barnes G.C. Series Hydraulic Pumps are compact, external gear models for use in pumping fluids with lubricating qualities. Suitable for use in a wide variety of material handling, agricultural, and construction equipment in addition to machine tools, robotics, and other types of machinery.

Designed to provide reliable, long-life service under rugged conditions, G.C. Series pumps are built with cast iron bodies and hardened steel gears. Among their other standard, extra-value features are:

- ☐ Speeds to 5000 RPM
- ☐ Pressures to 4000 PSI
- ☐ Superior volumetric efficiency
- ☐ Needle bearing construction
- ☐ High mechanical efficiency
- ☐ Temperature ratings to 400°F (204°C)
- ☐ Wide variety of options

See the chart on this page for basic sizes. Dimensional and option information is listed on pages 3-5 and performance curves are shown on pages 6 & 7. See the back cover for complete ordering information.



Order Code (Gear)	Displacement Revolution		Flow				Pressure Rating			
			At 1800 RPM		At 3600 RPM		Continuous		Intermittent	
	cu. in.	cc.	GPM	L/Min.	GPM	L/Min.	PSI	BAR	PSI	BAR
04	0.065	1.07	0.50	1.93	1.0	3.86	3000	207	4000	275
06	0.097	1.59	0.75	2.86	1.5	5.72	3000	207	4000	275
08	0.129	2.11	1.0	3.80	2.0	7.60	3000	207	4000	275
*10	0.161	2.64	1.25	4.75	2.5	9.50	3000	207	4000	275
12	0.194	3.18	1.5	5.72	3.0	11.44	3000	207	4000	275
*14	0.226	3.70	1.75	6.66	3.5	13.32	2600	179	4000	275
16	0.258	4.23	2.0	7.61	4.0	15.22	2300	159	4000	275
*18	0.291	4.77	2.25	8.59	4.5	17.18	2100	149	3500	241
20	0.323	5.29	2.5	9.52	5.0	19.04	1900	131	3000	207
→ 24	0.388	6.36	3.0	11.45	6.0	22.90	1600	110	2500	172
28	0.453	7.42	3.5	13.36	7.0	26.72	1300	90	2250	155
32	0.517	8.47	4.0	15.25	8.0	30.50	1200	83	2000	138
†36	0.581	9.52	4.5	17.03	9.0	34.06	2250	155	2475	171
†40	0.647	10.59	5.0	18.92	10.0	37.95	2000	138	2200	152
†44	0.711	11.65	5.5	20.82	11.0	41.64	1800	124	2000	138

Flow listed in U.S. gallons. 200 SSU oil.

\*Available, but not standard (100-piece minimum order).

†For speed above 2400 RPM, 1-in. dia. inlet tube must be used.

# How to Order G.C. Series Pumps

## ORDERING INFORMATION

Each option has been assigned an order code—listed in the tables below—for placement in the sequence shown here.

2

Order Code	Mounting Flange Options
1	4-Bolt w/1.78" Pilot
2	2-Bolt SAE "AA" w/2.0" Pilot
*3	2-Bolt SAE "A" w/1.78" Pilot
4	2-Bolt SAE "A" w/3.25" Pilot

3

Order Code	Shaft Options
1	0.171" Tang w/Short Coupling (.5" long) (For DC Motors)
2	0.50" Diameter x 1.50" Extension, 1/8" Square Key
*3	Flexible Coupling
*4	Threaded End (Specify Thread)
*5	SAE Spline (Specify: "AA" = 9T, 20/40 DP; "A" = 9T, 16/32 DP) (Selected sizes available from stock. Consult factory.)
6	0.171" Tang w/Long Coupling (.8" long) (For AC Motors)

4 & 5

Order Code	Gear Size Width, Inches	Displacement Cu. In./Revolution
04	0.125	0.065
06	0.188	0.097
08	0.250	0.129
*10	0.312	0.161
12	0.375	0.194
*14	0.437	0.226
16	0.500	0.258
*18	0.562	0.291
20	0.625	0.323
24	0.750	0.388
28	0.875	0.453
32	1.000	0.517
36	1.125	0.581
40	1.250	0.647
44	1.375	0.711

6

Order Code	Valve Options
A	No Valves
B	Relief Valve
C	Direction Checks (Not Shown)
*D	Check Valve
*E	Check & Relief Valves (Not Shown)
*F	Check, Relief & Normally Closed Solenoid
*G	Check, Relief & Normally Open Solenoid
*H	Check, Relief & Solenoid Cavity Plugged
**J	#8 Size Side Mounted Solenoid
	Release Valve & #8 Size Needle Valve
**K	#8 Size Rear Mounted Solenoid
	Release Valve & #8 Size Needle Valve
†**L	#10 Size Rear Mounted Solenoid
	Release Valve & #8 Size Needle Valve

NOTE: Minimum relief valve pressure 200 psi; for lower settings, consult factory.

\*Available ONLY for gear sizes 04 through 36

\*\*Available ONLY for gear sizes 04 through 32

†Must be rear mounted solenoid valve (section 12 option R)

Pump Type	Mounting Flange	Shaft	Gear Size (Displacement)	Valving	Seals & Bearings	Porting	Rotation	Relief Valve Setting	Solenoid Valve Location	Solenoid Valve Voltage	Example	Your Options
G	2	2	08	F	1	A	1	10	R	12		
G												

7

Order Code	Seals & Bearings Options
1	Single Lip Buna-N Low Pressure Seal
2	Viton Seal
3	Viton High-Pressure Seal w/Outboard Ball Bearing
*4	Double Seal w/Overboard Drain
5	Buna-N Seal w/Outboard Ball Bearing

8

Order Code	Port Location Options
A	SAE Side Ports
*B	SAE Rear Ports
*C	NPTF Side Ports
*D	NPTF Rear Ports
*E	Inlet Tube, 1.0" Dia. w/SAE Side Outlet Port

NOTE: If ordering NPTF Ports, specify size:  
1/4", 3/8", or 1/2".

†For gear sizes 36, 40 & 44, 1-in. Dia. Inlet Tube must be used for speed above 2400 RPM.

9

Order Code	Rotation Options
1	Clockwise
2	Counterclockwise
3	Bidirectional

10 & 11

Order Code	Relief Valve Setting
00:30	Full bypass pressure in hundreds of PSI. (Example: 00 = No Relief; 09 = 900 PSI (Full Bypass Pressure); 25 = 2500 PSI Full Bypass Pressure.)

12

Order Code	Solenoid Valve Location
R	Rear Mounted Solenoid Valve
S	Side Mounted Solenoid Valve
N	No Solenoid Valve

13 & 14

Order Code	Solenoid Valve Voltage
12	12 Volts DC
24	24 Volts DC
15	115 Volts AC
PG	Solenoid Valve Cavity Plugged
00	No Solenoid Valve Cavity

\*Available, but not standard (100-piece minimum order).

NOTE: Pumps with Model Codes without asterisks are available in 2-4 weeks.



**John S. Barnes Corporation**

a Garphyttan company

2222 15th Street • P.O. Box 6166 • Rockford, Illinois 61125  
Phone: 815/398-4400 • Telex: 257-311 • Fax: 815/398-5977

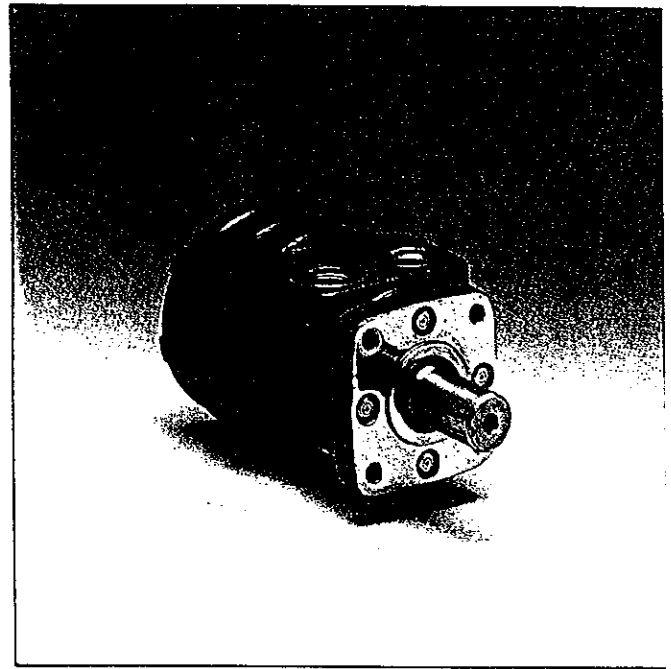
# Char-Lynn®

## General Purpose Hydraulic Motors

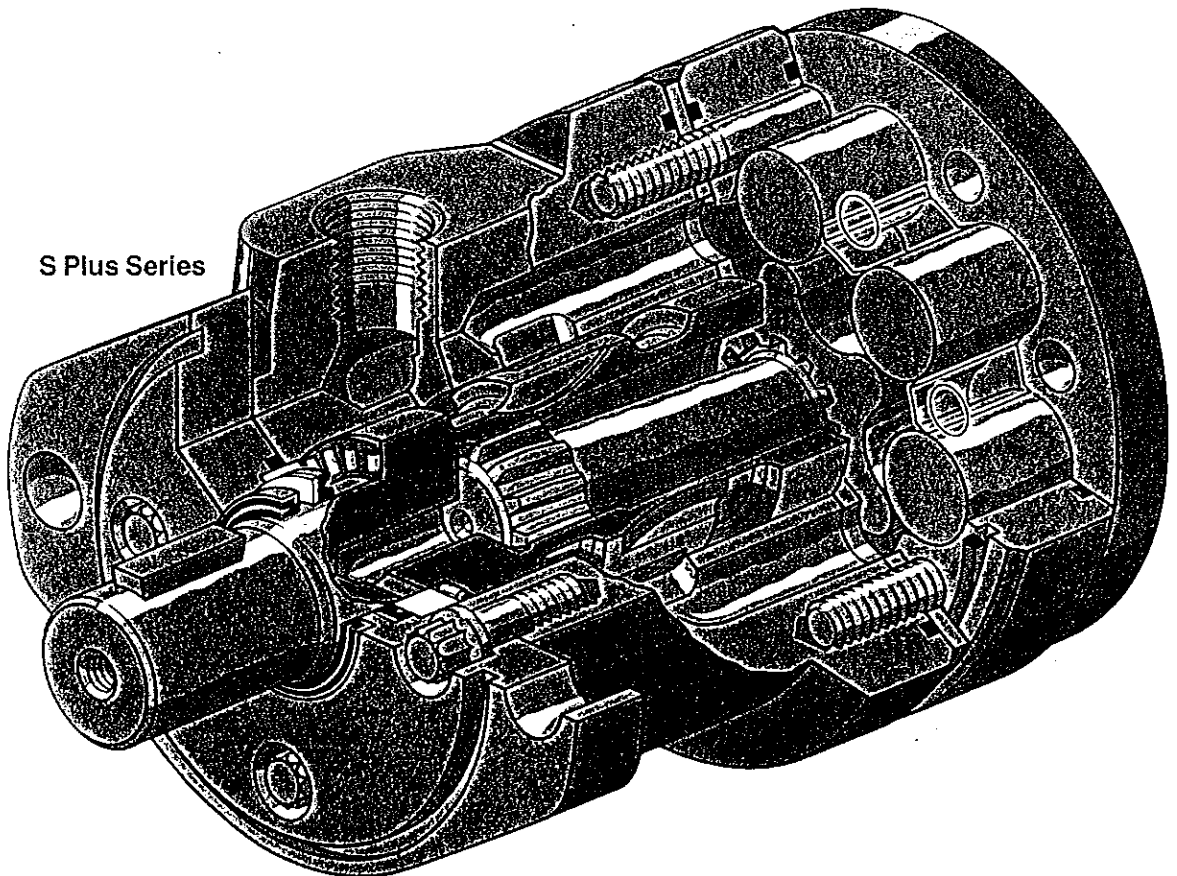
### S Plus Series

The S Plus motor with Geroler offers the same advantage of low speed, high torque and compact size as the H Plus motor with gerotor. In the Geroler element precision machined rollers form the displacement chambers. The rollers provide support with a rolling contact as the inner gear rotates, minimizing friction, especially startup resulting in high efficiency even at low speeds.

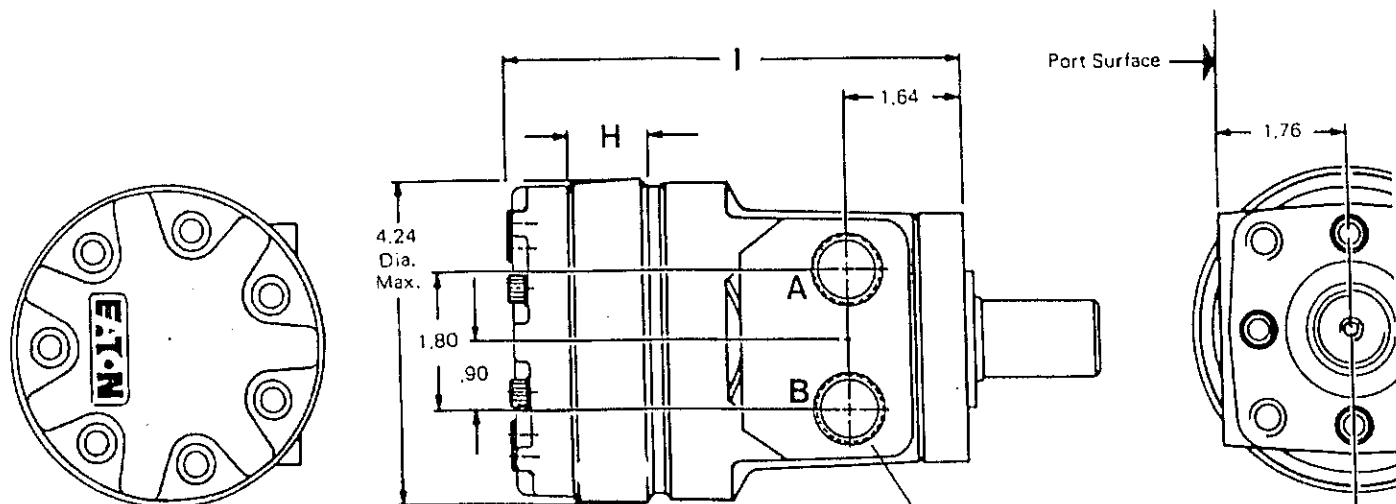
With up to 20% more power, the new S Plus motors can deliver up to 3500 pound inches of torque continuously and over 4000 pounds inches intermittently. Speeds up to 847 RPM and three more displacement sizes make the motor even more versatile than its predecessor, the S motor.



S Plus Series

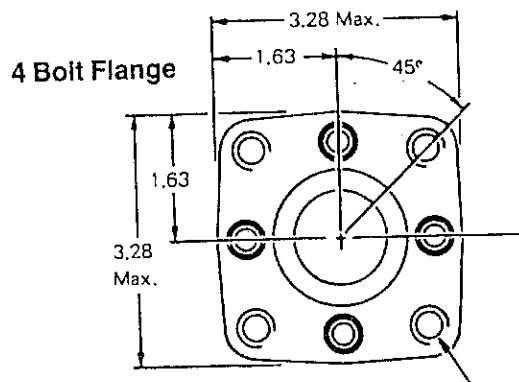


# Dimensions and Mounting Data—S Plus Series

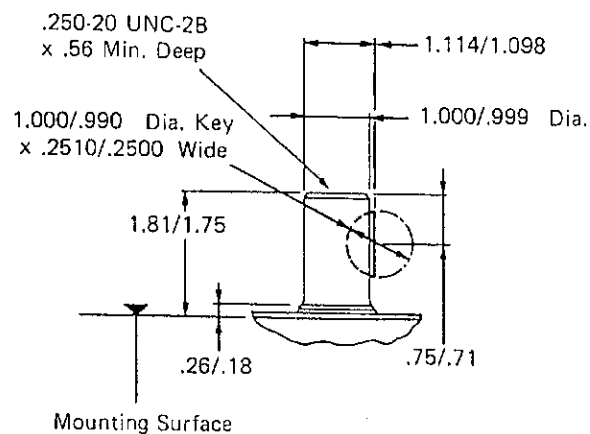
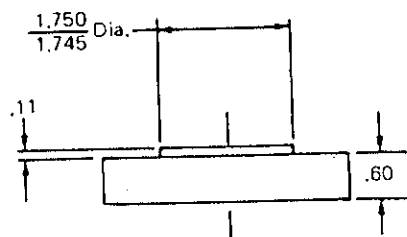


**Rotation** — Viewed from Shaft End  
 Port A Pressurized — Clockwise  
 Port B Pressurized — Counter Clockwise

	H	I
Displ. (cu. in./rev.)	Geroler Width	Overall
7.3	.650	5.74



3/8-16 UNC (.60 Max. Bolt Thread Engagement)  
 Mounting Holes (4) Equally Spaced on 3.25 Dia.  
 Bolt Circle



1 in. Dia. Straight Shaft with Woodruff Key

# Specification Data—S Plus Series

Displacement (cu. in./rev.)		7.3
Speed (RPM) @ Continuous Flow & Continuous Press.		427
Flow (GPM)	Continuous	15
	Intermittent	20
Torque (lb.-in.)	Continuous	2010
	Intermittent	2490
Min. Starting Torque (lb.-in.)	@ Cont. Pressure	1630
	@ Int. Pressure	2090
Pressure (ΔPSI)	Continuous	2000
	Intermittent	2500

# Performance Data—S Plus Series

Performance data is typical. Actual data may vary slightly from unit to unit in production.

7.3 cu. in./rev.

		Pressure (Δ PSI)										Max. Cont.	Max Int.
		200	400	600	800	1000	1200	1400	1600	1800	2000		
Flow (GPM)	2	190	403	608	814	1017	1214	1411	1598	1770	1947		
		63	62	60	58	56	52	47	41	31	27		
	4	192	400	606	803	1014	1221	1422	1627	1815	2008		
		125	124	122	121	118	115	111	106	100	93		
	6	178	380	591	798	1006	1209	1413	1615	1815	2010	248	
		188	187	185	183	181	177	173	167	158	148	11	
	8	161	366	579	782	982	1193	1403	1605	1804	2003	249	
		250	249	248	246	243	240	235	230	221	211	17	
	10	144	351	556	760	963	1172	1381	1579	1786	1984	248	
		313	312	310	309	305	302	297	292	283	274	23	
Max. Cont.	12	124	323	527	739	950	1153	1359	1561	1761	1966	246	
		376	374	372	370	368	364	359	354	346	335	30	
	14	93	296	507	709	920	1123	1328	1532	1738	1940	244	
		438	437	434	432	430	426	421	415	407	396	35	
Max. Int.	15	72	281	491	696	907	1110	1316	1519	1722	1928	242	
		470	468	466	463	461	457	452	446	438	427	38	
	20		179	409	617	851	1047	1249	1448	1644	1837		
			624	621	618	614	610	607	600	591	579		

**Ordering Information—** Add three digit prefix—103—to four digit number from chart for complete model number—  
Example—103-1537.  
Orders will not be accepted without three digit prefix.

## S Plus Series

For motors with case drain option, contact your Eaton representative.

Mounting	Shaft	Port	Displacement (cu. in./rev.) Product Number 103-xxxx											
			3.6	4.5	5.9	7.3	8.9	9.7	11.3	14.1	17.9	22.6		
4 Bolt Flange	Straight Keyed	1/4-14 O-ring	103-1570	1010	1011	1571	1572	1012	1013	1014	1015	1016		
		1/2 NPTF	103-1573	1002	1003	1574	1575	1004	1005	1006	1007	1008		
		Manifold	103-1576	1018	1019	1577	1578	1020	1021	1022	1023	1024		
	Splined	1/4-14 O-ring	103-1579	1058	1059	1580	1581	1060	1061	1062	1063	1064		
		1/2 NPTF	103-1582	1050	1051	1583	1584	1052	1053	1054	1055	1056		
		Manifold	103-1585	1066	1067	1586	1587	1068	1069	1070	1071	1072		

103-1072

## Fluids

Proper lubrication is very important to the life of the motor. Using the correct fluid with proper viscosity will help to insure the long life and high efficiency of the motor. Eaton recommends using a premium quality, anti-wear type hydraulic oil.

For optimum performance Eaton recommends that a fluid used in the A Plus and H Plus motors have a viscosity of not less than 100 SUS and the S Plus motor 70 SUS at operating temperature. Recommended maximum system operating temperature is 180° F. Recommended filtration is per ISO Cleanliness Code, level 18/13.

In certain low speed applications of the A Plus and H Plus motors where continuous operation is at less than 10% of rated speed with high pressures, higher viscosity oils may be required to assure proper lubrication. If operating under these conditions, see your Eaton representative. Eaton Service Bulletin number 1032 will give more information about the selection of proper fluids to use in Char-Lynn products under specific operating conditions.

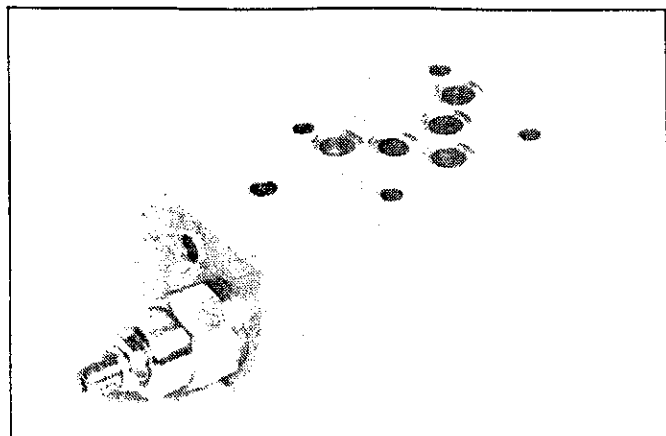




# POLYSTAC PRESSURE RELIEF VALVE

Pilot Operated

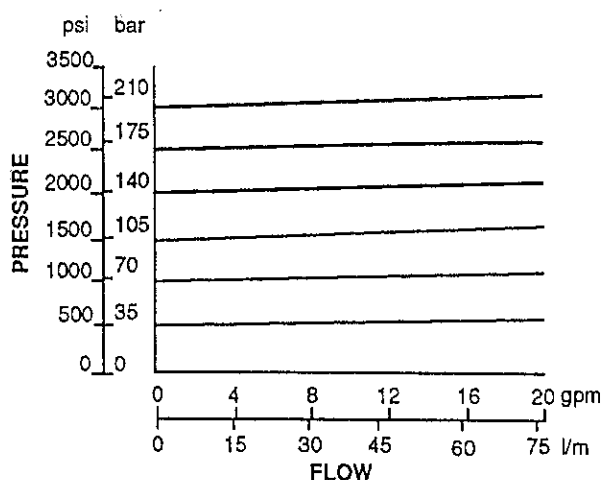
D05



## DESCRIPTION OF PRODUCT

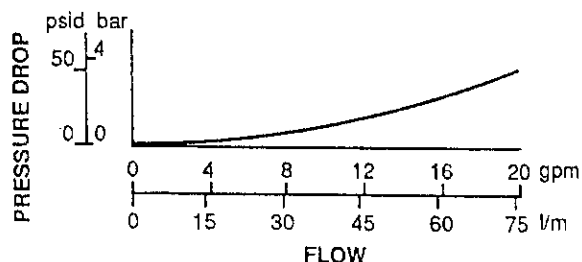
The relief valve is used to protect against pressure overloads. This valve is pilot operated and has an accurate pressure control even under conditions of wide variance in flow. When inlet pressure exceeds the setting of the valve, the pilot section opens causing an imbalance across the main spool which then opens allowing relief flow to the tank.

## TYPICAL CONTROLLED PRESSURE VS. FLOW



## TYPICAL PRESSURE DROP

(A > A1, P > P1, T > T1, B > B1)



Pressure drops shown are based on 100 SUS fluid viscosity and 0.87 specific gravity.

## TYPICAL PERFORMANCE SPECIFICATIONS

FLOW RATES	Maximum	20 gpm	76 l/m
MAXIMUM INLET PRESSURE		3500 psi	240 bar
PRESSURE ADJUSTMENT RANGE		100-3000 psi	7.0-210 bar
MOUNTING INTERFACE:	To Be Used With NFPA D05/ISO Size 05		
WEIGHT		3.2 lbs	1.5 kg

## GENERAL SPECIFICATIONS

### RECOMMENDED FLUID

Petroleum base fluids and most esters (other fluids may be acceptable with special O-rings) consult factory.

### FLUID TEMPERATURE RANGE

Fluid temperature up to 200°F will not appreciably affect valve performance, however, from a safety standpoint, temperatures above 130°F are not recommended.

### RECOMMENDED OPERATING VISCOSITY

80 to 350 SUS.

### FLUID OPERATING VISCOSITY RANGE

Acceptable start-up viscosity to 4000 SUS.

Minimum viscosity to 30 SUS.

### FILTRATION

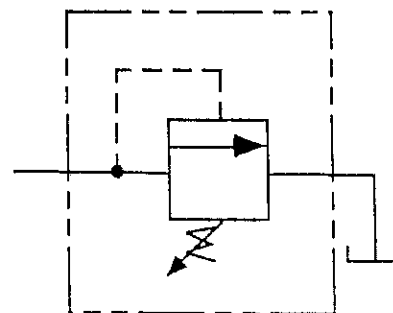
25 micron acceptable;

10 micron preferred.

All pressure drops shown on this data page are based on 100 SUS fluid viscosity and 0.87 specific gravity. For other viscosities see below.

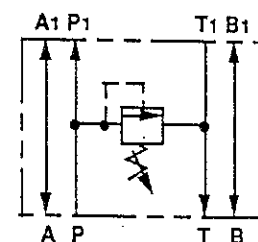
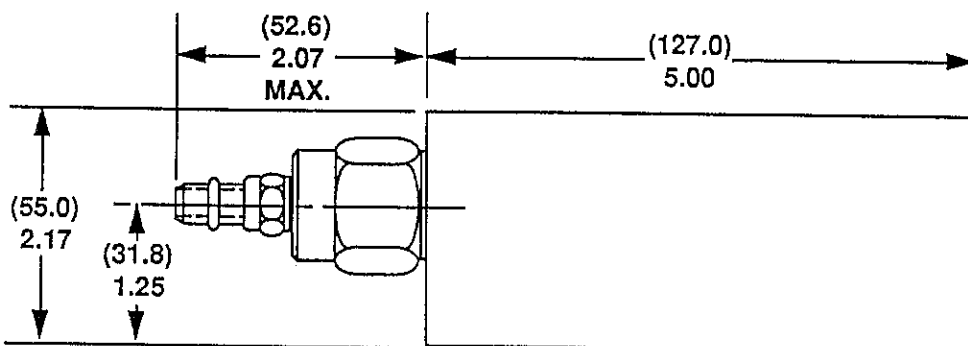
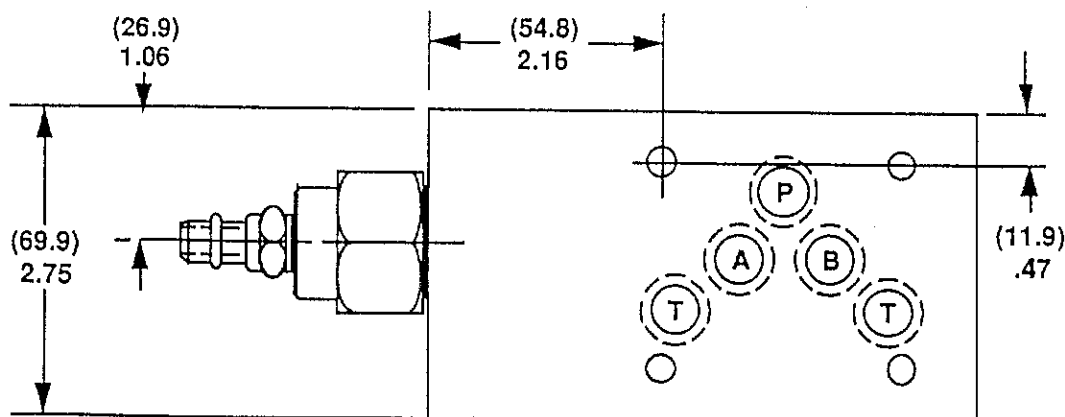
Fluid Viscosities	CS	14.5	20.5	32	43	54	65	76	86
	SUS	75	100	150	200	250	300	350	400
Multiplier		0.93	1.00	1.11	1.19	1.26	1.32	1.37	1.41

For any other specific gravity ( $G_1$ ) the pressure drop ( $\Delta P$ ) will be approximately  $\Delta P_1 = \Delta P (G_1/G)$ .



# VALVE DIMENSIONS

DIMENSIONS SHOWN IN: (MILLIMETERS)  
INCHES



## ORDERING INFORMATION

P12S — RP — 300 — GS					
VALVE SERIES	TYPE	PORT CONTROL	PRESSURE ADJ.		SEALS
			CODE	RANGE	
Polystac Pressure Control Valve	Relief Pilot Operated	P Port	300	100-3000 psi	VITON Seals Standard

## GENERAL INFORMATION

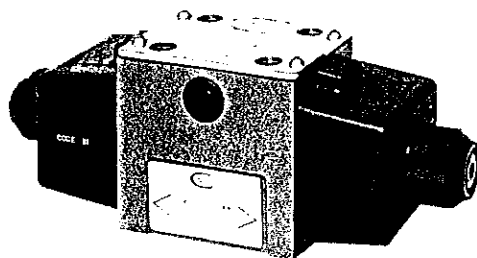
1. Back pressure in the tank port (T) adds to the relief valve setting. Recommended back pressure not to exceed 70 psi (5 bar). This valve is internally drained to tank (T).
2. When valve is used as a system limit valve, recommended valve setting should be 150 to 215 psi (10 to 15 bar) higher than maximum circuit pressure.

TYPICAL ORDERING CODE: P12S-RP-300-GS



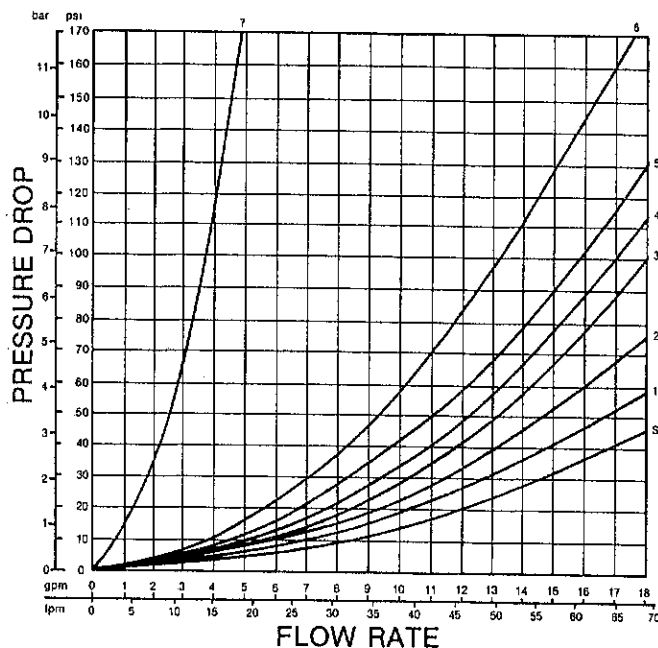
Division of Continental Machines, Inc.  
12520 Quentin Avenue South  
Savage, Minnesota, 55378 USA  
(612) 895-6400 FAX: (612) 895-6444

NFPA SIZE  
D05  
(FORMER D02)



CSA CERTIFIED

### TYPICAL PRESSURE DROP CURVES



Above curves based on 100 SUS fluid viscosity @ 120° F., .87 specific gravity.

For any other viscosities, the pressure drop ( $\Delta P$ ) will change as follows:

VISCOSITIES	75	100	150	200	250	300	350	400
% OF $\Delta P$ (approximate)	93	100	111	119	126	132	137	141

For any other specific gravity ( $G_1$ ), the pressure drop ( $\Delta P_1$ ) will be approximately  $\Delta P_1 = \Delta P (G_1/G)$ .

SPOOL TYPE	FLOW CURVE NUMBERS							
	SPOOL SHIFTED				SPOOL CENTERED			
	P→A OR B	B→T	A→T	...	P→A OR B	A→T	B→T	P→T
A	3	2	1	...	...	...	...	...
B	4	2	1	...	...	...	...	5
F	3	2	1	...	2	5	...	...
F1	3	2	1	...	7	7	...	...
G	2	2	1	4	...	...	...	...
K	3	2	1	...	6	...	...	...
L	6	6	5	...	...	...	...	4
SUBPLATE	S (FULL CIRCUIT)							

### TYPICAL PERFORMANCE SPECIFICATIONS

Performance measured on a four-way circuit (full circuit). Performance may be reduced from that shown if a three-way circuit (half circuit) is used, i.e. A or B port plugged.

NOMINAL FLOW RATES*	@ 3500 psi	12 gpm	46 l/m
	@ 1000 psi	18 gpm	68 l/m
MAXIMUM OPERATING PRESSURE	P, A, B, ports	3500 psi	250 bar
	T port (includes surges)	1000 psi	70 bar
INTERNAL LEAKAGE (2-ports)	3500 psi 100 SUS	7 cipm	115 ml/m
MAXIMUM CYCLE RATE	400 cpm		
MOUNTING SURFACE	NFPA T3.5.1.M R1-1984 - D05 ISO/DIS 4401 - SIZE 05		
WEIGHT	Single Actuator	8.75 lbs	3.9 kg
	Double Actuator	9.75 lbs	4.4 kg
SPOOL CODES AVAILABLE	A, B, F, F1, G, K, L		

\* Flow and pressure rates apply to all valves except with code 68L coils. Limitations with code 68L coils are:

Spool Code F1 = 12 gpm MAX. @ 1000 psi MAX.

Valve Codes 1F & 1G = 12 gpm MAX. @ 1000 psi MAX.

Valve Code 2 = 1000 psi MAX.

All Other Spool or Valve Codes = 12 gpm MAX. @ 1500 psi MAX.

Code 68L Recommended Start-up Viscosity 30 to 1000 SUS.

MAX. FLOW for B & L Spools = 12 gpm.

### SPOOL DESCRIPTION

CODE	SYMBOL	SPOOL FUNCTION	CENTER POSITION	CROSSOVER
A			All ports blocked	All ports blocked
B			All ports open	All ports open
F			P blocked A & B → T	P blocked A or B → T
F1			P blocked A & B restricted → T	P blocked A or B restricted → T
G			P → A & B T blocked	P → A or B T & A or B blocked
K			P & B blocked A → T	All ports blocked
L			P → T A & B blocked	All ports Restricted open

NOTE: CODE F1, OR L AVAILABLE ON CODE 3 OR 5 VALVES.  
CODE G AVAILABLE ON CODE 1, 3 OR 5 VALVES ONLY.

### TYPICAL ELECTRICAL and RESPONSE TIME

SOLENOID CODE	LEAD WIRE	DIW CONN	VOLTAGE & FREQUENCY	VOLTAGE LIMITS	IN-PUSH CURRENT (AMP)	HOLDING CURRENT (AMP)	HOLDING POWER (WATTS)	RESPONSE TIME (MILLESECONDS)	
								SOLENOID	SPRING
60L	33L		120 - 60	108-126	5.20	.91	45	10	12
			110 - 50	99-116	5.21	1.10	43	12	14
			120 - 60	108-132	3.70	.38	22	14	16
68L			110 - 50	99-121	3.75	.42	21	16	18
			240 - 60	216-252	2.30	.46	45	10	12
			220 - 50	190-231	3.20	.53	43	12	14
81L	34L		250 - 60	252-297	2.55	.41	45	10	12
			240 - 50	216-252	2.50	.47	43	12	14
			24 DC	20-26	1.20	1.80	44	35	35
75L			12 DC	10-13	3.50	3.50	44	35	35

**VS12M**  
DIRECTIONAL CONTROL VALVE  
SOLENOID ACTUATED, DIRECT OPERATED

**MINIMUM CLEARANCE FOR COIL REMOVAL**

- (81.3) 3.20 DC SOL.
- (45.7) 1.80 AC SOL.

**HAND TORQUE ONLY FOR SOLENOID NUT**

**ACCESS TO MOUNTING BOLTS (4)**  
TORQUE 10-12 lb.-ft.  
USE A 3/16" HEX WRENCH

**DOUBLE SOLENOID AC**  
(237.2) 9.34

**DOUBLE SOLENOID DC**  
(305.3) 12.02

**SINGLE SOLENOID AC**  
(170.7) 6.72

**SINGLE SOLENOID DC**  
(204.7) 8.06

**TWO LEAD WIRES FOR EACH SOLENOID APPROX. (154.0) 7.00 LONG**

**SOLENOID "b"**

**SOLENOID "a"**

**GROUND SCREW - ALL VALVE TYPES**

**MANUAL OVERRIDE PIN, SOLENOID ENDS ONLY**

**1/2-14 NPT BOTH SIDES**

**SOLENOID "b" DIMENSIONS:**  
 (69.9) 2.75  
 (39.9) 1.55  
 (86.9) 3.50

**SOLENOID "a" DIMENSIONS:**  
 (45.2) 1.78  
 (50.4) 3.56  
 (66.3) 2.69  
 (31.8) 1.25

**SOLENOID "b" ELECTRICAL DATA:**  
 (73.4) 2.89 AC SOL.  
 (107.4) 4.23 DC SOL.

Technical drawing of a solenoid assembly. The drawing shows a central rectangular component with a circular feature on its front face. To the left is a jagged line representing a solenoid core, labeled "SOLENOID 'b'". To the right is another jagged line representing a solenoid core, labeled "SOLENOID 'a'". Above the central component are two rectangular blocks: "BLACK PLUG" on the left and "GREY PLUG" on the right. Dimensions are indicated with arrows and text:

- Top dimension: (199.4) MAX. DOUBLE SOLENOID, 8.88
- Second dimension from top: (153.1) MAX. SINGLE SOLENOID, 6.00
- Third dimension from top: (53.0), 2.09
- Right side dimension (from top of grey plug): (120.0) MAX., 4.73
- Right side dimension (from bottom of grey plug): (108.7) MAX., 4.28

WITH TOP ELECTRICAL BOX OPTION B or BT  
AND SOLENOID INDICATOR LIGHT OPTION L1 OR L2

12-14 NPT

5-PIN CONNECTOR OPTION  
CODE B5H

(135.9)  
5.35

(125.0)  
4.92

SOL B

SOL A

**NOTE:** 1. ELECTRICAL BOX IS NOT REQUIRED FOR LIGHT OPTION  
2. ELECTRICAL BOX MAY BE ROTATED 180°  
3. 5-PIN QUICK DISCONNECT MEETS NFPA RECOMMENDED STD. T3.5.29M-1980

**VS12M**

BASIC VALVE

FUNCTION

CODE	OPTION	CODE	MECHANICAL OPTIONS	TOP ELECTRICAL BOX	SOLENOID INDICATOR LIGHTS	SOLENOID VOLTAGE
1	 Single actuator • 2 position spring offset	R	NONE  SINGLE SOLENOID REVERSE ASSEMBLY SOL A SUPPLIED	OMIT NOT REQ.  -  BY TOP ELECTR. BOX WITH TERMINALS & GROUND  BSH TOP ELECTR. BOX WITH 5 PIN MALE RECP. FOR 1 OR 2 SOL'S.	OMIT NOT REQ.  L1 SINGLE SOL. INDICATOR 110/120 V 50/60 HZ.  L2 DOUBLE SOLENOID INDICATOR 110/120V 50/60 HZ.	30L 110/120V 50/60 HZ. 81L 220/240 / 50/60 HZ. 86L 110/120V 50/60 HZ. (LOW AMP) 70L 24V DC 76L 12V DC
2	 Double actuator • 2 position no-spring detented					
3	 Double actuator • 3 position spring centered					
5	 Single actuator • 2 position spring centered					
5	 Single actuator • 2 position spring offset					

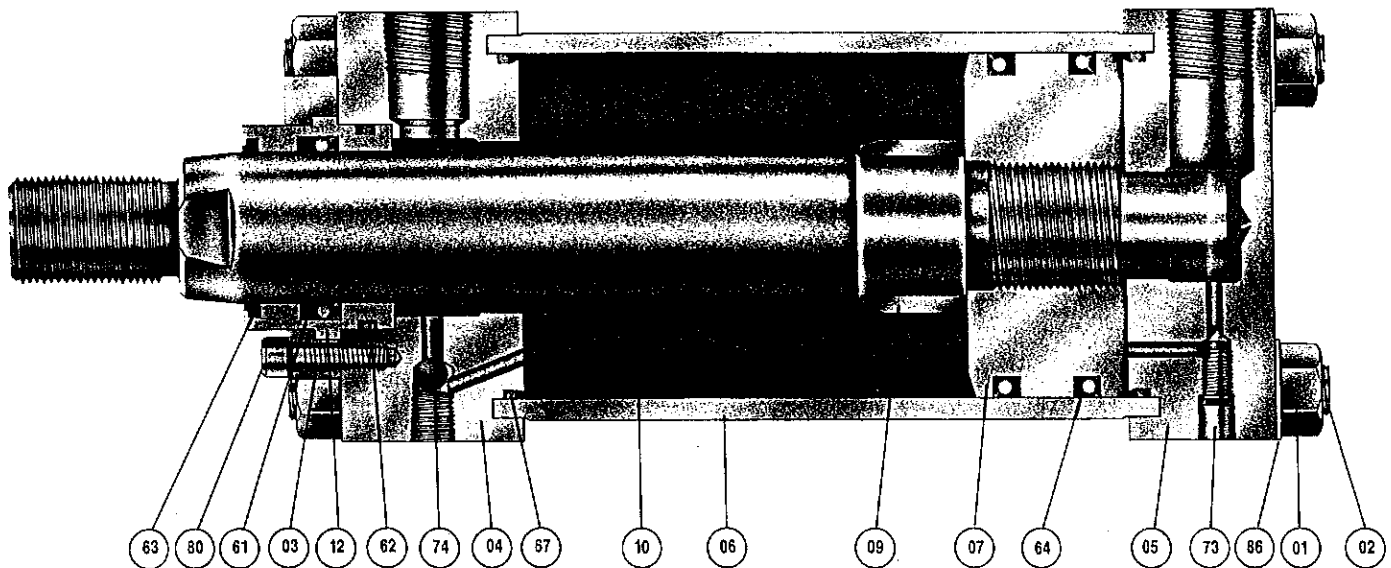
SEE OPPOSITE PAGE

VITON SEALS STANDARD

DIN 43650 CONNECTIONS

OMT	NOT AVAILABLE	OMT	NOT AVAILABLE	33L 110/120V 50/60 HZ.
				34L 220/240V 50/60 HZ.
				75L 240/280V 50/60 HZ.
				42L 24V DC

6:



## **PARTS LIST**

- |                                   |  |
|-----------------------------------|--|
| 01. Tie Rod Nut                   | 61. Rod Seal                                     |
| 02. Tie Rod                       | 62. Cartridge O.D. Seal<br>( 'O' Ring & Back-up) |
| 03. Retainer Plate                | 63. Rod Wiper                                    |
| 04. Rod Head                      | 64. Piston O.D. Seal                             |
| 05. Cap Head                      | 67. Barrel Seal ( 'O' Ring)                      |
| 06. Cylinder Barrel (Honed Steel) | 73. Adjustable Cushion Assembly                  |
| 07. Piston                        | 74. Cushion Check Assembly                       |
| 09. Rod End Cushion Sleeve        | 80. Retainer Plate Capscrews                     |
| 10. Piston Rod                    | 86. Hardened Washer                              |
| 12. Rod Bearing Cartridge         |  |

## **Cylinder Repair Kit Contents**

**ITEMS 12-61-62-63-64-67**

### **IMPORTANT**

To speed the handling of orders for parts or repair kits, please specify:

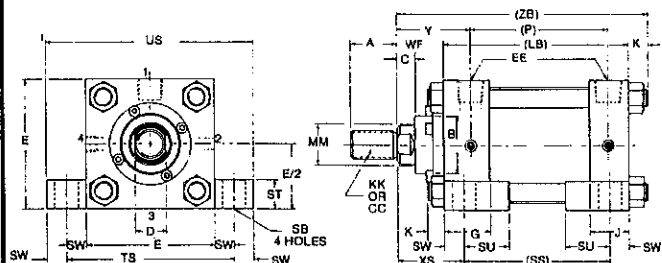
1. Cylinder serial number
2. Cylinder bore diameter
3. Stroke
4. Piston rod diameter
5. Operating medium

1½" THRU 4" "H" SIDE LUG, CENTER LUG, FLUSH MOUNT AND DOUBLE ROD END

5" THRU 12" TURN PAGE

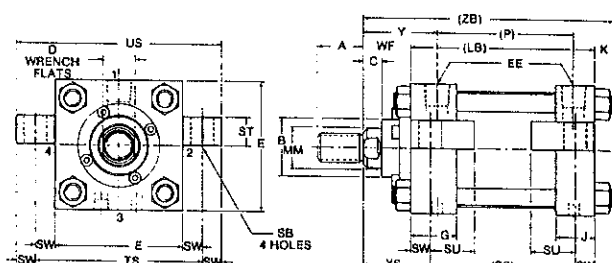
**H-SL**  
1½" THRU 4" BORE

NFPA STYLE MS2  
SIDE LUG



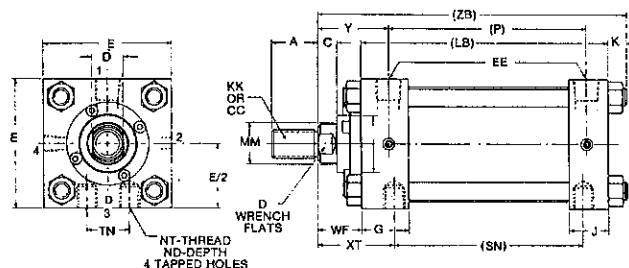
**H-CL**  
1½" THRU 4" BORE

NFPA STYLE MS3  
CENTER LUG



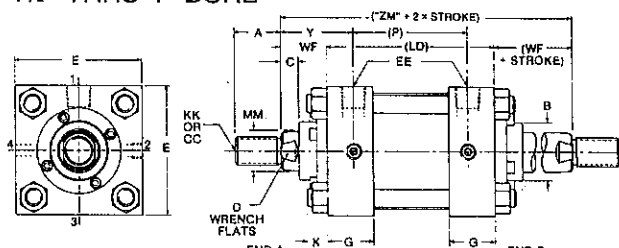
**H-FS**  
1½" THRU 4" BORE

NFPA STYLE MS4  
SIDE TAPPED



**H-DRE**  
1½" THRU 4" BORE

NFPA STYLE MD  
DOUBLE ROD END



MOUNTINGS AVAILABLE IN DOUBLE ROD MODELS

H-ME-5 H-NM-O, 1, 2, 3 H-REF-2 H-SL H-TM-1  
H-IH-3 H-REF-1 H-FS H-CL H-TM-3

NOTE: Stroke must be added to the letters in parentheses.

NOTE: All hydraulic cylinders furnished non-cushioned unless ordered otherwise.

BORE	E	NPT EE	SAE EE	G	J	K	(LB)	(LD)	ND	NT	(P)	SB	(SN)	(SS)	ST	SU	SW	TN	TS	US
1½	2½	½	#8	1¾	1½	½	4⅝	4⅞	7/16	3/8-16	3	7/16	2⅞	3⅞	½	15/16	3/8	¾	3¼	4
2	3	½	#8	1¾	1½	5/8	4⅝	4⅞	7/16	1/2-13	3	9/16	2⅞	3⅝	¾	1¼	1½	15/16	4	5
2½	3½	½	#8	1¾	1½	5/8	4¾	5	5/8	5/8-11	3⅞	13/16	3	3⅞	1	1⅞	11/16	15/16	4⅞	6¼
3¼	4½	¾	#12	2	1¾	¾	5½	5¾	¾	¾-10	3⅞	13/16	3½	4⅞	1	1⅞	11/16	1½	5⅞	7¼
4	5	¾	#12	2⅞	1¾	¾	5¾	6⅞	1	1-8	4	1⅞	3¾	4	1¼	2	7/8	2⅞	6¾	8½

♦ Subtract ⅛ for H-FS Mount

## ATLAS CYLINDERS



National  
**FLUID POWER**  
Association  
MEMBER

Main Plant & Corporate Headquarters: 29289 Airport Road • P.O. Box 2248 • Eugene, Oregon 97402-0079 • (503) 689-9111 • FAX (503) 688-6771  
Southern Manufacturing Plant: 1021 Brooks Street, S.E. • P.O. Box 1466 • Decatur, Alabama 35602-1466 • (205) 355-1812 • FAX (205) 355-9296

## Installation Instructions

### Patented Throttle Control Solenoid Kit

**P613 - K Series (12 VDC Systems)**  
**P613 - K Series (24 VDC Systems)**

#### Parts List

Item No.	Replacement Part No.	Description
1	EO7195	Cable Pivot
2	NA	Wire Core
3	NA	Cable Bulkhead Fitting
4	NA	Cable Bracket
5	Specify Kit No.	Cable Assembly
6	NA	Jam Nut UNF 3/8-24
7	NA	Aluminum Adjustment Nut 1.00 Inch Hex
8	S500-A6	Control Module

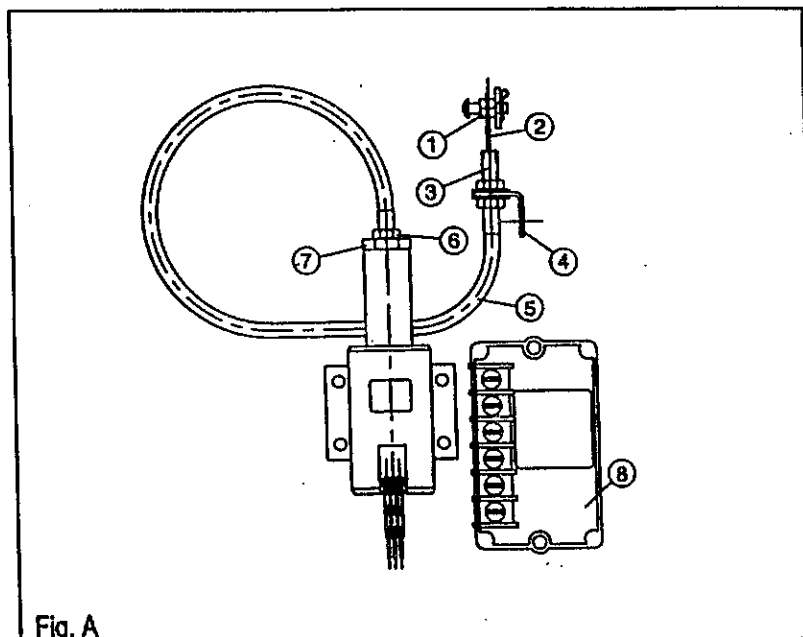


Fig. A

#### S500 - A6 Control Module Specifications

Specification	Note
Operating Temperature Range	-40 to 185° F (-40 to 85° C)
Maximum (Jump Start) Voltage	32 VDC
Maximum Solenoid Wattage (12 VDC System)	1000 Watts
Pull-In Coil Activation Duration	0.5 Seconds
Module Recycle Time	0.1 Seconds
Maximum Module Cycle Rate	6 per minute
Minimum Operating Voltage	8.8 VDC at 68° F (20° C)
Voltage Loss Through Module	0.35 VDC Maximum

**Notes:**

1. The output of the control module must be connected to the contactor/relay in 24 VDC systems. See wiring diagram.
2. Do not leave the module connected if you use over 32 VDC to jump-start a vehicle
3. If the load exceeds 1000 watts or if the voltage exceeds 32 VDC, use an external contactor as an interface between the module and the load.
4. Recycle time is the time the module must be de-energized before it will re-initiate the pull-in cycle.
5. Although the module can tolerate higher cycle rates, the solenoid may overheat in these situations. Consult the factory if you anticipate a high cycle rate.
6. This is the voltage drop anticipated between the input voltage and output voltage to the solenoid.

**Solenoid Assembly Specifications**

Specifications	P613-A41V12	P613-A41V24
Rated voltage	12 VDC	24 VDC
Pull-In Current	70.5 Amps	36.4 Amps
Hold-In Current	0.9 Amps	0.5 Amps
Pull-In Force (at 68° F [20° C])	20 lb.	20 lb.
Hold-In Force (at 68° F [20° C])	40 lb.	40 lb.
Maximum Ambient Temperature	257° F (125° C)	257° F (125° C)
Maximum Coil Temperature	380° F (193° C)	380° F (193° C)
Maximum Solenoid Cycle Rate	6/min.- see note 5 above	6/min. - see note 5 above

**Safety First**

Trombetta has made every effort to provide you with a safe solenoid kit, but wishes to point out information on safe installation and operation

**⚠ WARNING**

To avoid control module damage, always disconnect the module when you jump-start the vehicle with voltages that exceed 32 VDC.

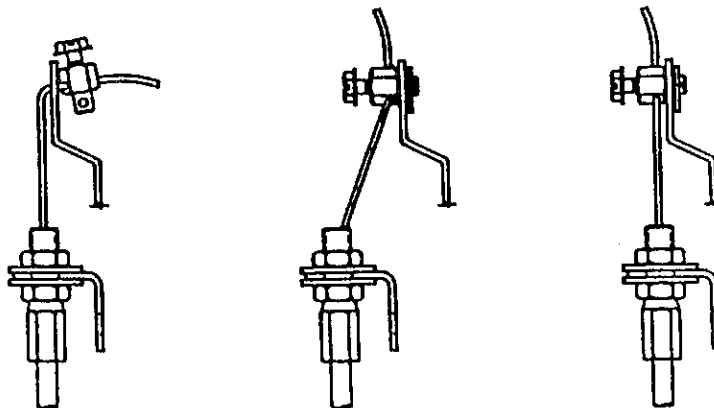
**⚠ CAUTION**

To avoid eye and/or face injury, eye and/or face protection must be worn when installing this device.

**Improper installation of cable pivot can result in premature wire cable failure.**

Consult the diagram below for proper installation.

Contact Trombetta service representatives at (414) 251~ 5454 with questions regarding your application.



INCORRECT

INCORRECT

CORRECT

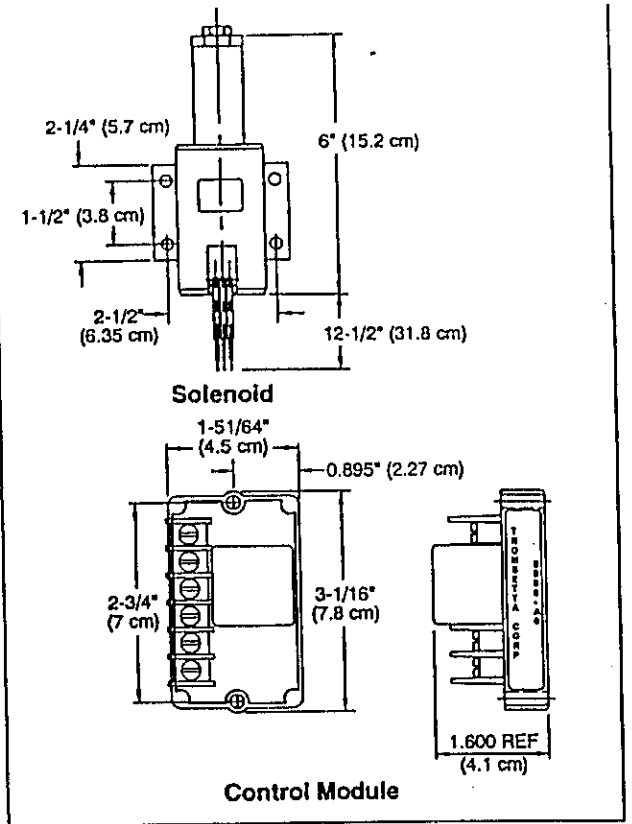


## Installing Your Throttle Control Solenoid

### Location

Follow these simple rules to properly locate your throttle control kit:

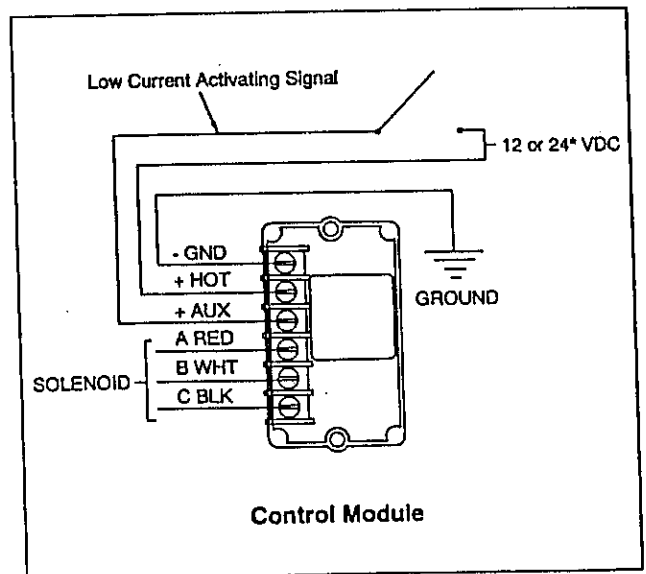
- Mount the solenoid off the engine but within 46 inches (116.8 cm) of the throttle lever, to avoid engine vibration and high temperature components (more than 257° F [125° C]).
- Mount Control Module out of the engine compartment if possible. If not possible, mount the module as far away from high temperature components as possible. Maximum temperature range is 185° F (85° C).
- Route the Flexible cable away from high temperature (220° F [105° C]) components such as exhaust manifolds.
- Avoid sharp bends in flexible cable. Bends should form a smooth arc (360° maximum) with a radius of 5 inches (12.7 cm) minimum.



### Controlling the Solenoid Throttle Kit

The throttle kit can be controlled remotely by applying a low current 12 or 24 VDC signal to the module "AUX" terminal.

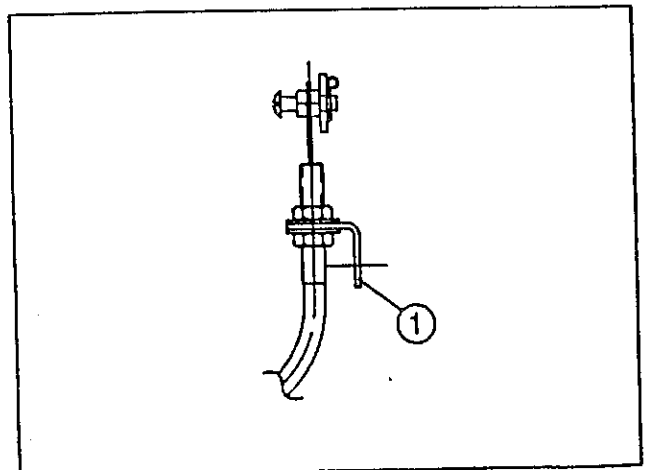
Examples of activating signals are the air compressor pressure switch or air conditioning switching circuits.



### Mounting Procedures

Use the following procedure to mount your throttle controller:

1. Mount the solenoid and control module according to the recommendations on the "Location" instructions.
2. Electrically connect the solenoid to the control module and power source according to the wiring diagram.
3. Mount the cable bracket (1) and fasten the cable sheath to the bracket using the collar nut so the sheath does not turn during idle adjustment.



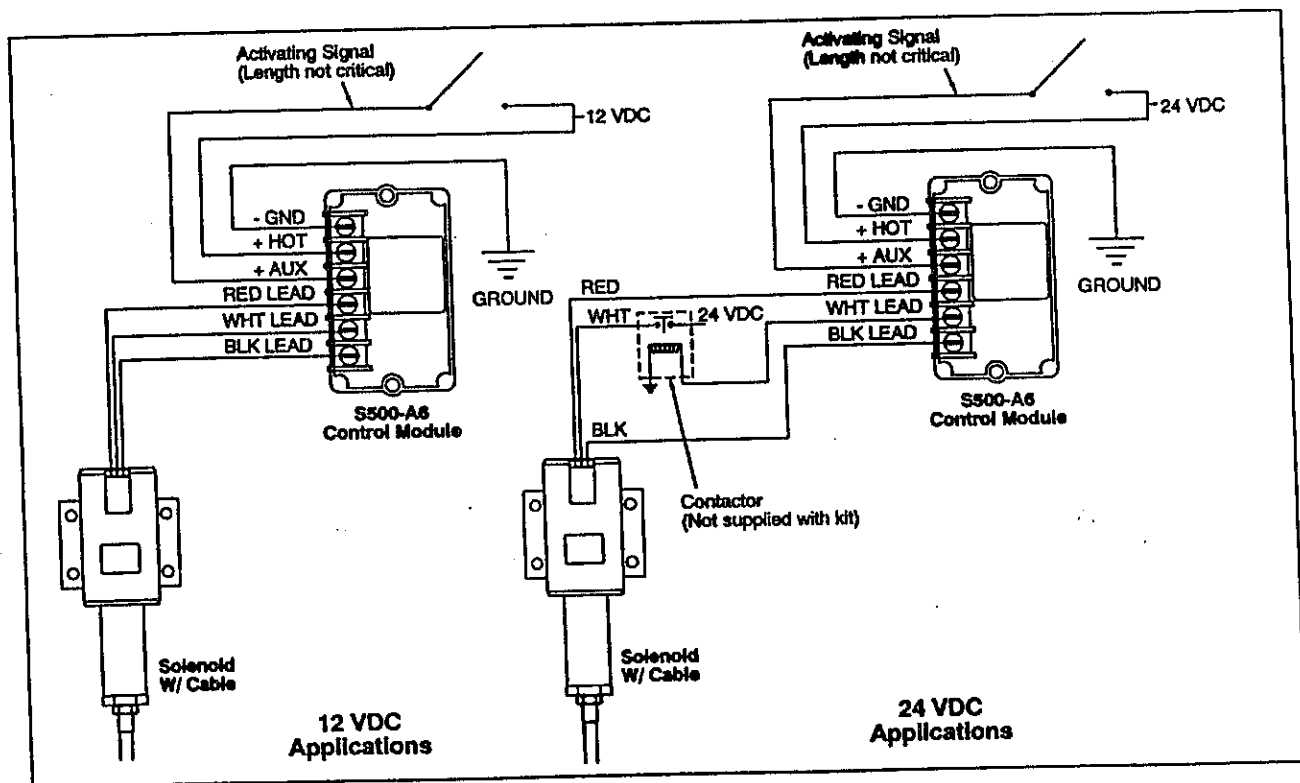
Use the following table to determine all wire lengths except "AUX" terminal:

**Note:** The wire size and length to "AUX" terminal of the control module is not critical because of low current; 16-18 gage wire may be used.

Maximum Lead Length - In Feet\*

System Voltage	Wire Gage						
	18 AWG	16 AWG	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG
12 VDC	2.5 ft.	4 ft.	6 ft.	10 ft.	16 ft.	25 ft.	40 ft.
24 VDC	10 ft.	16 ft.	25 ft.	40 ft.	64 ft.	100 ft.	160 ft.

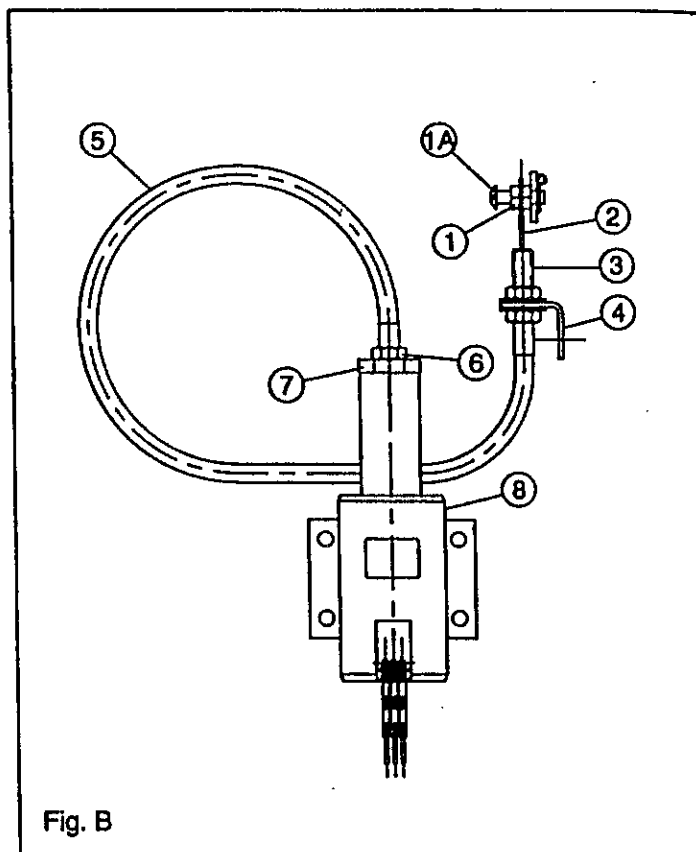
\* Total of "-GND" and "+HOT" wire lengths plus "B WHT" and "C BLK" wire length.



## Set Normal Engine Idle Speed

Use the following procedure to set the "normal" engine idle speed with the solenoid de-energized:

1. With the engine "off", attach the cable pivot assembly (1) to the throttle lever.  
Note: DO NOT tighten the wire core pivot setscrew (1A). The wire core (2) must be free to move through the pivot until step 2.
2. Insert the wire core (2) into the wire core pivot (1).
3. If the cable adjuster is not fully retracted into the solenoid, loosen the jam nut (6) and turn the aluminum adjustment nut (7) counterclockwise until the cable adjustment nut (7) is flush with the solenoid (8).
4. With all connections made to the throttle control systems, apply 12 VDC to "AUX" terminal of the control module. Make sure the wire core (2) is free to move through the cable pivot (1) with out restriction.
5. Adjust "normal" engine idle speed using the "standard method" required for your engine.
6. Eliminate the slack in the cable (2).
7. Tighten the cable pivot setscrew (1A).



## Set High Idle Speed

Use the following procedure to set the "high" engine idle speed with the solenoid activated:

1. Set the "normal" engine idle speed per the previous procedure.
2. With the engine running, apply 12 VDC to the "AUX" terminal of the control module.
3. Make sure the jam nut (6) is loose and turn the aluminum adjustment nut (7) clockwise until the high engine idle speed is reached.
4. Tighten the jam nut (6).
5. Check the throttle speed controller operation rechecking the "normal" engine idle speed with the solenoid deactivated and high engine idle speed with the solenoid activated. If necessary, repeat the "normal" idle speed and high idle speed adjustments.

Note: Do not leave the aluminum adjustment nut (7) tight against the solenoid body since this does not allow the cable (5) to float.

## System Operation

Trombetta's P613-K1 throttle control solenoid kit consists of a "three wire," dual coil solenoid, electromechanical control module and stainless steel sheathed pull cable. The sheathed pull cable allows the solenoid to be mounted away from hostile environments, such as engine vibration and high temperature.

The throttle solenoid can be activated automatically for "on demand" or bring the idle speed to a pre-set high idle position.

The control module allows the solenoid to operate as a continuous duty device. When the module is wired as recommended, applying 12 VDC to the "AUX" terminal applied voltage to the hold-in and pull-in coil of the solenoid. After 0.5 seconds to 0.75 seconds, power is automatically removed from the pull-in coil. Power will remain at the hold-in coil until the 12 VDC signal is removed from the "AUX" terminal.

## Control Module Voltage Measurements

Terminal Designation	Voltage
- GND	Chassis Ground
+ HOT	12 or 24 VDC at all times
+ AUX	12 or 24 VDC required to activate solenoid
A RED	12 or 24 VDC when signal is present at "AUX" terminal
B WHT	12 or 24 VDC for 0.5 to 0.75 seconds after signal at "AUX" terminal
C BLK	Common for solenoid

## Troubleshooting Hints

If the solenoid will not engage, check the following:

1. Check the stranded pull cable for damage (e.g., melted or crimped sheath).
2. Check the stranded pull cable for binding
3. Check system voltage at the "+HOT" and "AUX" terminals.
4. Check module terminals for proper voltage and operation. If the module does not meet these specifications, replace it.
5. Check solenoid resistance (remove wires from module). If resistance is not within specifications listed below, replace the solenoid.
6. Make sure you have the recommended wire length and gage (refer to wire chart).
7. Be sure cable is not bent beyond guidelines.
8. Check for proper adjustments.
9. Contact the factory if you are unable to resolve the problem.

12 VDC System	24 VDC System
0.17 ohms White to Black wire	0.66 ohms White to Black wire
0.13 ohms Red to Black wire	0.48 ohms Red to Black wire

## Trombetta Pull Cable Shortening Instructions

Use the following procedures to shorten pull cables supplied with Trombetta products.

### IMPORTANT!

DO NOT cut wire core (2) until step #11! Remove wire core (2) from cable sheath (5) *before* cutting the sheathing.

1. Remove the cable assembly (1-7) from the solenoid body (8) by loosening the jam nut (6) and turning the large aluminum adjusting nut (7) "clockwise".

**Note:** The solenoid "plunger" located inside the solenoid body can be removed at this point. Take care not to damage or contaminate the plunger while it is out of the solenoid body (8). Be sure to keep the inside of the solenoid body (8) "clean" while the plunger is removed.

2. Remove the wire core (2) from the cable sheath (5).
3. Lightly fixture the cable sheath (5) in a vise or other suitable holding device.

**Note:** Over tightening the vise may deform the cable sheath (5) and cause the wire core (2) to bind!

### !! CAUTION !!

Safety Goggles must be worn before proceeding!

4. Use an abrasive "cut-off wheel" (eg. A Dremel tool and Dremel abrasive disk), to cut the cable sheath (5) to the desired length. Deburr and clean the "cut end" of the sheath (5).
5. Mark the cable sheath (5) 1" from the end with a wrap of masking tape (see Fig. C).
6. If the threaded-on bulkhead connector is to be reused, remove it from the cut-off piece of cable sheathing by unthreading it in a counter-clockwise direction. Wipe the connector clean and reuse it for step #8.
7. Wipe the wire core (2) clean and then re-insert this core (2) through the cable sheath (5).

**Note:** Make sure the wire core (2) moves "freely" inside the cable sheath (5). If it does not, discard the whole cable assembly and replace.

8. Turn the "cable bulkhead fitting" (see fig. A) onto the sheathing (5). Torque to maximum 8 pound - inches. At this point, the fitting should be approximately  $\frac{1}{4}$ " or less from the tape mark on the sheath.

**!! CAUTION !!**

Cable bulkhead fitting must engage at least  $\frac{3}{4}$ " of the cable sheath to be properly attached. Over tightening the fit may strip the threads.

9. Re-install the cable assembly.
10. Using the "throttle solenoid" setting instructions, proceed with setting the throttle solenoids.
11. After the throttle solenoid is set and connections are tightened, cut the excess wire core approximately "one" inch beyond the cable pivot (1).

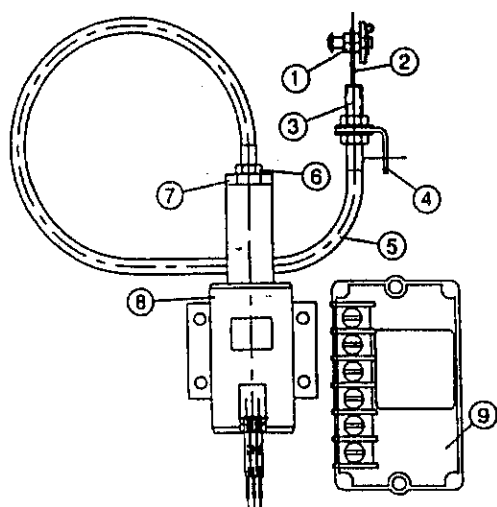


Fig. A

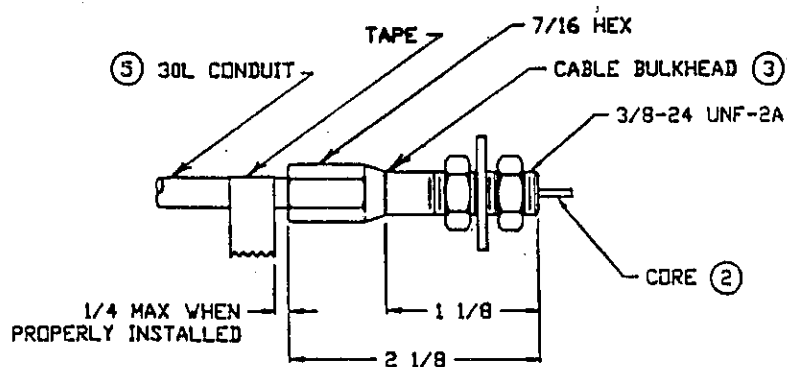


Fig. C

**If you have problems or questions, please contact the  
Factory Service Department at (414) 251-5454.**