HELIX-200

AUTOMATIC SPIRAL TUBEFORMER

OPERATIONS MANUAL

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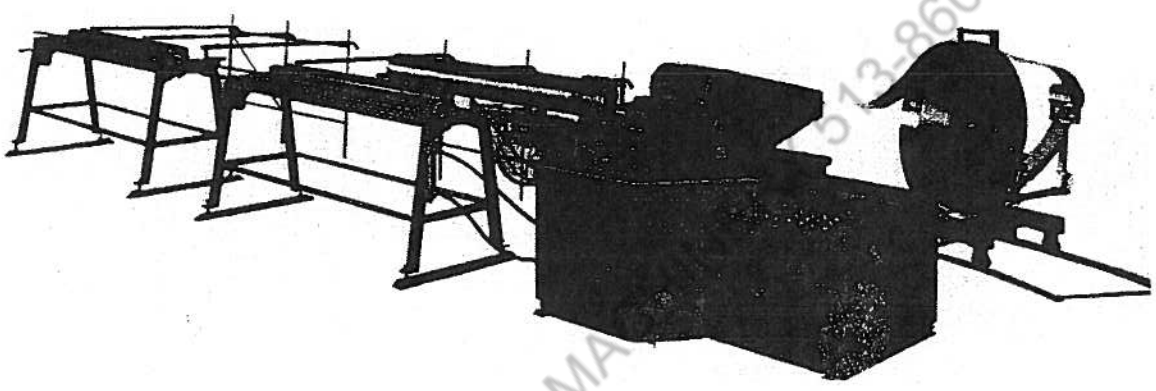

OPERATIONS MANUAL

SPIRAL-HELIX, INC.

PREFACE

INTRODUCTION

This manual has three goals: to provide information needed for installing the HELIX-200 Automatic Spiral Tubeformer; to help you understand the HELIX-200, how to operate it, and how to trouble shoot it during production; and to guide you with what must be done to maintain the HELIX-200 in optimum operating condition. The manual is offered as your primary resource for engineering and operating information for the HELIX-200. Reading the manual will help you become familiar with the HELIX-200, and help you develop more efficient and more cost effective ways to operate the machine so as to get the most for your production dollars. ALL HELIX-200 OPERATORS ARE ENCOURAGED TO READ THIS MANUAL.

WHAT DOES THIS MANUAL CONTAIN?

The first chapter introduces this manual and its goals; while the second chapter introduces the HELIX-200 and offers a partial listing of where it finds its uses. Chapter 3 describes the HELIX-200, its key features and a partial listing of the benefits offered the owner and/or the operator of a HELIX-200. Chapter 4 provides an in-depth look at the HELIX-200 main machine, and what makes it work.

Chapters 5 and 6 cover the transportation and storage guidelines, and the step-by-step instructions for installing the standard equipment HELIX-200 and its optional equipment. Chapter 7 provides operating instruction sets that include setting up the standard equipment, setting up optional equipment, making a setup run, and making a production run. Chapter 8 offers trouble shooting guidelines for the rare case when you may encounter a problem while operating the HELIX-200. Chapter 9 recommends a planned maintenance schedule designed to help you keep your investment in the HELIX-200 performing for years to come; and Chapter 10 refers you to the appropriate document for all your HELIX-200 Spare Parts needs.

Together, the chapters of this manual provide a complete and cohesive resource for information on your HELIX-200. Each chapter is designed and written to be self contained. However, you are encouraged to read this manual, at least once, in sequence from end to end.

WHO SHOULD USE THIS MANUAL?

The HELIX-200 Automatic Spiral Tubeformer Operations Manual is a useful manual for anyone who wants to get the most from the HELIX-200. Although the manual is useful for everyone, it is designed and written especially for the first-time HELIX-200 operator as well as the seasoned and experienced operator, for the HELIX-200 field service technician, for the new as well as the seasoned design engineer, and the engineered product sales and marketing specialist. The manual presents the full complement of information to give you a working understanding of the HELIX-200; and then builds on your proficiency by providing step-by-step information on installation,

doing a production setup, making a production run and the steps to take when the occasional production problem occurs, and what you must do to keep the HELIX-200 in optimum operating condition.

WHERE TO FIND MORE HELP

The HELIX-200 Automatic Spiral Tubeformer is designed for trouble free operation and minimal maintenance. However, from time to time, the rare problem may arise when operating the HELIX-200. In such cases, first document the problem and refer to the appropriate sections and subsections of this manual for a solution. In the event the problem encountered is not covered in this manual, call SPIRAL-HELIX, INC. for a solution; and be prepared to describe your problem in full.

SAFETY INFORMATION - ALWAYS BE AWARE

This HELIX-200 Automatic Spiral Tubeformer Operations Manual contains safety information to protect you and your equipment. This information is provided in **boldface** and/or ***boldface italic*** type, and is captioned with one of the following words: **NOTE**, ***DANGER***, ***WARNING***, and ***CAUTION*** and/or ***PRECAUTION***. It shall be the sole responsibility of the HELIX-200 operator and the site management to follow the requirements of all safety information. A partial compilation of key safety information is provided here for your reference. Please pay attention.

NOTE: **ALL APPROPRIATE LOCAL SAFETY AND HANDLING PRACTICES MUST BE FOLLOWED WHEN TRANSPORTING THE HELIX-200 TO OR STORING IT AT A STAGING OR INSTALLATION SITE.**

CAUTION: ***DO NOT STACK UNITS for transportation or during storage.***

NOTE: **THIS MANUAL CONTAINS INSTALLATION INSTRUCTIONS FOR A STANDARD HELIX-200. IT SHALL BE THE RESPONSIBILITY OF THE SUPERVISING SITE ENGINEER AND/OR THE RESPONSIBLE SITE MANAGEMENT TO ENSURE THAT THE INSTALLATION SITE COMPLIES WITH ALL LOCAL CONDITIONS, PRACTICES AND/OR CODES; AND THAT ANY AND ALL RELEVANT INDUSTRY AND/OR NATIONAL CODES ARE MET.**

WARNING: ***TO AVOID DAMAGING THE HELIX-200, OR A COMPONENT, OR AN OPTIONAL EQUIPMENT, DO NOT REMOVE THE PALLETIZED CRATE AND PACKAGING UNTIL THE EQUIPMENT IS TRANSPORTED TO THE INSTALLATION SITE.***

WARNING: OBSERVE ALL LOCAL SAFETY PRACTICES AND WEAR ALL LOCALLY APPROVED SAFETY GEAR WHEN INSTALLING THE HELIX-200. ALSO FOLLOW THE ADDITIONAL PRECAUTIONS LISTED BELOW IF THEY ARE NOT INCLUDED IN THE LOCAL SAFETY PRACTICES.

1. *Keep bystanders away from the installation site at all times.*

2. *Crane or forklift operators should not suspend any load over people, or should any person be permitted to work, stand, or pass under a suspended load.*

3. *All persons working with crane equipment shall wear standard safety headgear, eye protection, and (when required) gloves. Only those operators who are specifically trained shall be permitted to operate crane equipment for placing the HELIX-200.*

4. *Do not operate a crane until all stabilizers are extended and in firm contact with the ground or adequate support structure. Do not attempt to retract or extend the stabilizers while a load is suspended from the crane.*

5. *When raising a crane from the stowed position, and while operating the crane, be alert for overhead obstructions or power lines that might interfere with movement of the crane.*

6. *If the equipment is moved while it is attached to the pallet, it may be lifted by a forklift vehicle provided that the forklift is rated for the weight of the equipment, and has a fork length no more than 6 inches shorter than the pallet dimension when measured across from the forklift.*

7. *Do not transport, lift, or install a HELIX-200 with electrical power and/or pneumatic power source already engaged. External AC power and/or pneumatic power source may be connected to the equipment only after it has been fully installed and secured.*

DANGER: IT IS VERY IMPORTANT THAT THE MAIN MACHINE IS LEVEL. FAILURE TO LEVEL THE MAIN MACHINE WILL RESULT IN UNSATISFACTORY PERFORMANCE, AND MAY RESULT IN DAMAGE TO THE EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL DURING OPERATION.

WARNING: POWER DOWN THE HELIX-200 PRIOR TO ANY PROCEDURE TO INSTALL ANY OPTIONAL EQUIPMENT. EXTERNAL AC POWER AND/OR PNEUMATIC POWER SOURCE MAY BE

ENGAGED ONLY AFTER THE OPTIONAL EQUIPMENT HAVE BEEN FULLY INSTALLED AND SECURED.

DANGER: TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL, ONLY TRAINED PERSONNEL MAY OPERATE THE HELIX-200.

DANGER: TO AVOID BODILY INJURY TO PERSONNEL AND POSSIBLE DAMAGE TO EQUIPMENT, KEEP CLEAR OF MOVING PARTS.

DANGER: TO AVOID BODILY INJURY TO PERSONNEL AND POTENTIAL DAMAGE TO EQUIPMENT, MAKE SURE THAT NO ONE IS IN THE CUTTER BLADE DANGER ZONE WHEN A SAW UNIT IS IN USE.

WARNING: BEWARE OF METAL PARTICLES FROM THE SAW BLADE WHEN THE SAW UNIT IS IN USE.

WARNING: KEEP UNTRAINED PERSONS AWAY FROM THE EQUIPMENT.

WARNING: TO AVOID PRODUCTION PROBLEMS, MAKE SURE THAT THE RUN-OFF TABLE ASSEMBLY IS PROPERLY INSTALLED, AND LEVELED; AND THAT CUT FORMED TUBE LENGTHS ON THE RUN-OFF TABLE ASSEMBLY MATE SQUARELY TO THE CORRESPONDING UNCUT PIECE OF FORMED TUBE IN THE FORMING HEAD.

WARNING: TO AVOID OVERHEATING AND POSSIBLE DAMAGE TO EQUIPMENT, DO NOT LEAVE THE HELIX-200 IDLING FOR MORE THAN TEN MINUTES AT ANY TIME. THAT IS, DO NOT RUN THE HELIX-200 AT ZERO SPEED FOR MORE THAN TEN MINUTES AT ANY TIME.

DANGER: AN ELECTRICAL SHOCK HAZARD EXISTS WHEN WORKING WITH EITHER AC OR DC POWER. TO AVOID THE RISK OF INJURY TO PERSONNEL OR EQUIPMENT DAMAGE, ALL LOCAL SAFETY PRACTICES MUST BE FOLLOWED AND APPROVED SAFETY GEAR MUST BE WORN WHEN ANY WORK IS TO BE DONE INSIDE THE ELECTRICAL SYSTEM COMPARTMENT. POWER DOWN THE HELIX-200 AND DISCONNECT THE EXTERNAL AC POWER SOURCE BEFORE DOING ANY WORK WITHIN THE ELECTRICAL SYSTEM COMPARTMENT.

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

CAUTION: ***Always wear protective goggles or appropriate eye protection gear; and always wear gloves when lifting or handling tubes.***

NOTE: **IN AN EMERGENCY, PUSH DOWN ON THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL LABELED "MAIN SWITCH". THIS WILL IMMEDIATELY STOP ALL MOTORS AND OPERATION OF THE HELIX-200.**

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL, MAKE SURE THAT NO ONE IS TOUCHING THE STRIP MATERIAL BETWEEN THE DECOILER AND THE ROLLER HOUSING WHEN STARTING THE HELIX-200.***

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE BODILY INJURY TO PERSONNEL, THE ROLLER HOUSING MUST BE POSITIONED ON THE TUBE SIZE SELECTOR SCALE TO CORRESPOND TO THE FORMING HEAD TO BE USED.***

WARNING: ***TITANIUM AND NIOBIUM STABILIZED STEELS ARE NOT SUITABLE FOR USE AS TUBEFORMING STRIP MATERIALS IN THE HELIX-200.***

CAUTION: ***Use of Prime lockseam quality strip material is preferred; where prime stock lockseam quality is defined as lockseam quality stock that is free of rust and dirt.***

WARNING: ***TO AVOID DAMAGE TO THE DRIVE UNIT AND FEED ROLLERS, MAINTAIN A GAP OF NO LESS THAN 0.002 INCH (0.051 MM) BETWEEN THE UPPER (DRIVE) ROLLER AND THE LOWER (PINCH) ROLLER WHEN THE DRIVE UNIT AND FEED ROLLERS PRESSURE SETTING IS APPROXIMATELY 150 PSI (10 BARS) AND THERE IS NO STRIP MATERIAL BETWEEN THE ROLLERS.***

CAUTION: ***The initial lower (pinch) roller pressure setting should not exceed 10 bars at the start of the drive unit setup.***

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE BODILY INJURY TO PERSONNEL, DO NOT FORM TUBE SIZES***

SMALLER THAN 6 INCHES (152 MM) DIAMETER USING STRIP MATERIAL THICKER THAN 0.0400 INCH (1.020 MM OR 20 GAUGE).

CAUTION: ***Make sure that the clinching roller is installed before mounting the forming head.***

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE BODILY INJURY TO PERSONNEL, DO NOT USE THE HEAVY DUTY SUPPORT ROLLER AND ROLLER HOLDER PLATE ASSEMBLY WHEN FORMING TUBE SIZES SMALLER THAN 6 INCHES (152 MM) DIAMETER.***

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE BODILY INJURY TO PERSONNEL, DO NOT USE THE HEAVY DUTY SUPPORT ARM WHEN FORMING TUBE SIZES SMALLER THAN 6 INCHES (152 MM) DIAMETER.***

CAUTION: ***To ensure a good lockseam when a corrugating attachment is used, the grooves and the beads on the rollers of the corrugating attachment must be parallel to the lockseam. Where the corrugating attachment does not have a readily alignable set of grooves or beads, the angle of the corrugating attachment must be exactly the same as the angle of the lockseam with respect to the same reference, regardless of the reference.***

WARNING: ***IN ALL CASES AVOID USING HIGHER DRIVE UNIT AND FEED ROLLERS PRESSURE, OR CLINCHING ROLLER PRESSURE, AND/OR SUPPORT ARM PRESSURE THAN IS NECESSARY.***

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT, ESPECIALLY THE HYDRAULIC PUMPS, MAKE SURE THAT THE HYDRAULIC MEDIUM IS CLEAN, AND MEETS THE TEMPERATURE REQUIREMENTS OF THE OPERATING ENVIRONMENT.***

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT - ESPECIALLY THE DRIVE UNIT GEARING AND FEED ROLLERS, FORM ROLL UNIT ROLLERS, ALL BEARINGS, THE GUIDE PLATES, AND THE FORMING HEAD - MAKE SURE THAT THESE COMPONENTS, ASSEMBLIES AND SUBASSEMBLIES ARE PROPERLY GREASED AT ALL TIMES, AND THAT THE STRIP MATERIAL IS PROPERLY LUBRICATED DURING THE PRODUCTION RUN.***

CAUTION: ***Make sure that all lubricants are clean when used.***

NOTE: **THE RECOMMENDED WATER SOLUBLE STRIP MATERIAL LUBRICANT IS SPIRALUBE FROM SPIRAL-HELIX, INC.**

CAUTION: ***Use of secondary lockseam-quality strip material stock is NOT recommended.***

CAUTION: ***The operating speed setting must not exceed the recommended values at any time or for any reason. To avoid the risk of damage to equipment or the potential for injury to personnel, operating speeds below the recommended values are always preferred.***

CAUTION: ***Power down the HELIX-200 before initiating any trouble shooting adjustments involving moving assemblies, subassemblies and/or components.***

WARNING: ***IN THE EVENT OF A DECOILER SAFETY SENSOR BEING TRIPPED, DO NOT RESTART THE HELIX-200 UNTIL THE OPERATING SPEED SETTING HAS BEEN DIALED DOWN TO A VALUE IN KEEPING WITH THE RECOMMENDED VALUE.***

NOTE: **STRIP MATERIAL 0.0401 INCH (1.021 MM OR 19 GAUGE) AND THICKER IS CONSIDERED HEAVY GAUGE STRIP MATERIAL FOR PURPOSES OF SPIRAL TUBEFORMING.**

NOTE: **FOR EACH PRODUCTION RUN USE A WIRE BRUSH, AS NECESSARY, TO KEEP THE DRIVE UNIT AND FEED ROLLERS FREE FROM STRIP MATERIAL RESIDUE BUILD UP.**

WARNING: ***UNLOAD THE RECEIVING RAMP AND THE RUN-OFF TABLE ASSEMBLY AFTER EACH PRODUCTION RUN.***

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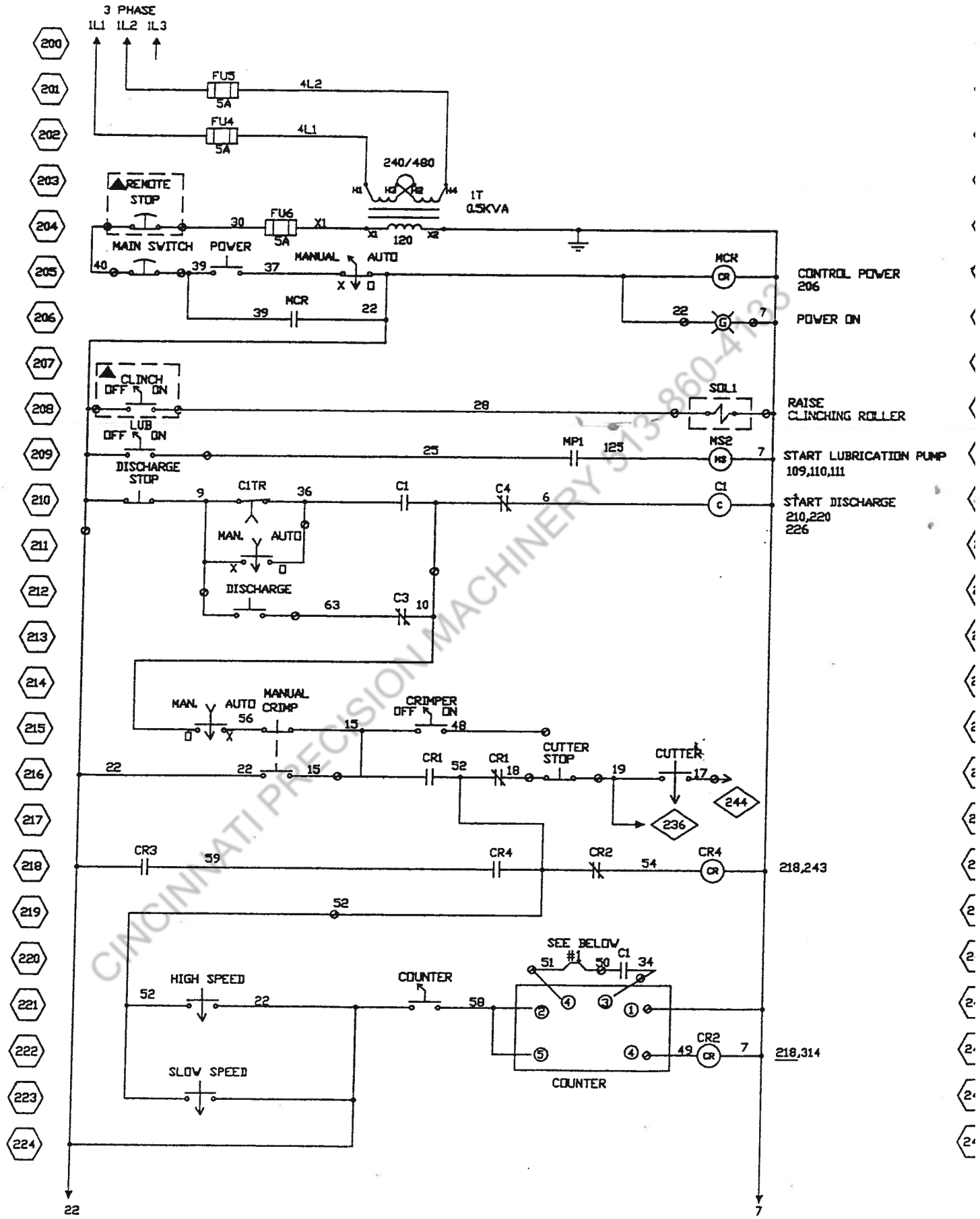
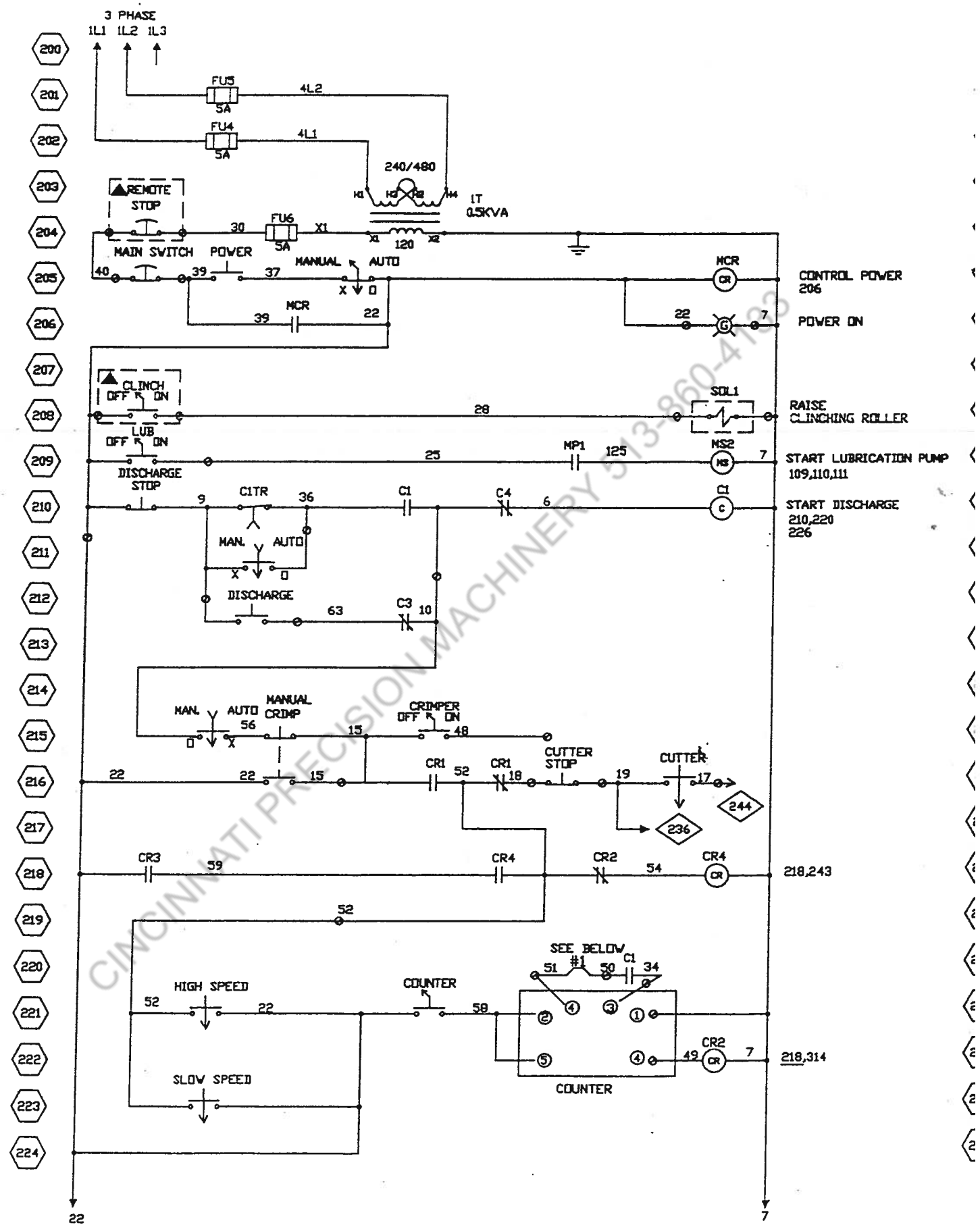
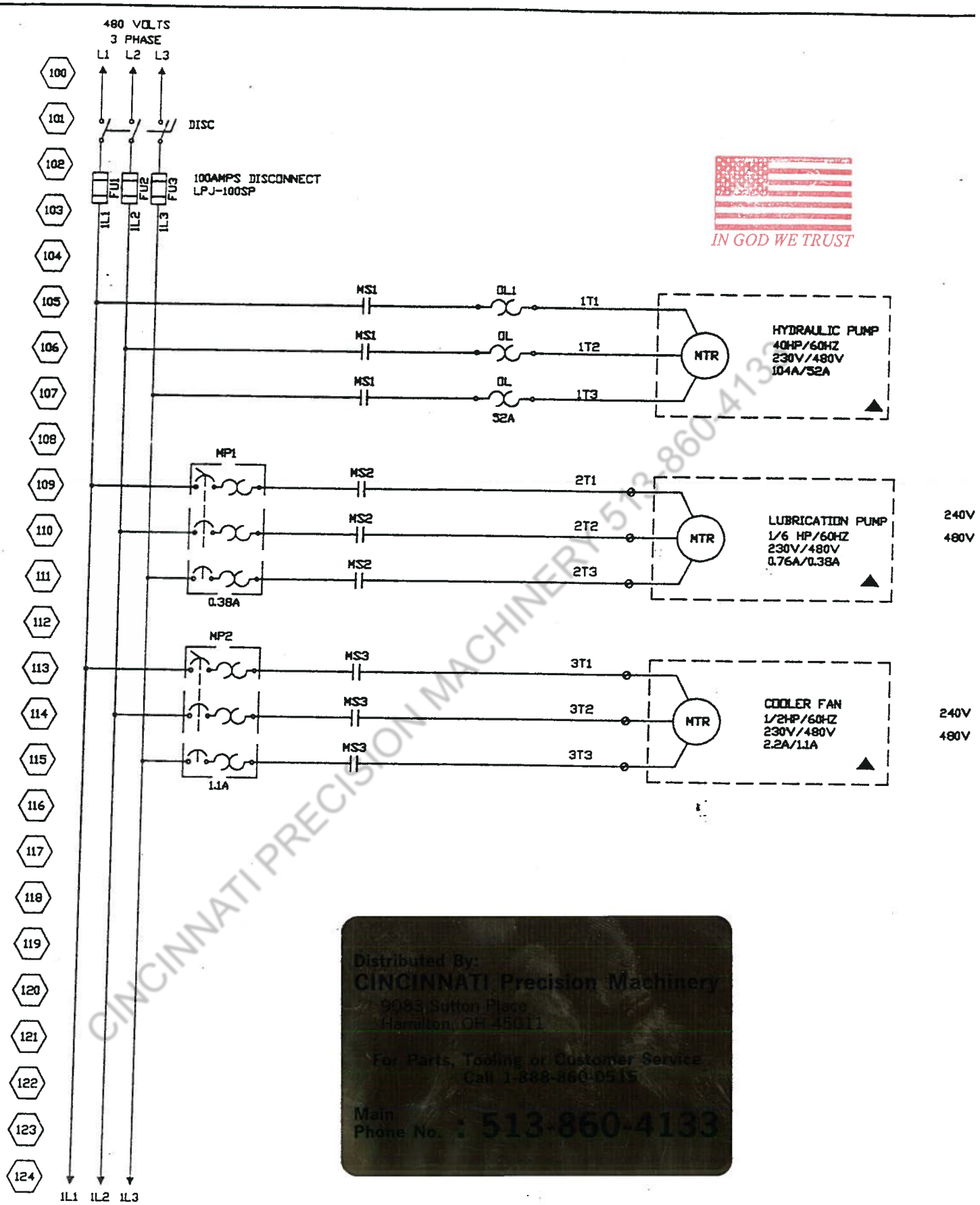




#1 REMOVE JUMPER WHEN USING CRIMPER



▲ NOTE: LOCATED OUTSIDE OF ENCLOSURE

MOTOR OVERLOAD

20HP/60HZ 230V/480V 54A/27A	240V P/N LR2D3359
	480V P/N LR2D3353
25HP/60HZ 230V/480V 68A/34A	240V P/N LR2D3361
	480V P/N LR2D3355
30HP/60HZ 230V/480V 77.2A/38.6A	240V P/N LR2D3363
	480V P/N LR2D3357
40HP/60HZ 230V/480V 104A/52A	480V P/N LR2D3359
50HP/60HZ 230V/480V 130A/65A	480V P/N LR2D3361

2M05

2M03

2M07

2M06

COMPLETED SEP 2 1 1999

DATE	REVISION	BY	CHK'D

CUSTOMER: SPIRAL HELIX

TITLE: TUBEFORMER 100 & 200 SERIES

SCALE	DRAWN BY	CHECKED BY	APP'D BY
N/A	RKP		

ISSUED	SHEET	OF SHEETS	DRAWING NO.
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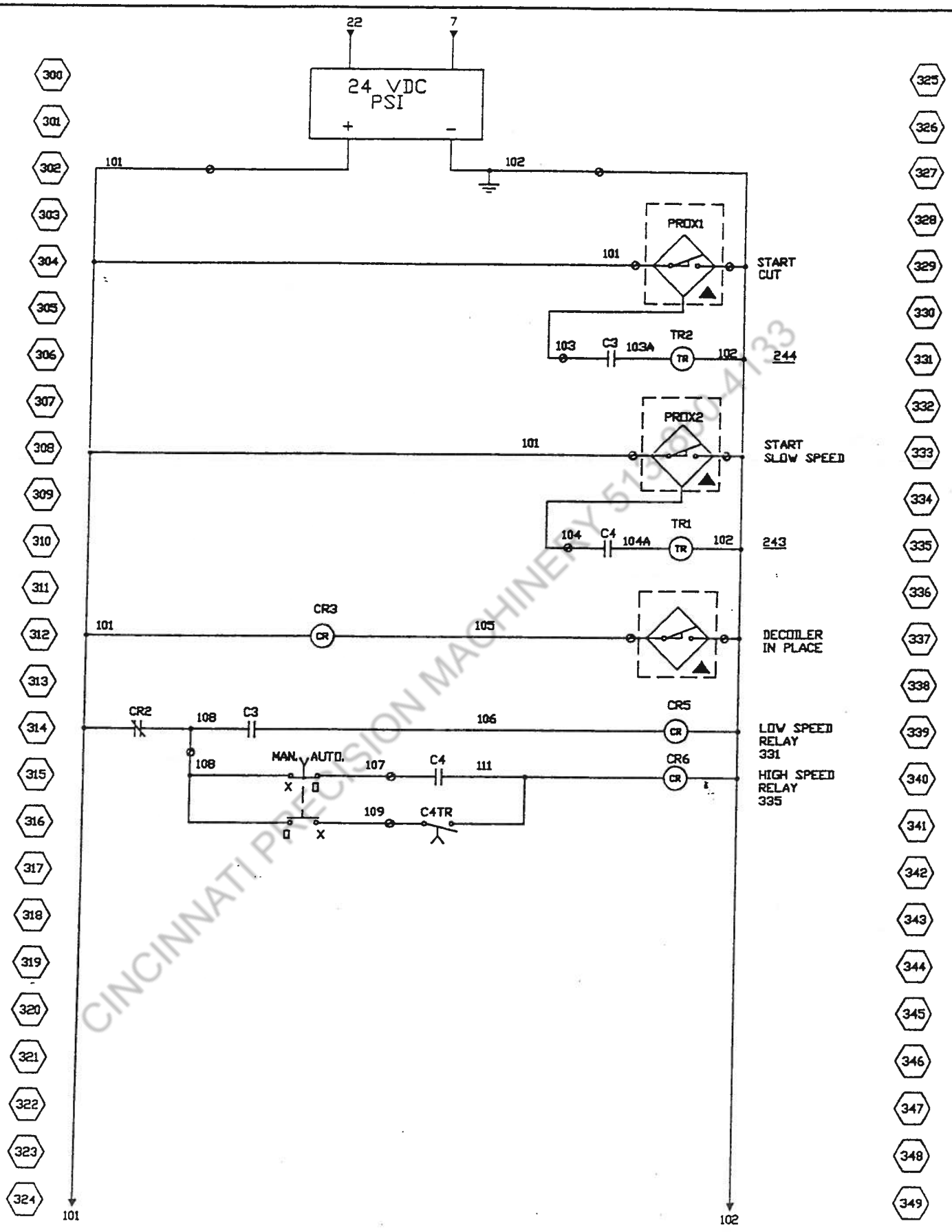

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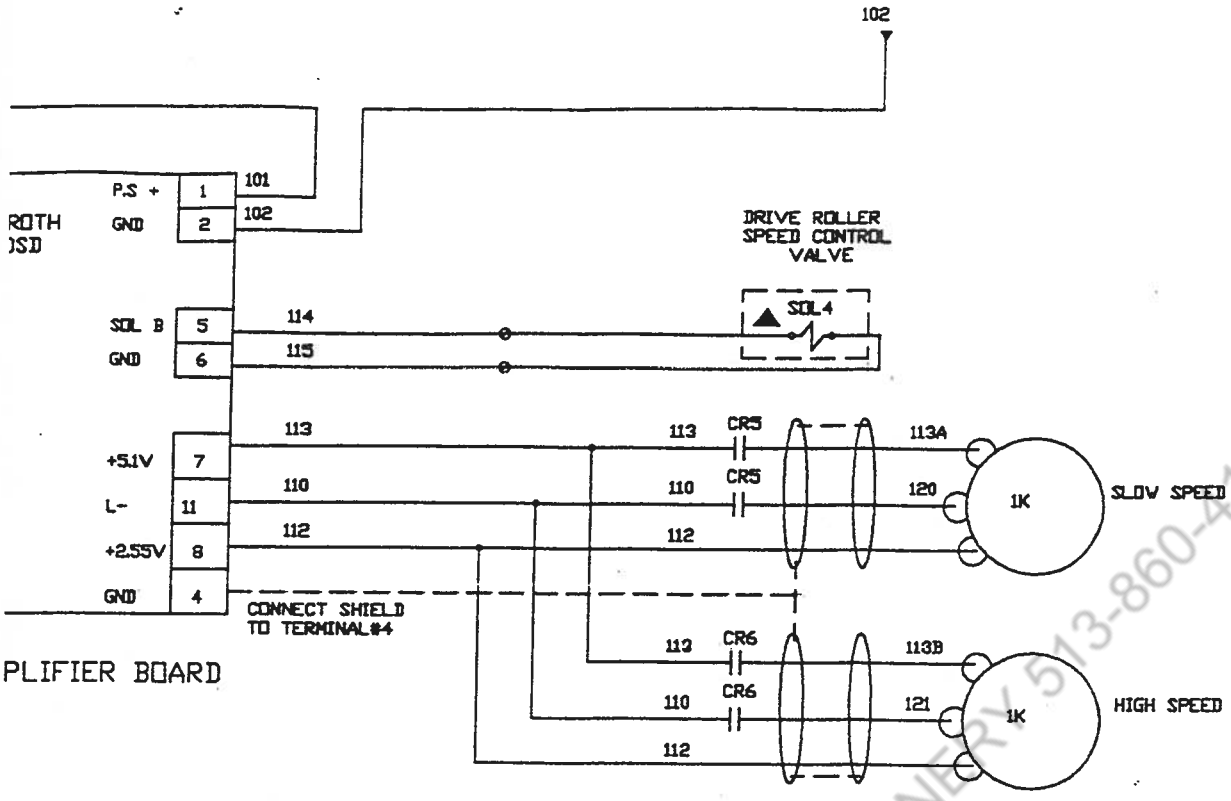

-1-99	AMPLIFIER BOARD,CR5 AND CR6 ADDED	RKP		
DATE	REVISION	BY	CH'D	

COMPLETED SEP 2 1 1999

CUSTOMER: SPIRAL HELIX

TITLE: TUBEFORMER
100 & 200 SERIES

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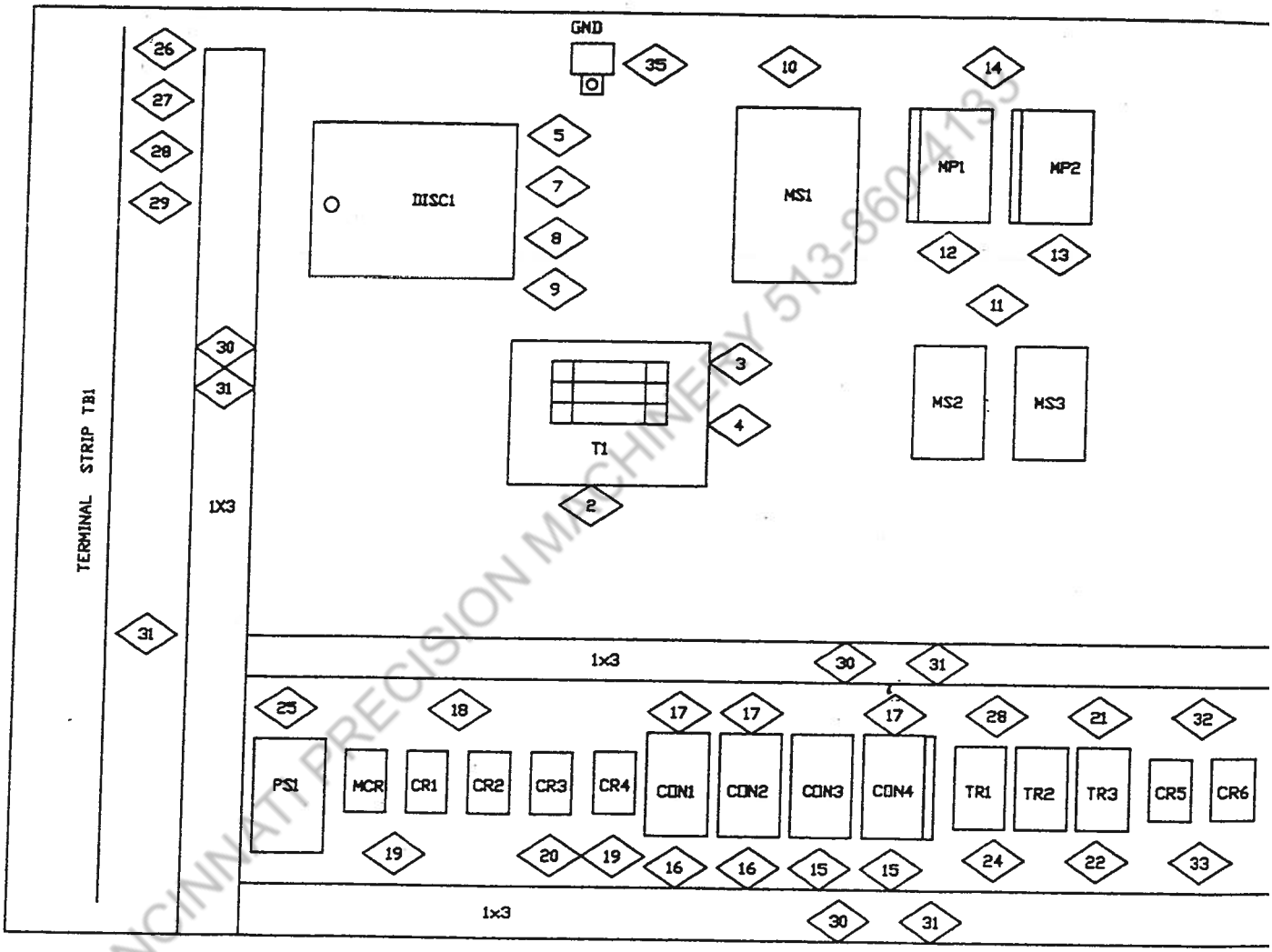

ITEM	PART NUMBER	DESCRIPTION	MANUFACTURE	SYMBOL
1	A-36P24	ELECTRIC PANEL	HOFFMAN	
10	LC1-D8011-G6	CONTACTOR	SQUARE D	MS1
11	LC1-D9011-G6	110V CONTACTOR	SQUARE D	MS2,MS3
12	GV2M0[illegible]	MOTOR PROTECTOR	SQUARE D	MP1
13	GV1M0[illegible]	MOTOR PROTECTOR	SQUARE D	MP2
14	GV2AE1	AUX. CONTACTOR	SQUARE D	MP1,MP2
15	CA2DN22G6	CONTACTOR	SQUARE D	CON3,CON4
16	CA2DN31G6	CONTACTOR	SQUARE D	CON1,CON2
17	LA2DT2	TIME RELAY	SQUARE D	CON1,CON2,CON4
18	SH2B-05	RELAY SOCKET	IDEC	MCR,CR1-4
19	RH2B-U-120V	RELAY 120VAC	IDEC	MCR,CR1,CR2,CR4
20	RH2B-U-24VDC	RELAY 24VDC	IDEC	CR3
21	GTY-24SN6A100	TIMER	IDEC	TR3
22	SY4S-05	SOCKET	IDEC	TR3
23	SR2P06	SOCKET	IDEC	TR1,TR2
24	S1K00010462	TIMER	NCC	TR1,TR2
2	TF500D1	TRANSFORMER	SQUARE D	T1
25	IHC24-2.4A	POWER SUPPLY	POWER ONE	PS1
26	1492-W4	TERMINAL BLOCK	ALLEN BRADLEY	TB1
27	1492-EB3	END BARRIER	ALLEN BRADLEY	TB1
28	1492-EA35	END ANCHOR	ALLEN BRADLEY	TB1
29	1492-WG4	GROUND TERMINAL	ALLEN BRADLEY	TB1
30	C1LG6	DUCT COVER	PANDUIT	
31	E1X3LG6	WIRE DUCT	PANDUIT	
3	FNQ-R-5	FUSE 5 AMP	BUSSMAN	FU4,FU5
4	FNM-5	FUSE 5 AMP	BUSSMAN	FU6
5	OESA-F100JT6A	DISCONNECT	ABB	DISC1
6	YASOB-49	HANDLE	ABB	DISC1
7	OZXA-24	LUGS	ABB	DISC1
8	IESA-ZS31	SHAFT	ABB	DISC1
9	LPJ-80/100	FUSE 80/100AMPS	BUSSMAN	FU1,FU2,FU3
32	RYS22V24VDC	RELAY	IDEC	CR5,CR6
33	SY2S-05	SOCKET	IDEC	CR5,CR6
34	US00886176	AMPLIFIER BOARD	REXROTH	
35	LAMA2-14Q	GROUND LUG	PANDUIT	GND

DATE	REVISION	BY	CHD
-1-99	AMPLIFIER BOARD,CR5 AND CR6 ADDED	RKP	

COMPLETED SEP 2 1 1999

CUSTOMER: SPIRAL HELIX

TITLE: TUBE FORMER 100 & 200 SERIES

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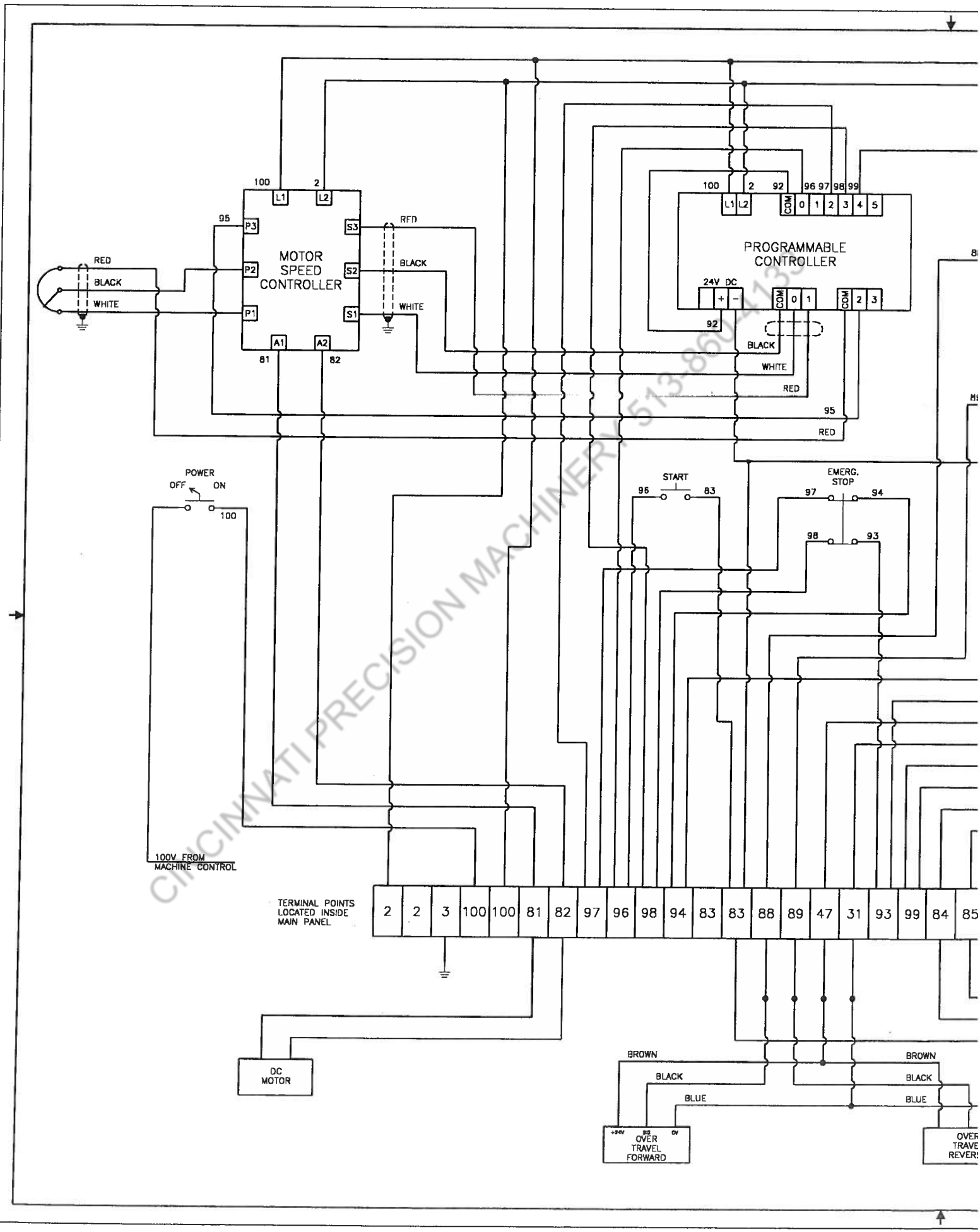

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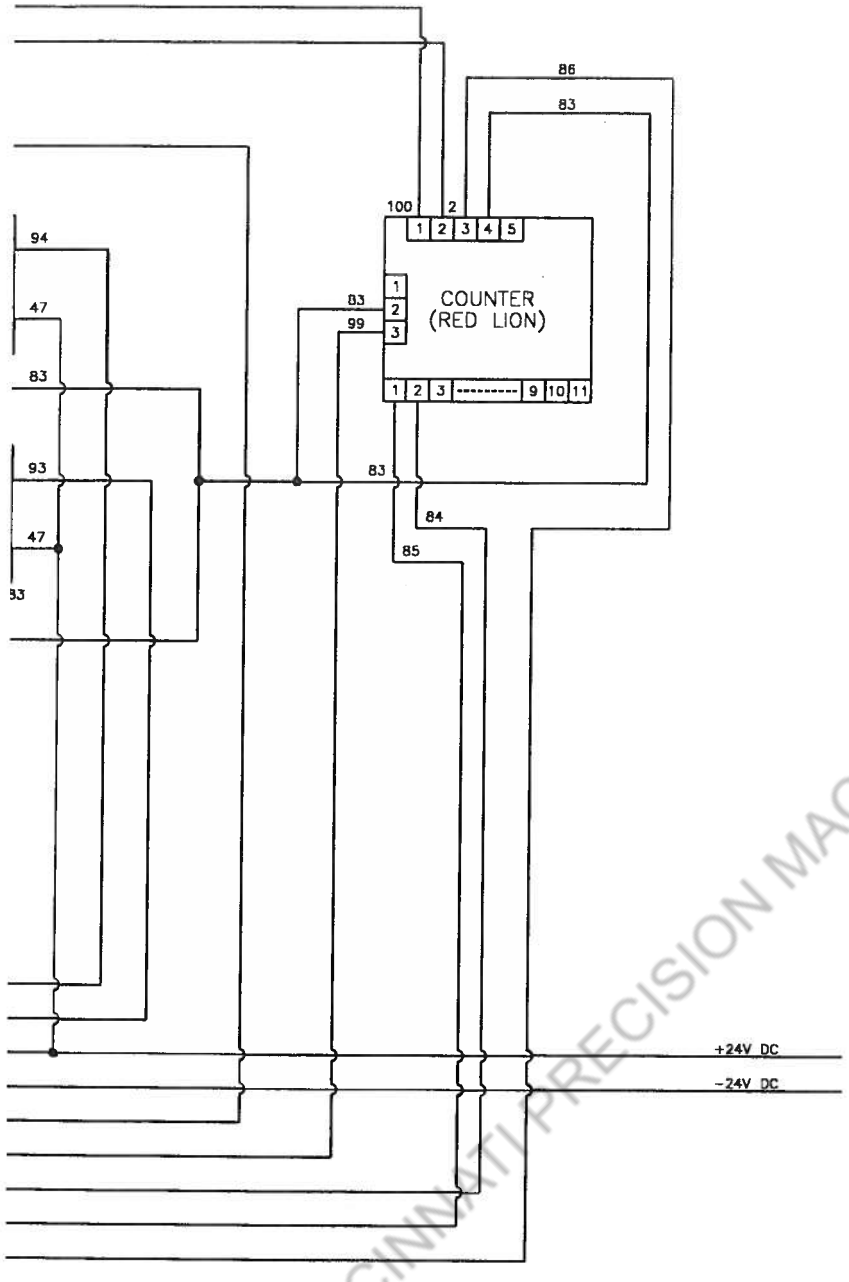

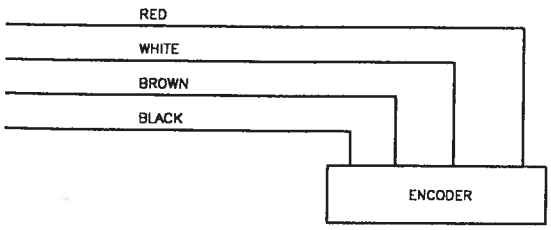

THIRD ANGLE PROJECTION

TOLERANCES
UNLESS OTHERWISE SPECIFIED
DIMENSIONS IN INCHES
.XXX = ±.005
.XX = ±.010
.X = ±.030
X/XX = 1/16
ANG. = 0° 30'
ON HOLE LOCATION IS

Spiral-Helix Inc.
Buffalo Grove, IL 60089-4511, U.S.A.

PROPRIETARY
THIS DRAWING IS THE PROPERTY OF THE SPIRAL-HELIX INC. AND IS FURNISHED AS CONFIDENTIAL INFORMATION SHALL IN WHOLE NOR BE COPIED, RACED OR REFERENCED IN ANY MANNER, NOR SUBMITTED TO ANY PURPOSE NON-COMPETITIVE PURPOSES, AND USE OF THE SUBJECT MATTER OF THIS DRAWING WITHOUT PERMISSION OF SPIRAL-HELIX INC. IS A VIOLATION OF OUR EXCLUSIVE RIGHTS.

GENERAL NOTES
1. BREAK ALL SHARP EDGES .01/.03 RAD OR 45° CHAM.
2. INTERPRET SYMBOLS PER ANSI Y14.5.
3. TRUE POSITION LOCATING DIMENSIONS ARE BASIC.
4. ALL SURFACES ARE ▽ UNLESS OTHERWISE SPECIFIED.
5. ALL SURFACES WITH 3-PLACE DIMENSION ARE ▽.
6. ALL DIMENSIONS IN ( ) ARE IN MILLIMETERS.

VENTILATION MACHINE

WIRING DIAGRAM FOR LENGTH CONTROL WITH RED LION COUNTER

DRAWN BY	BI	DATE	10/31/95
CHECKED BY		APPROVED BY	
FILE NO.	E1W130		
SCALE	1/1	SIZE	D

MATERIAL

DRAWING NO. E1W130 REV. 0

CST. WGHT LBS. SHEET 1 OF 1

List of Illustrations

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NOTES

1. GENERAL

1.1 This manual is issued to provide instructions for installing, operating, and maintaining the HELIX-200 Automatic Spiral Tubeformer (Fig. 1).

1.2 Whenever this manual is reissued, the reason for reissue will be listed in this paragraph.

1.3 Refer to other practices and instruction manuals as applicable for the correct methods, tools, and materials to be used in performing procedures not specifically described in this manual. **Note that the information in this manual is subject to change without notice.**

2. APPLICATION

2.1 The HELIX-200 Automatic Spiral Tubeformer is a user friendly machine designed to avoid the delicate time consuming adjustments and risk of human error in tube forming and seaming processes. The HELIX-200 is equally at home in a factory setting or at remote sites when time and cost are critical for the success of a project.

2.2 The HELIX-200 may be used in tube forming and seaming applications in such diverse industries as energy management - HVAC tubing, and forced draft chimney; building and highway construction - voids in concrete, concrete column forms, caisson liners, sleeves for prestressed concrete, protection of electrical cables, and down spouts; environmental protection - drainage, drums and containers, fume and dust removal, and sound absorbers; chemical and petroleum production - weatherproof jacketing for pipeline insulation, and double skin vents; materials handling - conveyor systems; and water and agricultural - irrigation, well casings; and so on.

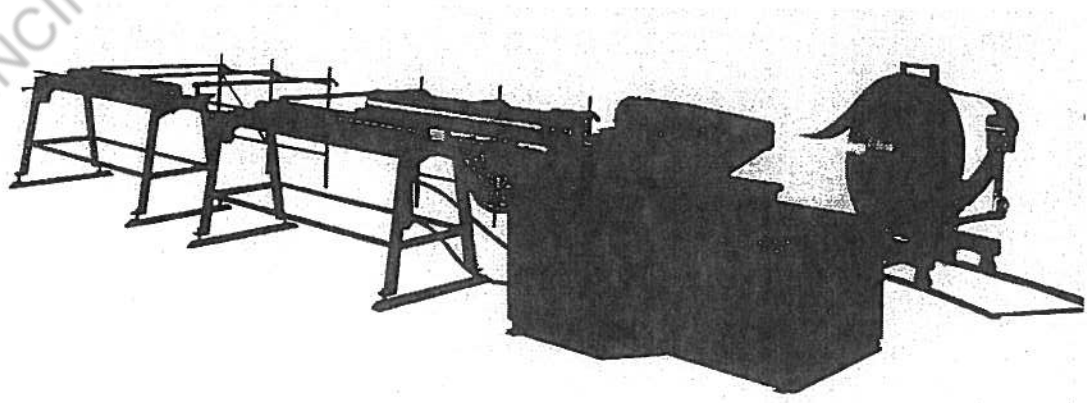

Fig. 1 - HELIX-200 Automatic Spiral Tubeformer

3. DESCRIPTION

3.1 The HELIX-200 Automatic Spiral Tubeformer is a heavy duty production machine engineered to give many years of user friendly and dependable service, with unmatched versatility, in the manufacture of continuous spiral lockseam tubes cut to exact length. The HELIX-200 handles a large range of tube diameters up to 90 inches, and thicknesses up to 14 gauge, in a large array of materials; and will produce tubing from strip material as heavy as 14 gauge in galvanized steel, at strip speeds of up to 255 feet per minute. The design provides for a changeover time of less than 5 minutes when changing tooling for producing different tube sizes. The HELIX-200 features a compact design with a minimal footprint for optimal floor space utilization, and may be installed for production in a factory setting or at remote sites. The HELIX-200 is offered in two models - the HELIX-200L and the HELIX-200H; and is supplied as a complete plant ready to be installed and powered up for service.

3.2 The HELIX-200 is an electro-hydraulic machine, with dedicated electro-pneumatic devices; and is designed to operate on a control voltage of 110 VAC, independent of the external AC power source. The external AC power source may be any standard source between 220 VAC and 480 VAC at 50 Hz or 60 Hz. A 0.500 KVA transformer, protected by two 6.3 Amp fuses, steps down the incoming external AC power source to the 110 VAC control voltage. The 110 VAC control circuit is the primary electrical circuit, and is protected by a 6.25 Amp fuse. Proximity switches, which are part of dedicated devices, form part of the secondary electrical circuit which operates on 24 VDC. The design provides for two coupled hydraulic circuits. The primary hydraulic circuit is powered by a variable displacement hydraulic pump driven by a 30 HP main electric motor for the HELIX-200L or a 40 HP main electric motor for the HELIX-200H. The secondary hydraulic circuit is powered by a fixed displacement auxiliary pump that is coupled to the main hydraulic pump. The pneumatic circuits may be powered by a clean, regulated air source capable of 80 psi.

3.3 The HELIX-200 Features:

1. A hydraulic Drive Unit and Feed Rollers for even feeding of strip material - independent of thickness tolerances - up to 16 gauge and 80 inches of formed tube diameter at strip speeds up to 185 feet per minute for the HELIX-200L, and up to 14 gauge and 90 inches of formed tube diameter at strip speeds up to 255 feet per minute for the HELIX-200H;

2. Factory pre-set Form Roll units with multiple station control for accurate and uniform preforming of strip edges;

3. Sturdy Forming Heads with large guiding surfaces for ample linear support and perfect, constant sizing of diameter;

4. Hydraulically loaded and self-adjusting seaming rolls for uniform and pressure-tight 4-ply lockseam, independent of thickness tolerances;

5. Lock-joint section made to ensure consistent and lasting interlocking action;

6. A patented Flying Slitter that provides a clean cut at high speed. This eliminates the cost of deburring and reduces noise, sparks, fumes, flying galvanized chips and costly friction saw blades;

7. An electronic production counter; and

8. Provisions for adding a variety of optional equipment including Corrugation Attachments such as the Triple-Rib Attachment, the Flying Crimper, the Digital Tube Length Control, and a Saw Unit.

3.4 Benefits Offered by the HELIX-200 include:

1. One man attendance of fully automatic machine;

2. Machine-made uniformity of finished product;

3. Increased tube strength through 4-ply reinforcing spiral lockseam. This makes possible savings of up to 50% in material thickness over conventional fabrication methods for smooth tubes, with substantially larger savings possible with corrugated tubing;

4. High production speeds and quick changeover for various dimensions, eliminating the need for stocking of finished tubes;

5. Simplified stocking of raw material and no scrap as various sizes can be made from strip of the same width;

6. Unlimited tube length and lightweight construction resulting in fewer joints and supports with a subsequent saving in site labor and material;

7. Automatic cutting to exact predetermined tube length without interrupting production;

8. Exterior spiral lockseam that maintains complete tube roundness;

9. Tubing with perfectly smooth interior for non-turbulent flow;

10. No welded, soldered or riveted seams to distort material or mar coated surfaces;

11. Tubing that emerges clean from the forming process due to the use of water-soluble lubricants;

12. Compact design and footprint for optimal floor space utilization; and

13. Easy of transportation to and setup at remote job sites. Installation and line-up anywhere is greatly facilitated as the cutter unit is permanently mounted on the main cabinet.

3.5 HELIX-200 Footprint and Weight

NOTE: REFER TO FIG. 2

3.5.1 L-shaped layout

The L-shaped layout requires the receiving ramp(s) to be on the same side of the centerline of the forming head as the decoiler. In this configuration, the standard equipment occupies a floor space of approximately 351 square feet (32.6 square meters) with a long leg measurement, taken along the axis of the forming head, of 366.00 inches (9,296 mm) by 94.75 inches (2,407 mm) wide, and a short leg measurement of 184.50 inches (4,686 mm) by 176.25 inches (4,477 mm) wide. For each ten foot optional run-off table and a corresponding ten foot receiving ramp added, an additional 120.00 inches (3,048 mm) is added to the long leg dimension of the standard equipment for an additional floor space requirement of 79 square feet (7.3 square meters). For the addition of an optional saw unit, an additional 32.50 inches (826 mm) is added to the long leg dimension of the standard equipment for an additional floor space requirement of approximately 22 square feet (2.0 square meters).

3.5.2 Alternate Z-shape layout

The Z-shape layout places the receiving ramp(s) on the opposite side of the centerline of the forming head as the decoiler. Except for the placement and distribution of the components of the HELIX-200, the total space requirement for the Z-shape layout is approximately the same as that for the L-shape layout. In particular, the dimensions along the axis of the forming head are exactly the same in the Z-shape configuration as in the L-shape configuration, either when the standard equipment is configured or when optional equipment is added.

3.5.3 Height

The HELIX-200 is 56.50 inches (1,435 mm) high at the decoiler. For the standard equipment, the highest point on the HELIX-200, however, is dependent on the size of the tube to be manufactured and the size of the corresponding forming head. The addition of an optional corrugating attachment increases the overall height as measured at the forming head.

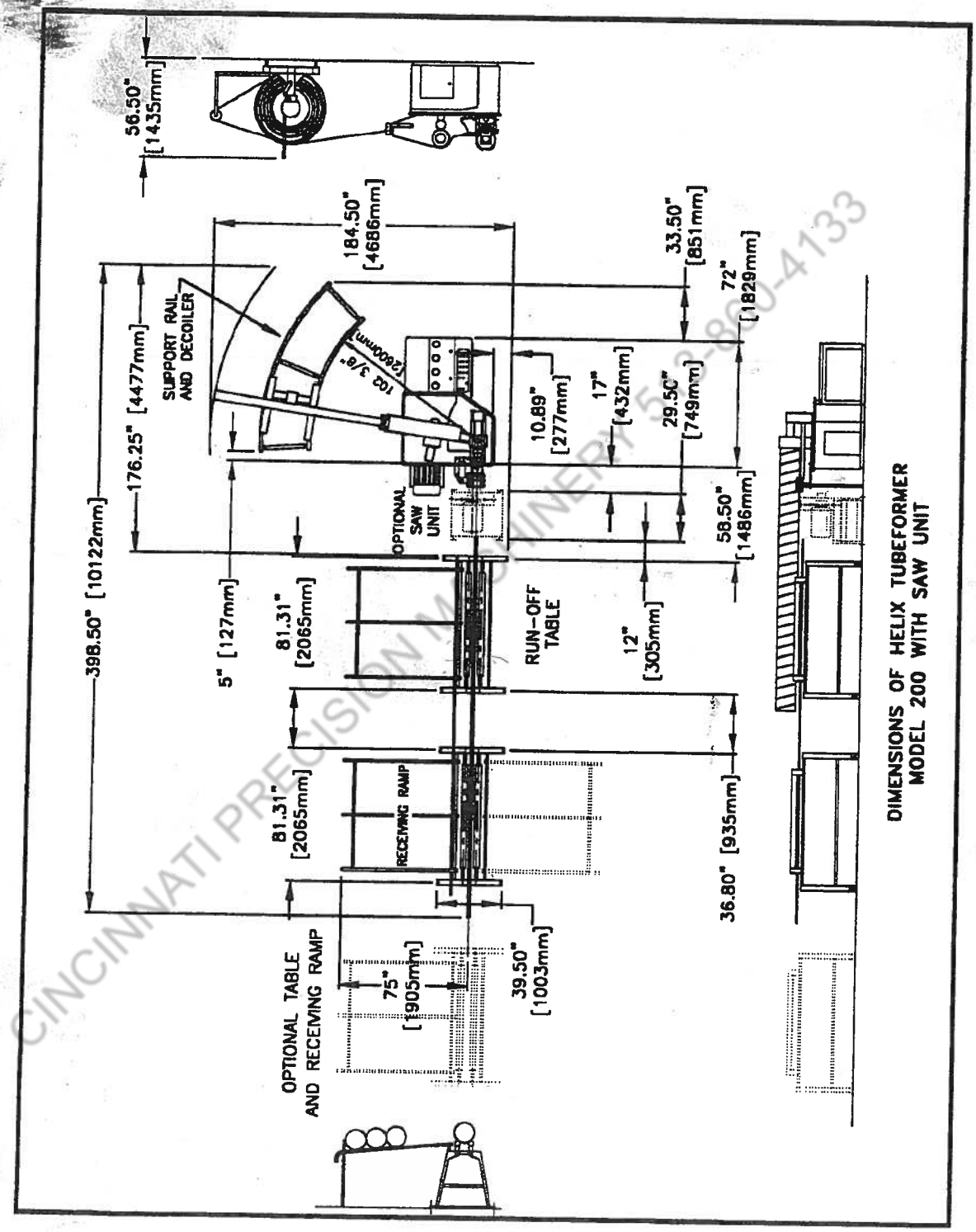

Fig. 2 - HELIX-200 Dimensions

3.5.4 Weight

The total weight of the HELIX-200 in the standard equipment configuration is approximately 7,500 lbs. The addition of optional equipment adds the following approximate weights: for each additional ten foot run-off table and the corresponding receiving ramp, an additional 1,100 lbs. is added to the weight of the standard equipment; for the addition of an optional saw unit, an additional 1,000 lbs. of weight is added; the addition of an optional flying crimper adds 30 lbs. of weight; and for the addition of an optional digital tube length control, an additional 100 lbs. of weight is added.

3.6 Materials of Construction

Components of the HELIX-200 are made with the highest quality materials and workmanship. The decoiler, the main machine cabinet, the run-off table, and the receiving ramp are of welded steel construction. Construction of the base, casters, and housings makes extensive use of special steel alloy castings to ensure long life. All rollers are made from high grade steel that is hardened and tempered. To facilitate easy mounting and ensure durability, metal alloys combining lightweight with maximum strength are used in making forming heads. The electrical motors and controls, the hydraulic equipment, and the lubricating units are of the finest makes obtainable and, wherever required, are made to SPIRAL-HELIX, INC specifications. Painted surfaces are acrylic enamel coated lunar blue, except for the drainage surfaces on the main machine table top which are acrylic enamel coated red.

3.7 Components of the Standard Equipment

3.7.1 The standard equipment includes a vertical decoiler (Fig. 3), the main machine (Fig. 4), the forming heads (Fig. 5), the flying slitter (Fig. 6), a run-off table (Fig. 7), a receiving ramp (See Fig. 7), and a production counter (Fig. 8).

3.7.2 Vertical decoiler

The vertical decoiler is fitted with an automatic brake to prevent unnecessary uncoiling of the strip material, and a spring-loaded collapsible arm with shock absorber for shock-free feeding of the strip material.

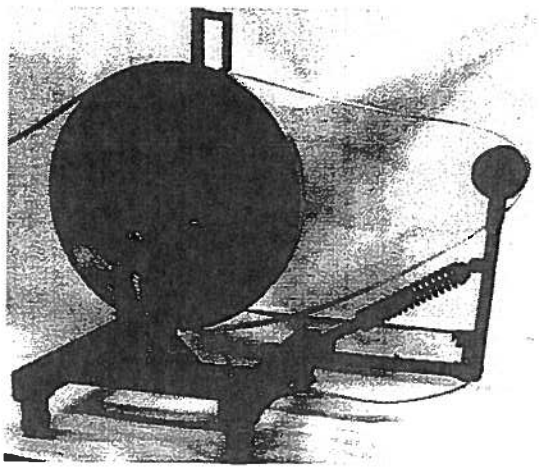

Fig. 3 - Vertical Decoiler

3.7.3 Main Machine

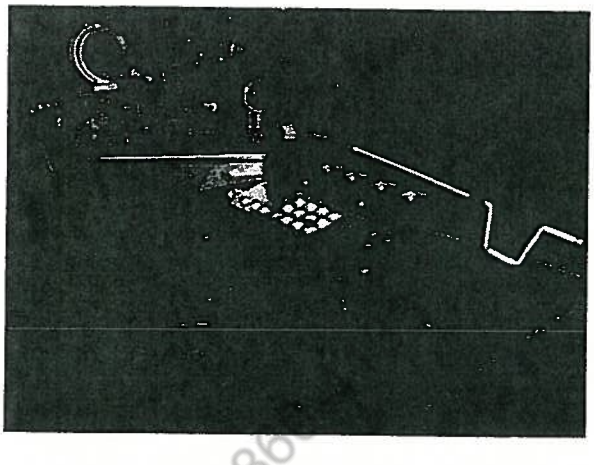

Fig. 4 - The Main Machine

The main machine consists of a Roller Housing which houses a factory pre-set Form Roll unit with multiple station control, a Hydraulic Drive and Feed Roller unit, and Guide Plates and a strip material thickness dependent Folding Finger; a strip material thickness dependent Flange Roller; a mandrel to carry the forming head; a Clinching Roller; a Support Roller and the Roller Holder Plate; support structures to carry the flying slitter and optional equipment; and a Machine Cabinet. The machine cabinet has separated chambers which hold the hydraulic system versus the electrical system and their related equipment, and carry the operator panel.

3.7.4 Forming heads

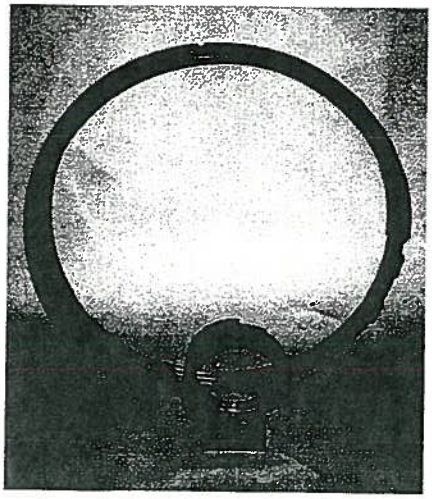

Fig. 5 - Forming Heads, Typical

Several forming heads may be supplied with each HELIX-200. The outside diameter of the formed tube is determined by the size of the forming head. Only one tube size can be formed by each forming head. The forming head is mounted on the mandrel and clamped in position by means of a lockpiece. For forming heads 60 inches and up in size, the design provides for an additional front support; and for forming heads 72 inches and up in size, the design provides for an additional rear support. Forming of the tube takes place in the forming head. To minimize friction between the strip material and the forming head, an inlay made of phosphor bronze is fastened to the inside of the forming head. The inlay starts at the point at which the strip enters the forming head and goes up part of a revolution. The strip material, with the preformed edges, enters the forming head and coils around inside. The preformed edges of the strip, one with a flange and the other with a channel, engage at the end of one complete revolution or coiling of strip travel. Further travel of the strip causes the engaged edges to pass between the clinching roller and the support roller to form the lockseam. The clinching roller contacts the tube through an opening in the base plate of the forming head.

3.7.5 Flying slitter

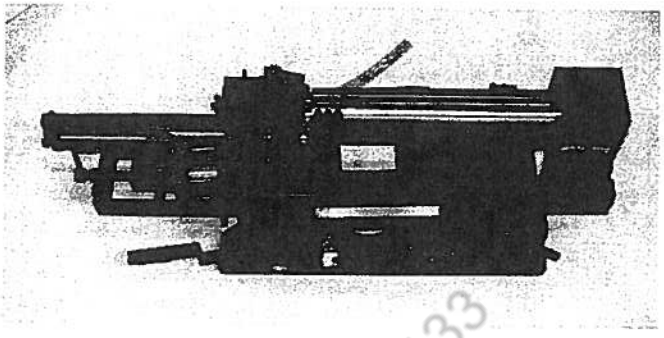

Fig. 6 - Flying Slitter

The flying slitter is a fully automatic and clean-cutting slitter that matches the speed of the tubeformer. It is a pneumatic roller-cutter that allows fully automatic cutting to exact predetermined tube lengths without interrupting production; and is easily adjustable for all strip material thicknesses. The flying slitter is permanently mounted on the machine cabinet, thus facilitating installation and operation if and when the plant is moved to a remote job site.

3.7.6 Run-off table assembly

The run-off table assembly is of sturdy construction, and furnished to support the tube as it is being made. The standard table assembly consists of two 10 foot tables, and is provided with an automatic tube discharge mechanism for right or left hand tilt-off. The table assembly is adjustable for all tube sizes, and can receive tubes over 20 feet long. Additional tables can be supplied for longer tube lengths. Each table in the assembly has two end-frames with bearings for two adjustable cylindrical supporting rolls. Gear wheel segments keep the support rolls at equal distance from the center line. Adjustment of the distance between the two rolls, which has to be done for every tube diameter, is effected by means of a handle located on the second end-frame of each table. The support rolls are mounted between the two end-frames, which are held together by means of four distance bars. The two upper bars have stand offs for connecting the receiving ramp assembly. A "C" channel, designed to hold movable proximity switches, is mounted on stand offs on each end frame. The switch holders can be moved in the channel, and are held in place with a bolt. On each table there are two discharge arms which lift the tubes out from the support rolls when the cutting operation is finished. The cut tube rolls from the discharge arms onto the receiving ramp. The first end-frame

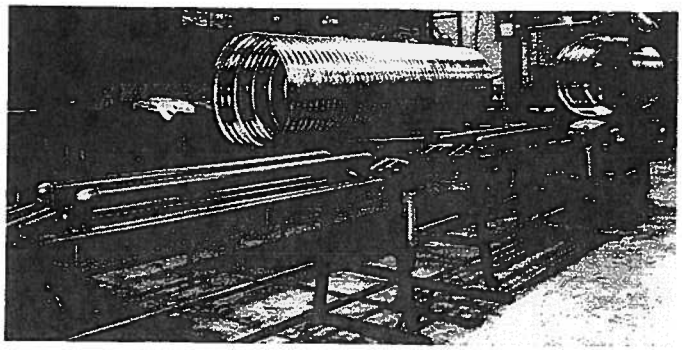

Fig. 7 - Run-off Table Assembly with Receiving Ramp

of the first table in the run-off table assembly is equipped with a hydraulic cylinder for operating the discharge arms. The HELIX-200 main machine design provides for an automatic restart device. In the automatic operating mode, upon discharging a formed tube length, the restart device automatically reinitiates tube forming of the new tube length.

3.7.7 Receiving ramp

The receiving ramp is connected to the run-off table; and provides temporary storage until formed tubes are marked or labeled for shipment.

3.7.8 Production Counter

An electronic counter is furnished as part of the standard equipment for counting the number of tubes made. The design provides for a six digit number register that may be preset for the required number of tubes to be produced for each production setup and cycle, and will stop the tubeformer when the number of tubes produced equals the preset value. The keypad and display unit, and the control switch for the production counter (Fig. 8) are located at the operator panel. The display consists of a single line of six numbers. The keypad consists of 8 buttons arranged in a three row combination of 3, 3, and 2 buttons. The top row of 3 buttons includes a button labeled **P1**; the middle row of 3 buttons are not labeled; and the bottom row of 2 buttons are labeled **E** and **R** respectively. The two rows of 3 buttons each, for a total of 6 buttons including the **P1** button, are used to enter the individual numbers that make up the six digit number register or memory for programming the value of the production preset count. Each of these 6 buttons allows the single digit number entries 0 through 9. The **P1** button serves the additional function as the button for activating the display screen. The **E** button is used to accept the value programmed for the production preset count; and the **R** button is used to reset or zero out the register or memory for production actual counts.

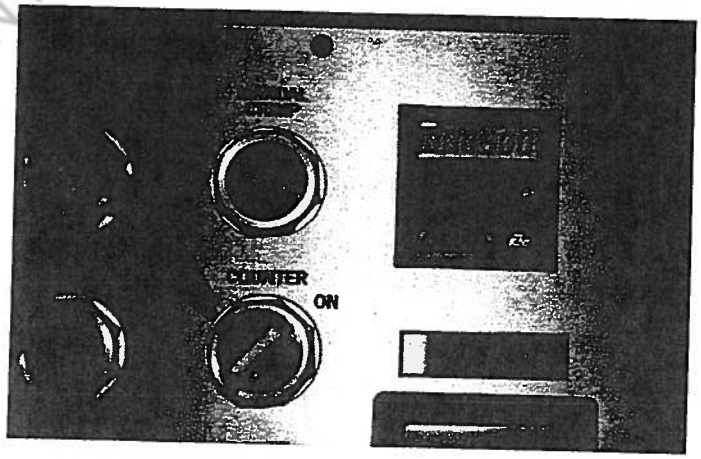

Fig. 8 - Production Counter Controls at the Operator Panel

3.8 Accessory and Optional Equipment

3.8.1 Accessory and optional equipment for the HELIX-200 include corrugating attachments, the flying crimper, digital tube length control, and the saw unit.

3.8.2 Corrugating attachments

Pads (Fig. 9) are furnished on forming heads for mounting corrugating attachments. A corrugating attachment may be designed to produce shallow beads (Type 1C/2C/3C), deep culvert (Type 1/CUX or Culvert); and may be assembled to produce either an outside or an inside corrugation. A corrugating attachment consists of a corrugating roller and a support roller mounted on eccentric shafts with a connecting body (Fig. 10). The body of the corrugating unit is mounted on the pad of the forming head with an adjusting plate in between (Fig. 11). The depth of corrugation is controlled by turning the eccentric shafts to adjust the distance between the corrugating roller and the support roller. Four adjusting screws are furnished on the adjusting plate to ensure that the grooves of the support roller are parallel to the lockseam of the tube. Interchanging the corrugating roller and the support roller produces outside versus inside corrugations. For Triple-Rib corrugation, the corrugating attachment is designed and integrated into the form roll unit.

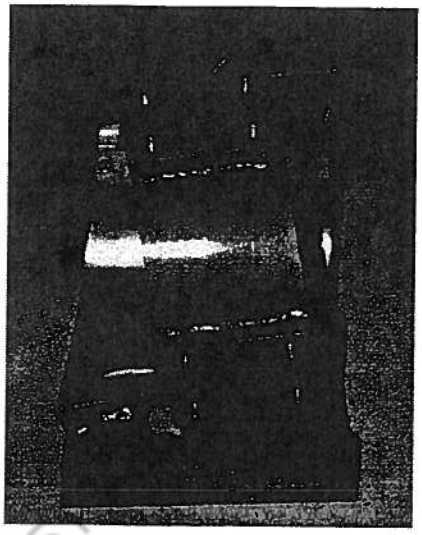

Fig. 9 - Mounting Pads for Corrugating Attachment

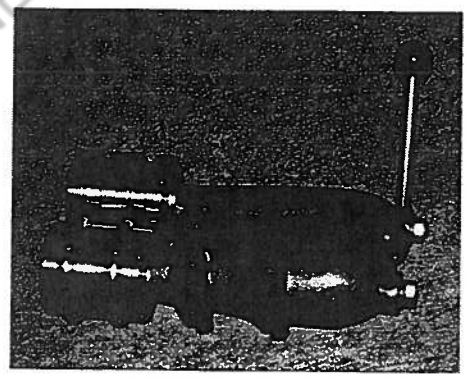

Fig. 10 - Corrugating Attachment, Typical

Fig. 11 - Forming Head with Corrugating Attachment, Typical

3.8.3 Digital tube length control

The digital tube length control (Figs. 12, 13 and 14) is an electronic measuring and control device for pre-setting and controlling tube length, for production. The keypad and display unit, and the control switch and buttons for the digital tube length control are located at the operator panel (Fig. 14). The control switch and buttons consist of a POWER OFF-ON selector switch, a GREEN colored START push button, and a RED colored EMERGENCY STOP push button. The keypad and display unit consists of a two-line display, and a keypad of two rows of 4 keys each for a total of 8 keys. Each line of display consists of a two-character alphanumeric field, and a six-digit numeric field. The 8 keys of the keypad consist of 4 dedicated motion keys for UP-DOWN and LEFT-RIGHT motion, and 4 dedicated function keys **F1**, **PRS**, **ENT**, and **F2/RST**. The motion keys are used primarily when entering the value of preset tube length for production. The LEFT-RIGHT motion keys are also used as the **ESC**ape and **SEL**ection keys, respectively, during factory programming of the digital tube length control. The **F1** key is used and active only for factory and/or advanced features programming, and is not available during programming for production. The **PRS** key activates the preset tube length register or memory for programming; the **ENT** key is used to accept programmed values for the production preset tube length; and the **F2/RST** key is used to recalibrate the encoder of the digital tube length control.

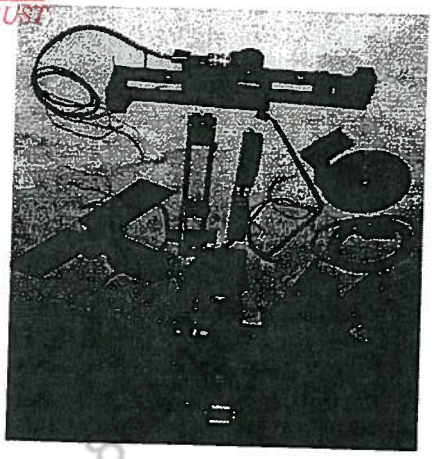

Fig. 12 - Components of the Digital Tube Length Control

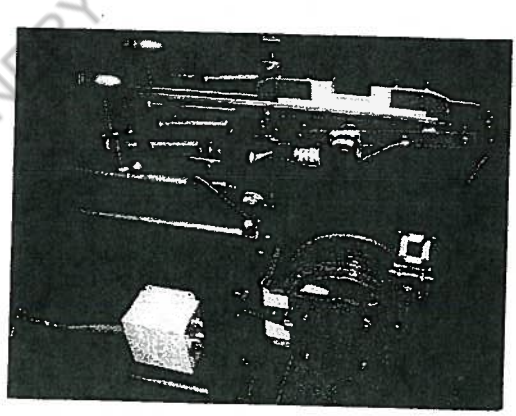

Fig. 13 - Typical Installation of Digital Tube Length Control

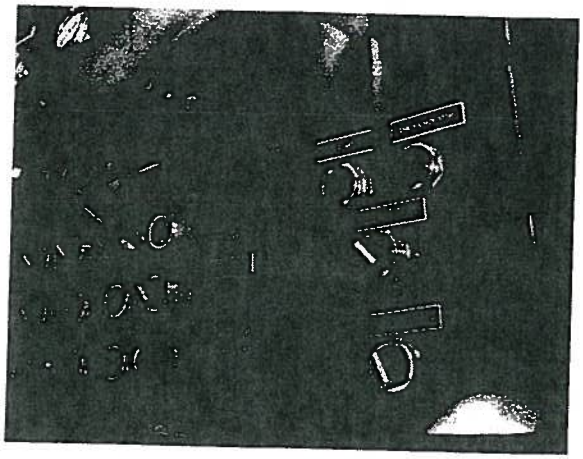

Fig. 14 - Operator Controls at Operator Panel for Digital Tube Length Control

3.8.4 Flying crimper

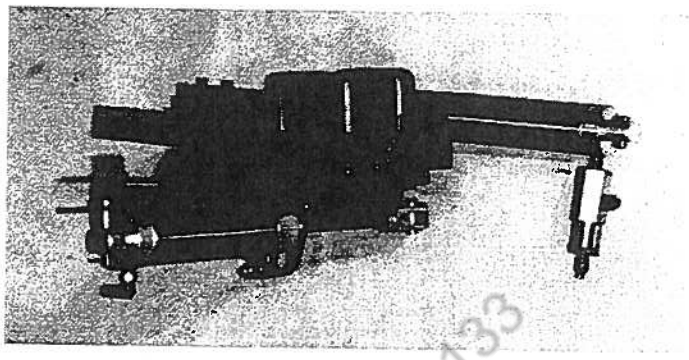

Fig. 15 - Flying Crimper

The flying crimper (Fig. 15) is an electro-pneumatic device for crimping the end of formed spiral tubes. The flying crimper consists of a matched pair of crimp rollers, two pneumatic cylinders, two limit switches, structural members and subassemblies, function specific adjustment screws, and the associated pneumatic piping and electrical wiring. One of the limit switches is provided as a safety switch that disengages high speed starts of the HELIX-200 tubeforming operation when the crimper is activated and/or in a crimping mode. The second limit switch provides for adjustments to ensure full and complete circumferential crimp coverage. When required, the flying crimper is fully factory pre-installed on the carriage of the flying slitter. The design provides for crimp length that is a standard 1.500 inches (38.10 mm) maximum, and may be adjusted to produce crimp lengths smaller than the standard crimp length.

3.8.5 Saw unit

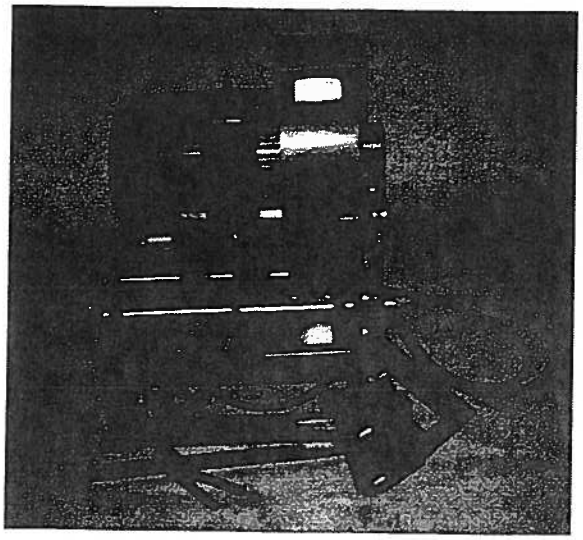

Fig. 16 - Saw Unit

The saw unit (Fig. 16) is a compact electro-hydraulic device. When provided as an optional equipment, operation of the saw unit is fully integrated into the HELIX-200 operating system and is controlled from the operator panel. The operating mode of the saw unit may be switch selectable for manual operation or fully automated cutting operation. The saw unit consists of an electric motor driven direct drive unit; a saw blade; a manifolded system of three independent hydraulic cylinders with flow control and solenoid valves - one for raising the saw blade up and down, one for linear motion to return the saw blade to its home position at the end of a cutting cycle, and one for controlling the saw blade YELLOW safety cover; structural members; a slide made up of linear bars; a set of support rollers that provide added support for formed tubes during the cutting operation; and a system of built-in safety devices and structures. The electrical subsystem consists of the electric motor,

the limit switches and timers. The hydraulic system consists of the system of hydraulic cylinders, the flow control valves, the solenoid valves, the slide, and the saw blade. During the cutting operation, the saw blade slides along the linear bars, parallel to its center axis, while it is simultaneously rotated about the center axis. After one revolution about the saw blade center axis, a micro switch is activated and actuates the hydraulic system to return the saw blade to its starting, and home, position. The safety structures are integrated and built-in to provide for safe operations.

3.9 The HELIX-200 is designed to require minimal maintenance. Items that must be maintained include: All Bearings including Drive Unit lower pinch roller bearings, needle bearings, and so on; surfaces of Drive unit and feed rollers; Run-off table assembly; Decoiler; Flying Slitter cam followers; Roller Housing adjusting screws; Lubricant Tank and Filter Plate(s); Air Regulator oilers; and Hydraulic filter and oil changes.

3.10 Follow all electronic manufacturers' maintenance procedures and schedules. Minimal monthly regreasing must be done on the decoiler, the run-off table assembly, the flying slitter cam followers, and the roller housing position adjusting screw. Every three months, at the same time as the monthly regreasing of the roller housing position adjusting screw is performed, visually inspect the main machine cabinet and its compartments for signs of corrosion or damage, and perform the following: visually inspect electrical wiring in the electrical compartment to be sure that there is no physical damage, and that all connections are secure and free of dirt and corrosion; visually inspect pneumatic piping in the pneumatic compartment to be sure that there is no physical damage, and that all connections are secure and free of dirt and corrosion; examine all accessible hydraulic connections and make sure that the connections are tight and free of dirt and corrosion; and check the oil cooler's air intake and exhaust for any obstructions, and clear the obstructions as necessary. Perform other maintenance and/or replacement procedures as required by local practices and codes. **Refer to the maintenance sections of this document for more detailed information on maintenance and replacement procedures.**

4. MAIN MACHINE

4.1 The main machine consists of a Roller Housing which houses a Form Roll unit with multiple station control, a Hydraulic Drive and Feed Roller unit, and Guide Plates and a strip material thickness dependent Folding Finger; a strip material thickness dependent Flange Roller; a mounting base to carry the forming head; a Clinching Roller; a Support Roller and the Roller Holder Plate; support structures to carry the flying slitter and

optional equipment; and a Machine Cabinet. The machine cabinet has separated chambers which hold the hydraulic system versus the electrical system and their related equipment, and carry the operator panel.

4.2 Roller Housing

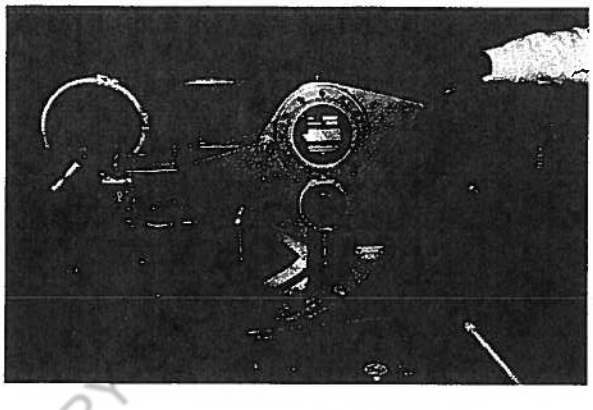

Fig. 17 - Roller Housing

The roller housing (Fig. 17) is a casting that houses the drive unit, the form roll unit and the guide plates. It is pivoted with the clinching roller cylinder center as pivot point. The roller housing must be moved to various angular positions to correspond to the required helix angle for different tube diameters. Movement of the housing is done manually by a hand crank through a screw and nut arrangement. A scale with tube sizes is furnished on the machine for locating the roller housing to the **approximate** position required for making tubes of various diameters.

NOTE: THE TUBE SIZE SELECTOR SCALE PROVIDES FOR ONLY APPROXIMATE POSITIONING OF THE ROLLER HOUSING.

4.2.1 Form roll unit

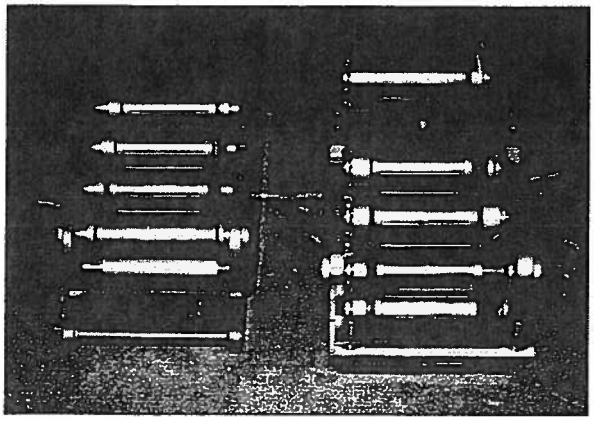

Fig. 18 - Form Roll Units

The form roll unit (Fig. 18) is located in the Roller Housing. It is a series of form rollers (upper and lower), which progressively form a flange on one edge and a channel on the other edge of the strip material. The flange engages the channel in the process of forming the tube in the forming head, and is lockseamed by the combination of clinching roller and support roller - aided by the support arm - to complete forming a rigid tube. The form roll unit is designed for making either an outside lockseam or an inside lockseam, and for a specific strip thickness. Depending on the strip material thickness, the flange and the channel produced in the form roll unit may require additional processing prior to lockseaming. For strip materials 0.0651 inch (1.651 mm or 15 gauge) and thicker, the flange and the channel produced in the form roll unit require no additional processing or staging prior to lockseaming.

However, for strip materials 0.0650 inch (1.650 mm or 16 gauge) and thinner, additional processing or staging prior to lockseaming is required for both the flange and the channel produced in the form roll unit. Final staging of the flange prior to lockseaming, for strip materials 0.0650 inch (1.650 mm or 16 gauge) and thinner, is accomplished with a flange roller. Similarly, final staging of the channel prior to lockseaming, for strip materials 0.0650 inch (1.650 mm or 16 gauge) and thinner, is accomplished with a folding finger.

4.2.2 Hydraulic drive unit and feed rollers

The drive unit (Fig. 19) is located in the Roller Housing. It is a hydraulic drive. Strip material is pulled from the coil through the form roll unit by the hydraulic drive unit. The drive unit consists of two rollers arranged as a matched pair of an upper roller and a lower roller. The upper roller has a knurled surface and functions as the drive roller, while the lower roller has a smooth surface and works as the pinch roller. The upper drive roller is driven by a hydraulic motor. When power to the drive unit is engaged, the lower pinch roller is pushed up towards the matched upper drive roller by a hydraulic cylinder in the drive unit housing. The hydraulic pressure in the cylinder can be adjusted by a regulating valve provided for the purpose, and indicated by the corresponding pressure gauge designated on the operator panel as DRIVE ROLLER PR. In the up position - that is, with the drive unit power engaged - without any material between the upper and the lower rollers, the lower pinch roller is stopped by two adjustable stop screws, one each at each end of the lower roller shaft.

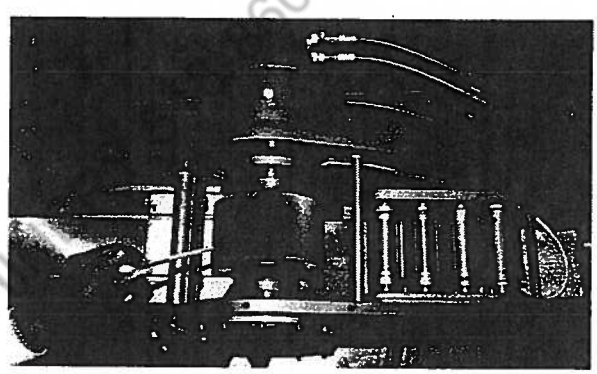

Fig. 19 - Drive Unit and Feed Rollers

4.2.3 Guide plates

A total of six guide plates are furnished with each HELIX-200 tubeformer. Of the six guide plates, two are two different versions of the lower front guide plate (Fig. 20), and two others are two different versions of the lower rear guide plate which is located immediately between the front drive and feed rollers and the lower front guide plate. The

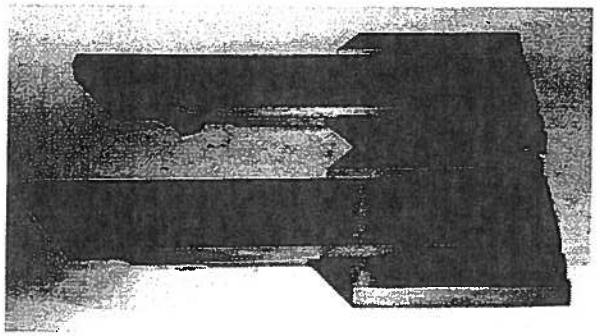

Fig. 20 - The two Versions of the Lower Front Guide Plate

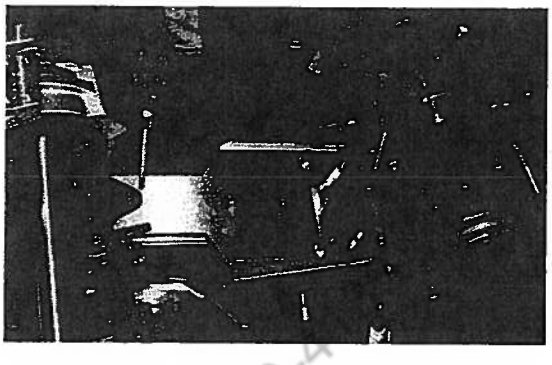

Fig. 21 - Guide Plate Assembly

remaining two plates form the complementing set of two common guide plates; and are the upper front and the upper rear guide plates respectively. The first version of the lower front guide plate is for running thin strip material up to 0.0650 inch (1.650 mm or 16 gauge) thick, and is equipped with a folding finger holder. This first version of the lower front guide plate is matched to one of the two versions of the lower rear guide plate. The second version of the lower front guide plate is for running heavy strip material 0.0651 inch through 0.0728 inch (1.651 mm through 1.850 mm or 15 and 14 gauge), and has no folding finger holder; and is matched to the second version of the lower rear guide plate. For each production setup and use of the HELIX-200, one version of the lower front guide plate together with its matched lower rear guide plate, and the common set of two, making a total of four guide plates (Fig. 21), are required to guide the strip material from the drive rollers to the forming head entrance. All four guide plates, installed for any use of the HELIX-200, are located between the forming head and the drive unit and feed rollers. A special set of sheet inlays are required between the guide plates. The purpose of these inlays is to allow the strip material free passage between the upper and lower guide plates. The guide plates and inlays are held together by means of a guide plate lock and support arm. The guide plate lock is an eccentric locking device, and has two adjustable set screws to accommodate different inlays.

4.2.4 Folding finger

The form roll unit makes a channel on one edge of the strip material. For strip material thicknesses 0.0650 inch (1.650 mm or 16 gauge) and thinner, the edge of the channel comes out from the form roll unit at 90 degrees to the strip. This, however, has to be bent back approximately 35 degrees towards the center of the strip (Fig. 22) to ensure a good lockseam.

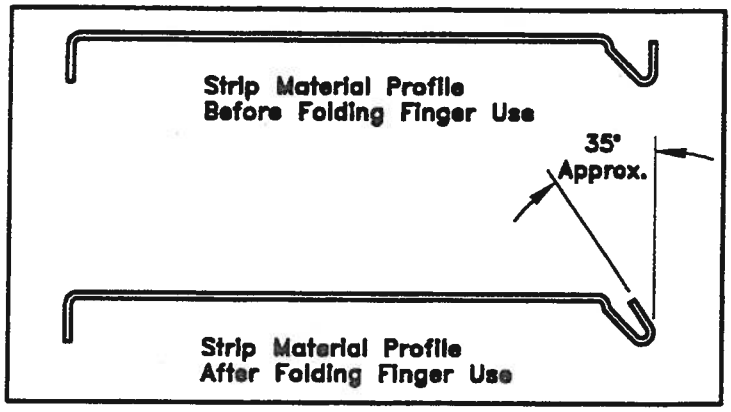

Fig. 22 - Strip Material Profile Before and After Folding Finger Use

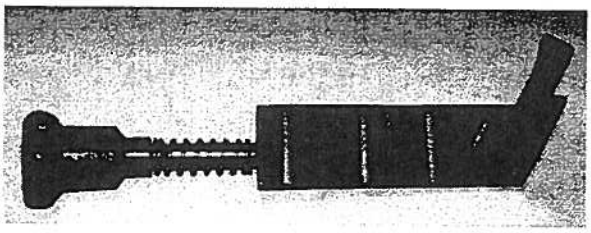

Fig. 23 - Folding Finger Assembly

The folding finger is used to accomplish this bending back of the edge of the channel. The folding finger assembly (Fig. 23) consists of a folding tool - the folding finger, a tool holder, a helical spring, and a knob. The tool holder has bevel edges that fit into slots in a lower front guide plate to allow adjustments and proper positioning of the folding finger. For making an outside lockseam, the folding finger is always on the lower front guide plate. Please note that the folding finger begins to wear at the tip as more tubes are produced. Thicker material and stainless steel will generally accelerate the rate of wear of the folding finger tip.

4.3 Clinching Roller

The clinching roller (Fig. 24) lockseams the edges of the strip material to form the tube. The clinching roller is hydraulically operated by the clinching roller cylinder, and is controlled by a valve. The hydraulic pressure in the clinching roller cylinder can be adjusted by the clinching roller pressure regulating valve on the operator panel. The clinching pressure is indicated by a gauge on the operator panel. This controls the lockseaming pressure. Three versions of the clinching roller are supplied with the HELIX-200. The first version of the clinching roller is designated as the Standard Duty clinching roller, and is used when tubeforming thin strip material up to 0.0400 inch (1.020 mm or 20 gauge) thick. The second version of the clinching roller is designated as the Heavy Duty clinching roller, and is used when tubeforming strip material from 0.0401 inch through 0.0650 inch (1.021 mm to 1.650 mm or 19 through 16 gauge) thick. The third version of the clinching roller is designated as the Extra Heavy Duty (XTD) clinching roller, and is used when tubeforming strip material from 0.0651 inch through 0.0728 inch (1.651 mm through 1.850 mm or 15 and 14 gauge) thick. There are two types of clinching roller holders. The Standard Duty clinching roller and Heavy Duty clinching roller may be alternately mounted in the same holder; and the Extra Heavy Duty (XTD) clinching roller is mounted in a XTD holder.

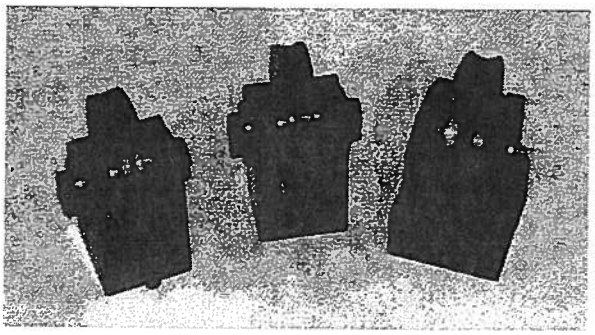

Fig. 24 - The Versions of the Clinching Roller and Assembly

4.4 Support Roller and the Roller Holder Plate Assembly

4.4.1 Roller holder plate assembly

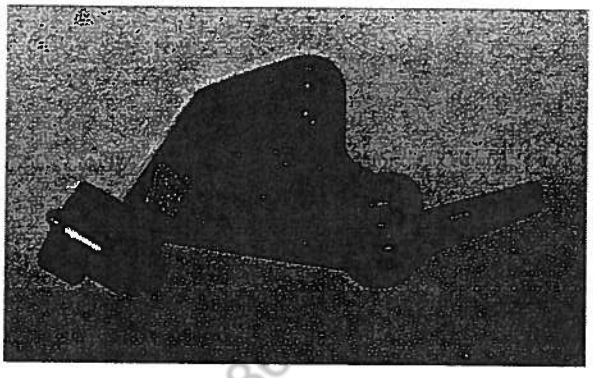

Fig. 25 - Roller Holder Plate Assembly

The roller holder plate assembly (Fig. 25) consists of the support roller assembly, the flange roller assembly, a mounting plate, an adjustment screw, and mounting hardware. The HELIX-200 is supplied with two versions of the roller holder plate assembly - the Standard Duty and the Heavy Duty roller holder plate assembly respectively. For tubeforming, the roller holder plate assembly is installed to the upper front guide plate (Fig. 26). The components of the roller holder plate assembly are matched for each version of the assembly. The Standard Duty assembly is used when tubeforming strip material thicknesses up to 0.0400 inch (1.020 mm or 20 gauge); that is, when using form roll units No. 0 through No. 3. The Heavy Duty roller holder plate assembly is used when tubeforming strip material thicknesses 0.0401 inches (1.021 mm or 19 gauge) and thicker; that is, when using form roll units No. 4 through No. 6.

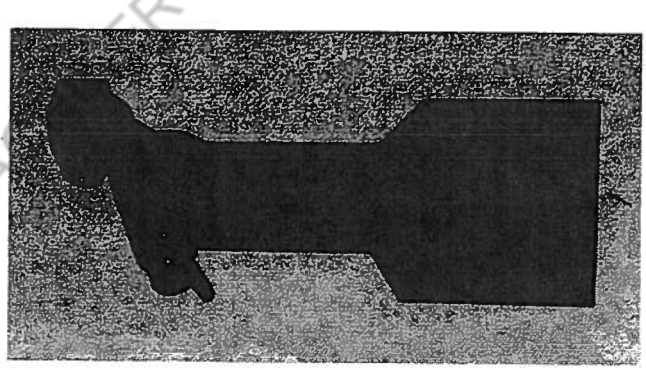

Fig. 26 - Roller Holder Plate Assembly and the Upper Front Guide Plate

4.4.2 Flange roller assembly

The form roll unit makes a flange on the second edge of the strip material. For strip material thicknesses 0.0650 inch (1.650 mm or 16 gauge) and thinner, this flange comes out of the form roll unit at 90 degrees to the strip. This, however, has to be bent approximately 35 degrees towards the center of the strip (Fig. 27) to

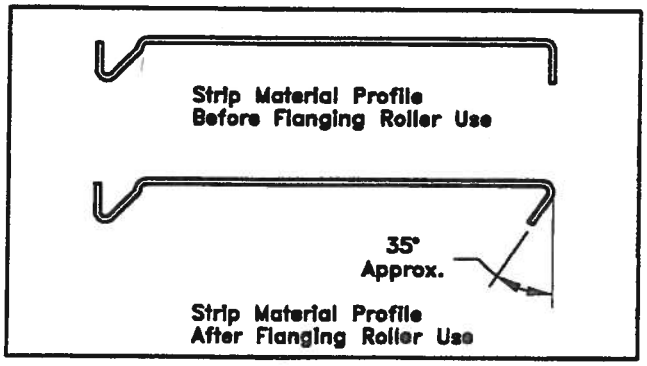

Fig. 27 - Strip Material Profile Before and After Flange Roller Use

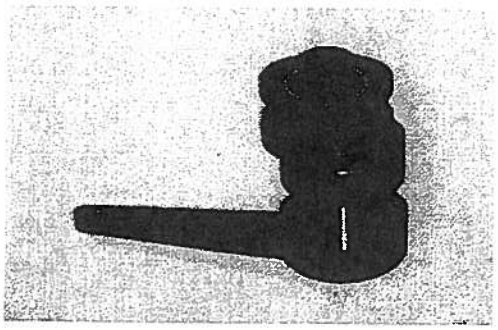

Fig. 28 - Flange Roller Assembly

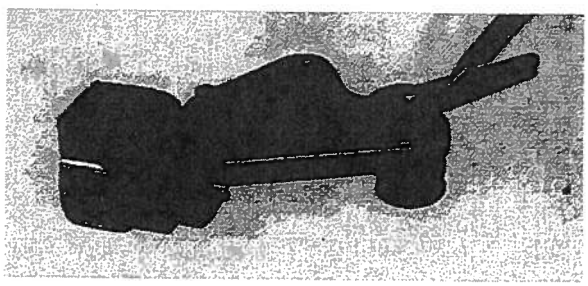

Fig. 29 - Flange Roller and the Roller Holder Plate Assembly

ensure a good lockseam. The flange roller assembly (Fig. 28) is used to accomplish this. The flange roller assembly is installed in the mounting plate of the roller holder plate assembly, as one of the two subassemblies that make up the roller holder plate assembly (Fig. 29), and is carried by an eccentric shaft. There are two types of flange roller assemblies - Standard Duty and Heavy Duty. The Standard Duty flange roller assembly is used when forming strip material thicknesses 0.0400 inch (1.020 mm or 20 gauge) and thinner; that is when form roll units No 0 through No. 3 are installed. The Heavy Duty flange roller assembly is used when forming strip material thicknesses between 0.0401 inch and 0.0650 inch (between 1.021 mm and 1.650 mm or between 18 gauge and 16 gauge); that is, when form roll units No. 4 and No. 5 are installed.

4.4.3 Support roller assembly

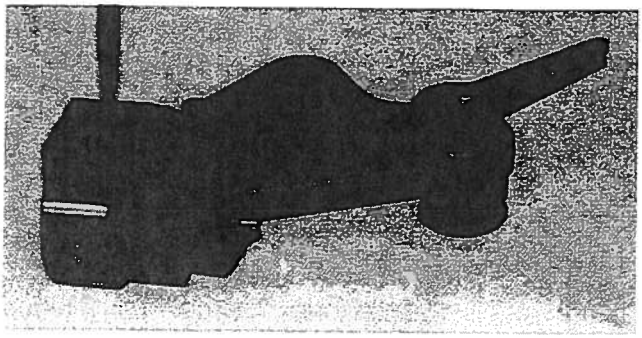

Fig. 30 - Support Roller and the Roller Holder Plate Assembly

During lockseaming of the edges of the strip material, the clinching roller exerts an upward force. The joint must be supported to allow the clinching roller to form the lockseam. This support is furnished by the support roller. The support roller assembly (Fig. 30) is installed in the mounting plate of the roller holder plate assembly, as the second of the two roller subassemblies that make up the roller holder plate assembly. The design provides for two versions of the support roller assembly, namely: the Standard Duty and the Heavy Duty support roller respectively. The Standard Duty support roller is used when tubeforming strip material thicknesses 0.0400 inch (1.020 mm or 20 gauge) and thinner; that is, when form roll units No. 0 through No. 3 are installed. The Heavy Duty support roller is used when tubeforming strip material thicknesses 0.0401 inch (1.021 mm or 19 gauge) and thicker; that is, when form roll units No. 4 through No. 6 are installed.

4.5 Support Arm for Support Roller

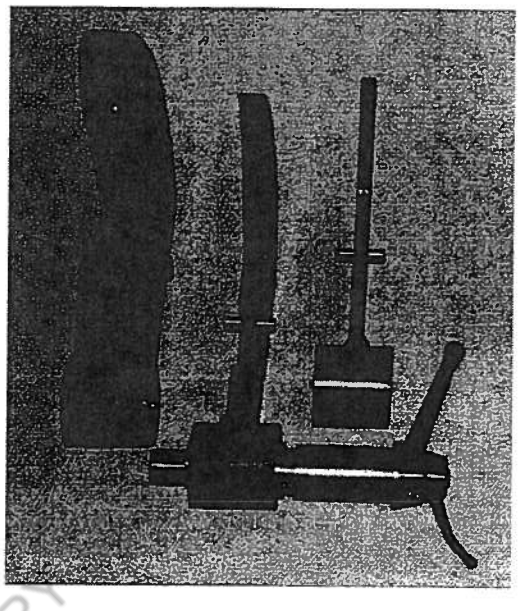

Fig. 31 - Versions of the Support Arm for Support Roller

The support roller is held against the strip material by a support arm that pivots on an eccentric shaft. In use, the support arm is swung over the support roller. The support arm is then pulled down by the eccentric shaft and held in place, over the support roller, by a locking handle. Too much pressure on the support roller will cause the tube diameter to shrink from the nominal size. Not enough pressure will cause the tube diameter to grow from the nominal diameter causing the tube to bind inside the forming head. Two versions of the support arm (Fig. 31) are provided with each HELIX-200, namely: the Standard Duty support arm and the Heavy Duty support arm. Each of the two versions of the support arm corresponds to each of the two versions of the roller holder plate assembly, namely: the Standard Duty support arm is used with the Standard Duty roller holder plate assembly; and the Heavy Duty support arm is used with the Heavy Duty roller holder plate assembly respectively. Thus, the Standard Duty support arm is used when tubeforming strip material thicknesses 0.0400 inch (1.020 mm or 20 gauge) and thinner; that is, when form roll units No. 0 through No. 3 are installed. And, the Heavy Duty support arm is used when tubeforming strip material thicknesses 0.0401 inch (1.021 mm or 19 gauge) and thicker; that is when form roll units No. 4 through No. 6 are installed.

4.6 Machine Cabinet

The machine cabinet (Fig. 32) is made up of compartments that house the hydraulic system, the pneumatic system, and the electrical system along with their respective components, and carry the operator panel on its top.

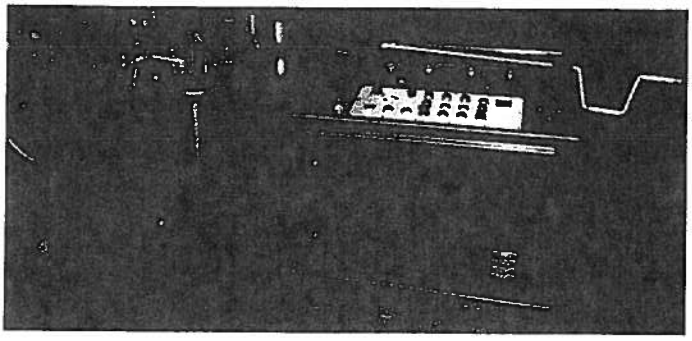

Fig. 32 - The Machine Cabinet

4.6.1 Hydraulic system

The hydraulic system consists of two separate oil circuits (Fig. 33). Hydraulic system

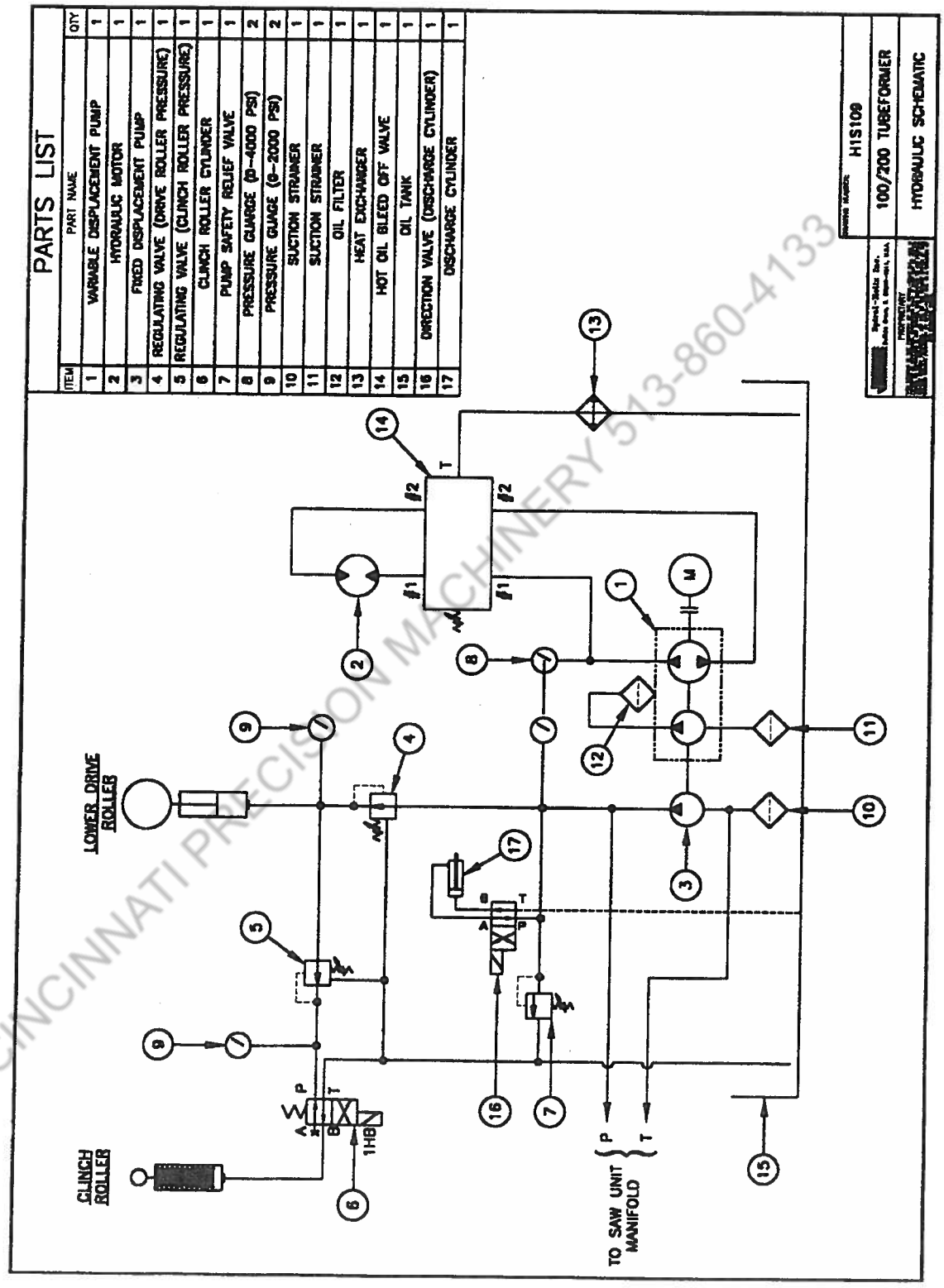

Fig. 33 - The HELIX-200 Hydraulic System Schematic

Circuit No. 1 drives the drive unit and feed rollers. Hydraulic system Circuit No. 2 controls the following: pressure to the pressure cylinders for the pinching pressure of the drive and feed rollers; clinching roller pressure; operation of the discharge mechanism on the run-off table assembly; and the operation of an optional saw unit.

4.6.1.1 Hydraulic system Circuit No. 1

The engine of hydraulic system Circuit No. 1 is a variable displacement hydraulic pump that is driven by a main electric motor that is rated at 30 HP for the HELIX-200L versus 40 HP for the HELIX-200H. The hydraulic pump delivers oil to a hydraulic motor, and is the main drive of the HELIX-200. Oil flow between the pump and the hydraulic motor is a closed circuit. Rate of oil flow in this circuit and, therefore, the motor shaft speed is determined by the pump displacement, which is proportional to the pump swash-plate angle. The swash-plate angle is electrically controlled by means of two potentiometers (Slow and High speed control potentiometers) on the operator control panel. To replenish oil to the closed circuit, a charge pump is integrated inside the main hydraulic pump. The charge pump also supplies oil at constant pressure for the servo controlled swash-plate operation. To ensure reliable performance, the main hydraulic pump is equipped with an integral oil filter with a replaceable filter element.

4.6.1.2 Hydraulic system Circuit No. 2

A fixed displacement auxiliary pump is coupled to the main hydraulic pump. Upon starting the auxiliary pump, oil from this pump circulates through a relief valve and back to the oil tank. The pinching pressure of the drive rollers can be adjusted by means of the drive roller pressure regulating valve. A pressure gauge on the operator panel indicates the drive roller pinching pressure. A separate pressure regulating valve is provided for separately regulating the hydraulic pressure of the clinching roller. The pressure of the clinching roller can only be adjusted to a value lower than the drive and feed roller pinching pressure. A pressure gauge on the operator panel indicates the clinching pressure. To operate the discharge mechanism on the run-off table, a push button provided for the purpose, and labeled DISCHARGE, actuates a discharge solenoid valve to allow oil flow to the discharge cylinder on the run-off table. The discharge cylinder lifts the discharge arms, which cause the cut tube to roll off the run-off table onto the receiving ramp. To operate an optional saw unit, a separate push button provided for the purpose, and labeled CUTTER, actuates the saw unit.

4.6.1.3 Hydraulic tank and the filtration unit

A clean hydraulic medium is critical for optimum operation of the HELIX-200. The design provides for a 22 gallon hydraulic tank, with a top filler cap, and is equipped with a combination sight glass and a temperature gauge. To ensure a clean medium, the design provides for a filtration unit that is mounted on the main hydraulic pump as an integral unit.

4.6.1.4 Hydraulic oil temperature control

Design of the HELIX-200 hydraulic system provides for controlling extreme working oil temperatures. The design provides for an oil cooler to avoid high oil temperatures. The oil cooler is activated when the main pump is switched on. For operation in low temperature environments, an optional oil heater and thermostat may be provided to keep working oil temperatures at optimum levels.

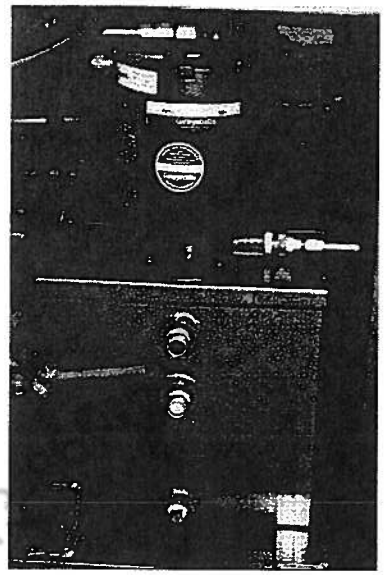

Fig. 34 - Strip Material Lubricant Tank

4.6.1.5 Lubricants

Proper lubrication is critical for optimum performance of the HELIX-200. The design provides an 8 gallon tank (Fig. 34) with a plate type filter to hold operating lubricants. A motor driven pump delivers lubricant to a lubricating roller ahead of the form roll unit, and to the lower rear guide plate. After lubricating the strip material, this lubricant drains back into the lubricant tank compartment ahead of the lubricant filter plate, passes through the filter, and is recirculated by the pump to lubricate the strip material. Two sight glasses are furnished on the tank for checking the level of the lubricant in the tank. The design provides a wiper for wiping off lubricant from the tube. The wiped-off lubricant drains back into the lubricating system. In addition, appropriate lubrication for spur gearing and bearings is provided in keeping with accepted industrial practice.

4.6.2 Pneumatic System

The pneumatic system (Fig. 35) of the HELIX-200 is designed to operate the flying

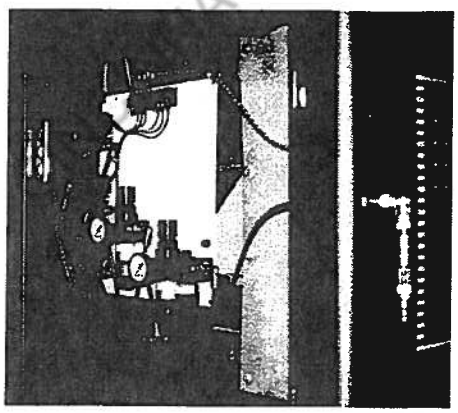

Fig. 35 - Pneumatic System for the Standard Equipment HELIX-200

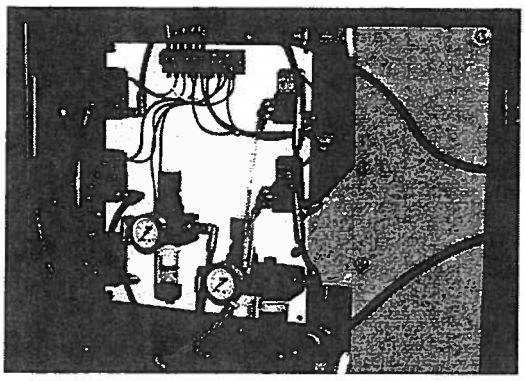

Fig. 36 - Pneumatic System when the Optional Flying Crimper is Installed

slitter for the standard equipment configuration. When the HELIX-200 is configured to include the optional flying crimper, the pneumatic system (Fig. 36) is expanded to include the operation of the flying crimper. The decoiler is equipped with an independent pneumatic subsystem.

4.6.3 Electrical system

NOTE: FOR THE ELECTRICAL SYSTEM SCHEMATICS, REFER TO THE FOLLOWING SPIRAL-HELIX, INC DRAWINGS WHICH ARE SUPPLIED WITH THE HELIX-200:- *DRAWING NUMBER EP2-002E: WIRING DIAGRAM FOR ELECTRICAL CONTROL PANEL FOR TUBEFORMER HELIX-100 AND 200 SERIES;* AND *DRAWING NUMBER E1S-195: ELECTRICAL SCHEMATIC FOR CUTOFF SAW UNIT.*

Fig. 37 depicts the electrical system for the HELIX-200. The HELIX-200 is designed to operate on a control voltage of 110 VAC, independent of the external AC power source. The external AC power source may be any standard source between 220 VAC and 480 VAC at 50 Hz or 60 Hz. The design uses a 0.500 KVA transformer, protected by two 6.3 Amp fuses, to step the incoming external AC power source down to the 110 VAC control voltage. The 110 VAC control circuit is the primary electrical circuit, and is protected by a 6.25 Amp fuse. Proximity switches, which are part of dedicated devices, form part of the secondary electrical circuit which operates on 24 VDC. The 24 VDC is derived from the 110 VAC using a converter provided for the purpose.

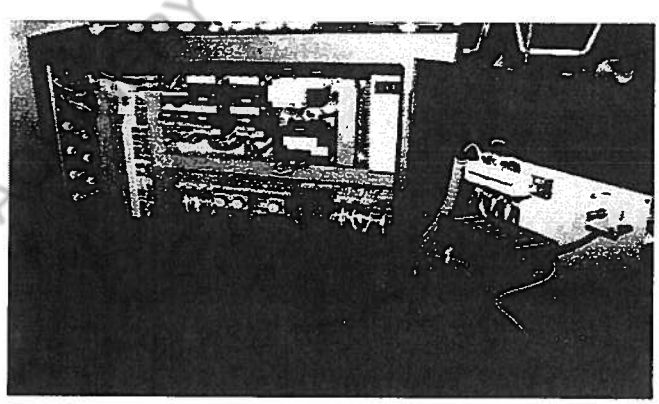

Fig. 37 - The HELIX-200 Electrical System

4.6.4 Operator panel

The operator panel (Fig. 38) is located on top of the machine cabinet, and consists of the following switches, push buttons and controls:

1. CLINCHING ROLLER DOWN-UP:- This selector switch raises or lowers the clinching roller.

2. SLOW SPEED:- This GREEN colored push button starts the tubeformer in slow speed. The actual speed is determined by the setting of the potentiometer

knob directly above the push button.

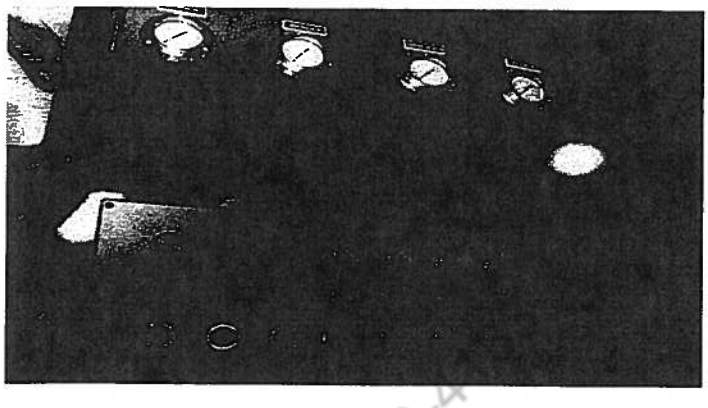

Fig. 38 - The Operator Panel

3. HIGH SPEED:- A GREEN colored push button similar to the Slow Speed button described above, and similarly set up for High Speed tubeforming.

4. STOP:- This RED colored push button is located between the SLOW SPEED and the HIGH SPEED push buttons, and may be used to stop either the SLOW SPEED or the HIGH SPEED operation of the drive unit and feed rollers. **Note that this STOP button does not stop a CUT or a CRIMP or a DISCHARGE operation.**

5. MAIN SWITCH:- This push-button turns the machine control power on or off and can be used as an emergency stop. Pushing this switch for the OFF mode stops all tubeformer operations.

6. HYDRAULIC OFF-ON:- This selector switch turns ON or OFF the motor that drives the hydraulic pump.

7. LUBRICATION OFF-ON:- This selector switch turns ON or OFF the pump that circulates the lubricant for the strip material. **Note that both pumps will start if these switches are in their ON position when the Main Switch is pulled out to its ON position.**

8. MAN-AUTO:- This selector switch selects tubeformer operation, either in Manual mode or in Automatic mode. In the Manual mode, discharge of the tube and restarting of the tubeformer are separate and distinct operations that have to be independently initiated by the operator. In the Automatic mode, both discharging the tube and restarting the tubeformer are part of a single operating cycle.

9. CUTTER:- This push button initiates a tube cutting operation. The cutting operation may be interrupted by the STOP push button directly below the CUTTER button.

10. CRIMPER OFF-ON:- This selector switch turns ON or OFF the automatic operation of an optional flying crimper if this option has been installed. When

this selector switch is in the ON position, CRIMPing will occur at the end of each CUTting operation.

11. MANUAL CRIMP:- This push button initiates an operator activated cycle for crimping the end of the formed tube. Crimping can only be done at the end of a CUT cycle.

12. DISCHARGE:- This GREEN colored push button activates the tube discharge arm(s) on the run-off table assembly to move the tube from the run-off tables onto the receiving ramps. The RED colored STOP push button directly below the DISCHARGE button may be used to abort the discharge operation at any point, and return the discharge arm(s) to the idle position.

13. COUNTER OFF-ON:- This selector switch turns the parts counter ON or OFF. In the ON mode, the counter must have a preset value for the number of tubes to be produced.

14. POWER ON:- This is an indicator light, and is lit when control power is ON.

15. SLITTER-SAW:- This is a selector switch for choosing the method of cutting the tube; and is provided only when an optional Saw Unit is installed.

16. HYD. MOTOR PR:- This is an indicating gauge that shows the actual hydraulic pressure in the hydraulic motor circuit.

17. DRIVE ROLLER PR:- This is an indicating gauge that shows the hydraulic pressure in the cylinders that push the lower pinching rollers of the drive and feed roller up against their matching pairs.

18. CLINCHING ROLLER PR:- This is an indicating gauge that shows the hydraulic pressure in the clinching roller cylinder.

19. AUX. PUMP PR:- This is an indicating gauge that shows the pressure at which the auxiliary pump is operating.

20. DRIVE ROLLER PRESSURE REGULATING VALVE:- This is a regulating valve that is used for setting the pressure in the drive roller cylinders.

21. CLINCHING ROLLER PRESSURE REGULATING VALVE:- This is a regulating valve that is used for setting the pressure in the clinching roller cylinder.

5. TRANSPORTATION AND STORAGE

NOTE: ALL APPROPRIATE LOCAL SAFETY AND HANDLING PRACTICES MUST BE FOLLOWED WHEN TRANSPORTING THE HELIX-200 TO OR STORING IT AT A STAGING OR INSTALLATION SITE.

5.1 The HELIX-200 and its components, and optional equipment are shipped in palletized wooden crates using appropriate packaging.

CAUTION: ***To avoid possible damage to the HELIX-200 and optional equipment, the palletized crate and packaging should not be removed until the equipment is transported to the installation site.***

5.2 If the crate and the packaging appear excessively damaged, the HELIX-200 or its component, or optional equipment should not be accepted from the shippers as damage to the equipment may not be apparent.

5.3 When a HELIX-200 or any of its components or an optional equipment is secured to the pallet, proper lifting equipment, such as a forklift, should be used to lift the pallet and the equipment.

5.4 Store the crated equipment in an upright position to avoid possible damage.

CAUTION: ***DO NOT STACK UNITS for transportation or during storage.***

5.5 A tool box is provided with each HELIX-200 and/or optional equipment shipped. The operations manual and all other documentation, and hardware are located in this tool box.

6. INSTALLATION

6.1 Site Preparation and Considerations

NOTE: THIS MANUAL CONTAINS INSTALLATION INSTRUCTIONS FOR A STANDARD HELIX-200. IT SHALL BE THE RESPONSIBILITY OF THE SUPERVISING SITE ENGINEER AND/OR THE RESPONSIBLE SITE MANAGEMENT TO ENSURE THAT THE INSTALLATION SITE COMPLIES WITH ALL LOCAL CONDITIONS, PRACTICES AND/OR CODES; AND THAT ANY AND ALL RELEVANT INDUSTRY AND/OR NATIONAL CODES ARE MET.

6.1.1 The installation site must be equipped with a standard electrical power source rated between 220 VAC and 480VAC at 50 Hz or 60 Hz; and have provisions for clean, regulated air pressure to 80 psi.

6.1.2 The site must have a floor space availability sufficient to accommodate a minimum installed space of 351 square feet (32.6 square meters) distributed as shown in Fig. 39 or Fig. 40, with additional floor space sufficient to comply with all local, industry, and national practices and codes. The surface of the designated site shall be flat and level to within 1/8 inch end-to-end, and have a weight carrying and anchoring capacity equivalent to a concrete floor of 4 inches minimum thickness.

NOTE: IF THE FLOOR IS NOT LEVEL TO WITHIN THE RECOMMENDED SPECIFICATIONS, USE SHIMS TO LEVEL THE MAIN MACHINE.

6.1.3 L-shaped footprint floor space requirements

The L-shaped layout (Fig. 39) requires the receiving ramp(s) to be on the same side of the centerline of the forming head as the decoiler. In this configuration, the standard equipment requires a floor space of approximately 351 square feet (32.6 square meters) with a long leg measurement of 366 inches (9,296 mm) by 94-3/4 inches (2,407 mm) wide, and a short leg measurement of 184-1/2 inches (4,686 mm) by 176-1/4 inches (4,477 mm) wide. For each ten foot optional run-off table and a corresponding ten foot receiving ramp added, an additional 120 inches (3,048 mm) is added to the long leg dimension of the standard equipment for an additional floor space requirement of approximately 79 square feet (7.3 square meters). For the addition of an optional saw unit, an additional 32-1/2 inches (826 mm) is added to the long leg dimension of the standard equipment for an additional floor space requirement of approximately 22 square feet (2.0 square meters).

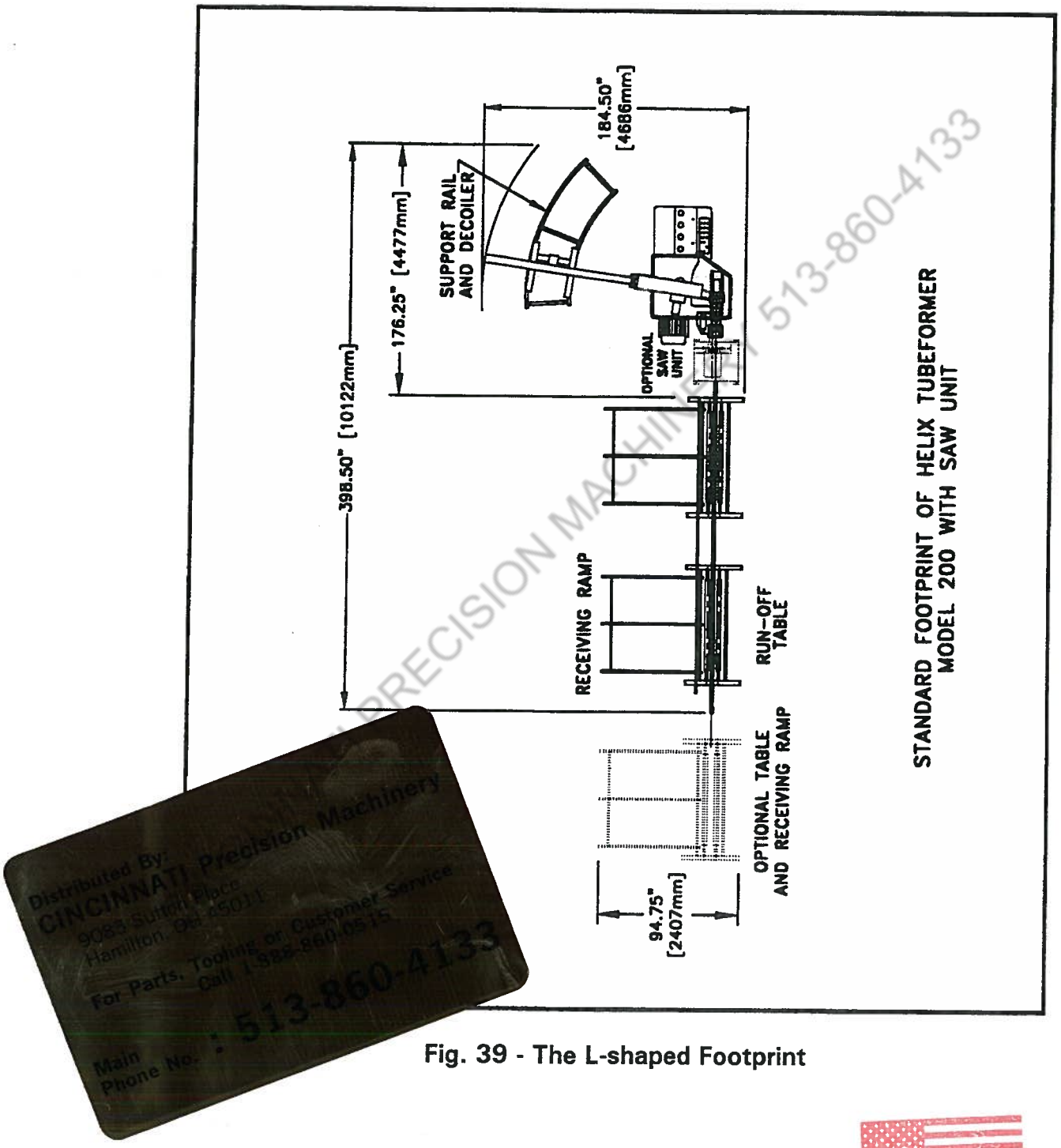

Fig. 39 - The L-shaped Footprint

6.1.4 Alternate Z-shape footprint floor space requirements

The Z-shape layout (Fig. 40) places the receiving ramp(s) on the opposite side of the centerline of the forming head as the decoiler. Except for the placement and distribution of the components of the HELIX-200, the total space requirement for the Z-shape layout is approximately the same as that for the L-shape layout. In particular, the dimensions along the axis of the forming head are exactly the same in the Z-shape configuration as in the L-shape configuration, either when the standard equipment is configured or when optional equipment is added.

6.2 Unpacking the HELIX-200

WARNING: TO AVOID DAMAGING THE HELIX-200, OR A COMPONENT, OR AN OPTIONAL EQUIPMENT, DO NOT REMOVE THE PALLETIZED CRATE AND PACKAGING UNTIL THE EQUIPMENT IS TRANSPORTED TO THE INSTALLATION SITE.

6.2.1 If the packaging and palletized crate appear excessively damaged, the equipment should not be accepted from the shippers as damage to the equipment may not be apparent.

6.2.2 Disassemble the crate starting with the top wood covering, and remove the four wooden sides. **Carefully** remove the plastic covering and all packaging materials from the equipment. Dispose of or save the packaging materials for reuse as specified by local practices. **Do not remove the equipment from the pallet at this time.**

6.2.3 Visually inspect the equipment for damage. If there is any damage apparent, contact your local supervisor or SPIRAL-HELIX, INC for further instructions.

6.3 Installing the Standard Equipment

WARNING: OBSERVE ALL LOCAL SAFETY PRACTICES AND WEAR ALL LOCALLY APPROVED SAFETY GEAR WHEN INSTALLING THE HELIX-200. ALSO FOLLOW THE ADDITIONAL PRECAUTIONS LISTED BELOW IF THEY ARE NOT INCLUDED IN THE LOCAL SAFETY PRACTICES.

1. *Keep bystanders away from the installation site at all times.*

2. *Crane or forklift operators should not suspend any load over people, or should any person be permitted to work, stand, or pass under a suspended load.*

3. *All persons working with crane equipment shall wear standard safety headgear, eye protection, and (when required) gloves. Only those operators who are*

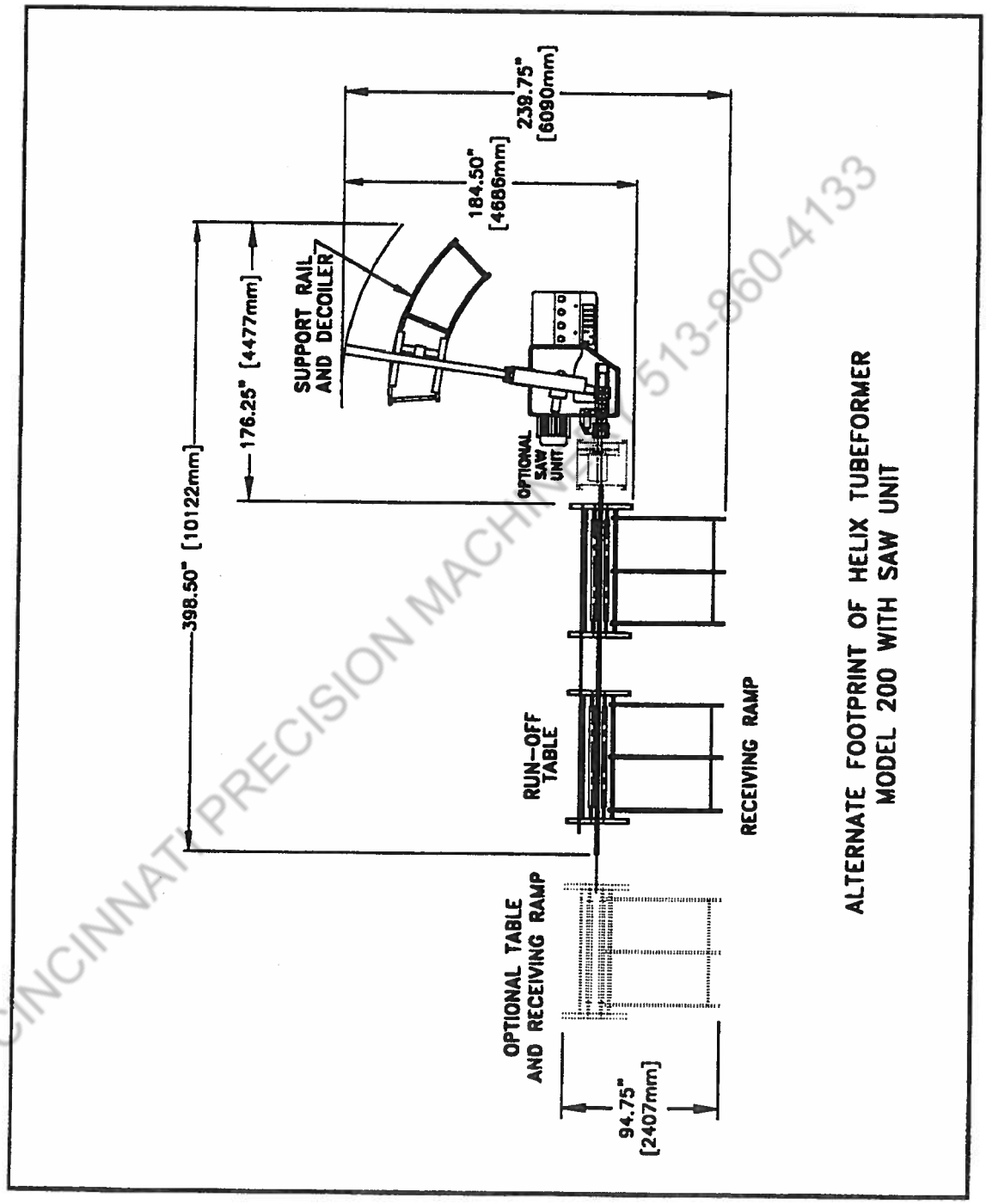

Fig. 40 - The Alternate Z-shaped Footprint

specifically trained shall be permitted to operate crane equipment for placing the HELIX-200.

4. ***Do not operate a crane until all stabilizers are extended and in firm contact with the ground or adequate support structure. Do not attempt to retract or extend the stabilizers while a load is suspended from the crane.***

5. ***When raising a crane from the stowed position, and while operating the crane, be alert for overhead obstructions or power lines that might interfere with movement of the crane.***

6. ***If the equipment is moved while it is attached to the pallet, it may be lifted by a forklift vehicle provided that the forklift is rated for the weight of the equipment, and has a fork length no more than 6 inches shorter than the pallet dimension when measured across from the forklift.***

7. ***Do not transport, lift, or install a HELIX-200 with electrical power and/or pneumatic power source already engaged. External AC power and/or pneumatic power source may be connected to the equipment only after it has been fully installed and secured.***

6.3.1 Special tools and materials needed

1. A hammer drill;
2. Lubricating tools and equipment such as a grease gun;
3. Lubricants;
4. 1/2 inch - 13 UNC x 3-1/2 inches minimum anchor bolt assemblies;
5. 3/8 inch - 16 UNC x 3 inches minimum anchor bolt assemblies; and
6. Source of clean, regulated air pressure to 80 psi.

6.3.2 Move the components into position, and take them off their respective pallets. Dispose of or save the pallets for reuse as specified by local practices.

6.3.3 Installing the main machine

Locate the components starting with the main machine. Level the main machine using the machined surface on top of the bed as datum. Fasten and secure the main machine and the machine cabinet to the floor using 1/2 inch - 13UNC x 3-1/2 inch minimum anchor bolt assemblies.

NOTE: **THE MAIN MACHINE SHOULD BE LEVELED UP CAREFULLY USING THE MACHINED SURFACE ON TOP OF THE BED FOR LEVELING.**

DANGER: ***IT IS VERY IMPORTANT THAT THE MAIN MACHINE IS LEVEL. FAILURE TO LEVEL THE MAIN MACHINE WILL RESULT IN UNSATISFACTORY PERFORMANCE, AND MAY RESULT IN DAMAGE TO THE EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL DURING OPERATION.***

6.3.4 Wipe any excess grease and/or lubricant, and cumulated dirt from transportation and storage, from the main machine and its components. Apply fresh grease and fresh lubricant to the main machine as necessary; and connect all pneumatic and/or hydraulic components as necessary.

6.3.5 Check the direction of rotation of the main motor

WARNING: ***TO AVOID DAMAGE TO THE MAIN MOTOR, CHECK THE DIRECTION OF ROTATION OF THE MAIN MOTOR AND MAKE SURE THAT IT MATCHES THE DIRECTION MARKER (ARROW) ON THE MAIN MOTOR.***

Check the direction of rotation of the main motor as follows: First connect the HELIX-200 main machine to the external AC power source. Pulse the main motor in approximately a 1/2 second burst, and check the direction of rotation of the main motor against the direction marker (ARROW) on the main motor. If the direction of rotation does not match the direction marker, turn-OFF the external AC power source and disengage the external AC power source; swicth any two phases of the external AC power source, and reconnect the external AC power source. Recheck the direction of rotation of the main motor to be sure that the direction of rotation matches the direction marker (ARROW) on the main motor.

WARNING: ***POWER DOWN THE MAIN MACHINE, AND DISCONNECT THE EXTERNAL AC POWER SOURCE BEFORE PROCEEDING.***

6.3.6 The flying slitter and the forming head

The HELIX-200 is delivered with the flying slitter factory pre-installed on the main machine. Installation of the main machine automatically properly installs the flying slitter. However, a forming head may or may not be factory pre-installed depending on the size of the forming head(s) required with the particular HELIX-200 shipped. The standard equipment HELIX-200 is, generally, factory pre-installed with a forming head for a tube diameter between 6 inches and 14 inches and requires no further attention to

2.000 lbs MAX LIMIT

the forming head at installation. For best results in leveling the run-off table and any other component, if the HELIX-200 was shipped without a factory pre-installed forming head of the size within the tube size range indicated, install and secure a forming head for a tube diameter between 6 inches and 14 inches.

6.3.7 Installing the vertical decoiler

Locate the decoiler rail track, and level it. **The decoiler track should be located approximately 102-3/8 inches (2600 mm) radius from the clinching roller.** Position the decoiler on the track; and load a coil of strip material onto the decoiler. **Make sure that the coil of strip material is flush against the backplate of the decoiler;** and feed the strip material into the roller housing. Move the roller housing, using the crank arm provided for the purpose, to the position representing the largest diameter on the tube size selector scale (Fig. 41). **Make any necessary adjustments in locating the decoiler track to ensure the decoiler stays on track, and the strip material feeds squarely into the roller housing at all times.** Reposition the roller housing to a middle diameter on the tube size selector scale. Adjust the decoiler track position, as necessary, to ensure that the decoiler stays on track while the strip material continues to feed squarely into the roller housing. Reposition the roller housing to the smallest diameter selection on the tube size selector scale, and repeat the adjustment process as necessary. Again, the decoiler must remain on track while the strip material feeds squarely into the roller housing. Fasten and secure the decoiler track to the floor using 3/8 inch - 16 UNC x 3 inch minimum anchor bolt assemblies.

Fig. 41 - Roller Housing and the Tube Size Selector Scale

NOTE: MAKE SURE THE DECOILER STAYS ON TRACK FOR ALL TUBE SIZE SELECTIONS AND THE CORRESPONDING POSITIONS OF THE ROLLER HOUSING, AND THAT THE STRIP MATERIAL FEEDS SQUARELY INTO THE ROLLER HOUSING AT ALL TIMES AND ROLLER HOUSING POSITIONS.

6.3.8 Installing the run-off table assembly

NOTE: THE END OF THE "C" CHANNEL ON THE FIRST RUN-OFF TABLE SHOULD BE APPROXIMATELY 18.00 INCHES FROM THE INSIDE KNIFE OF THE FLYING SLITTER; AND THE CENTERLINE BETWEEN THE TWO ROLLERS ON THE RUN-OFF TABLE MUST BE ON LINE WITH THE FORMING HEAD MOUNTING BASE ON THE MAIN MACHINE (OR THE BOOM OF THE FLYING SLITTER).

Locate the two floor plates of the first run-off table. If necessary, assemble the first run-off table, making sure that any stamped parts with identifying numbers are appropriately located and positioned within the table sub-assembly. Place the first run-off table into position with the end-frames on respective floor plates; and line up the first run-off table with the main machine. **The centerline between the two support rollers on the run-off table must be on line with the forming head mounting base on the main machine (or the boom of the flying slitter).** Fasten each end-frame to the corresponding floor plate using the height adjustment screws provided for the purpose; **and make sure that the height adjustment bolts are located approximately in the middle of the mounting slots on the floor plates**. Level the two support rollers on the run-off table, in both directions, parallel and perpendicular to the axis of the two rollers on the run-off table. Slide the proximity switches into the "C" channel and move them into position, towards the main machine, about 2.0 inches in front of the rollers on the run-off table. **Do not connect the proximity switches into the main machine circuits at this time.** Connect the HELIX-200 main machine to the external AC power source; and connect the pneumatic power source. Power up the main machine for a setup run. Run a spiral tube out to the front side of the rollers on the first run-off table. If necessary, adjust the height of the run-off table so that the bottom of the setup spiral tube is 3/8 inches or less from the eye of the proximity switches. **Note that: to adjust the height of the run-off table, each of the two height adjustment bolts of each end-frame must be adjusted by equal amounts.** Continue the setup run until the setup spiral tube reaches the end of the first run-off table; **and make appropriate adjustments to ensure that the setup tube remains parallel to and touches the entire length of both rollers.** Fasten and secure the first run-off table by anchoring the floor plates to the floor using 3/8 inch - 16 UNC x 3 inch minimum anchor bolt assemblies. Move the second run-off table sub-assembly into position and butt the "C" channel of the second table to the "C" channel of the first table. Align the second run-off table with the first, and repeat the installation procedure to level and adjust the second run-off table. Couple together and secure the "C" channels of the two run-off tables, using the channel coupler and hardware provided for the purpose.

NOTE: THE SPIRAL TUBE MUST BE PARALLEL TO, AND TOUCH THE ENTIRE LENGTH OF EACH ROLLER ON THE RUN-OFF TABLE ASSEMBLY DURING PRODUCTION.

6.3.9 Installing the receiving ramps

Move the receiving ramps into position and mount each one to a corresponding run-off table. Setup the discharge arms on each run-off table to match the direction of the receiving ramps; and check the run-off table assembly for proper installation per the instructions in Section 6.3.10.

6.3.10 Alignment check procedure for the run-off table assembly

WARNING: TO AVOID PRODUCTION PROBLEMS, MAKE SURE THAT THE RUN-OFF TABLE ASSEMBLY IS PROPERLY INSTALLED, AND LEVELED; AND THAT CUT FORMED TUBE LENGTHS ON THE RUN-OFF TABLE ASSEMBLY MATE SQUARELY TO THE CORRESPONDING UNCUT PIECE OF FORMED TUBE IN THE FORMING HEAD.

Check for proper installation of the run-off table assembly as follows: Place a cut formed tube length on the run-off table assembly, and move the tube toward the corresponding uncut piece of formed tube in the forming head (Fig. 42). Mate the cut formed tube length to the uncut piece of tube in the forming head, and check for squareness of the mating. The cut tube length and the uncut piece of formed tube must be parallel and mate squarely on center, while the cut formed tube length remains touching the support rolls along its entire tube length.

6.3.11 To complete the installation of the standard equipment HELIX-200, plug in the male Pollak connector from the run-off table assembly into the matching Pollak socket of the main machine circuitry. Connect all remaining pneumatic and/or hydraulic devices to their respective power sources; and test each to ensure their proper functioning. Power down the HELIX-200, unless it will be immediately commissioned for its first production run.

6.4 Installing Optional Equipment

WARNING: OBSERVE ALL LOCAL SAFETY PRACTICES AND WEAR ALL LOCALLY APPROVED SAFETY GEAR WHEN INSTALLING AN OPTIONAL EQUIPMENT FOR THE HELIX-200. ALSO FOLLOW THE ADDITIONAL PRECAUTIONS LISTED BELOW IF THEY ARE NOT INCLUDED IN THE LOCAL SAFETY PRACTICES.

1. ***Keep bystanders away from the installation site at all times.***

2. ***Crane or forklift operators should not suspend any load over people, or should any person be permitted to work, stand, or pass under a suspended load.***

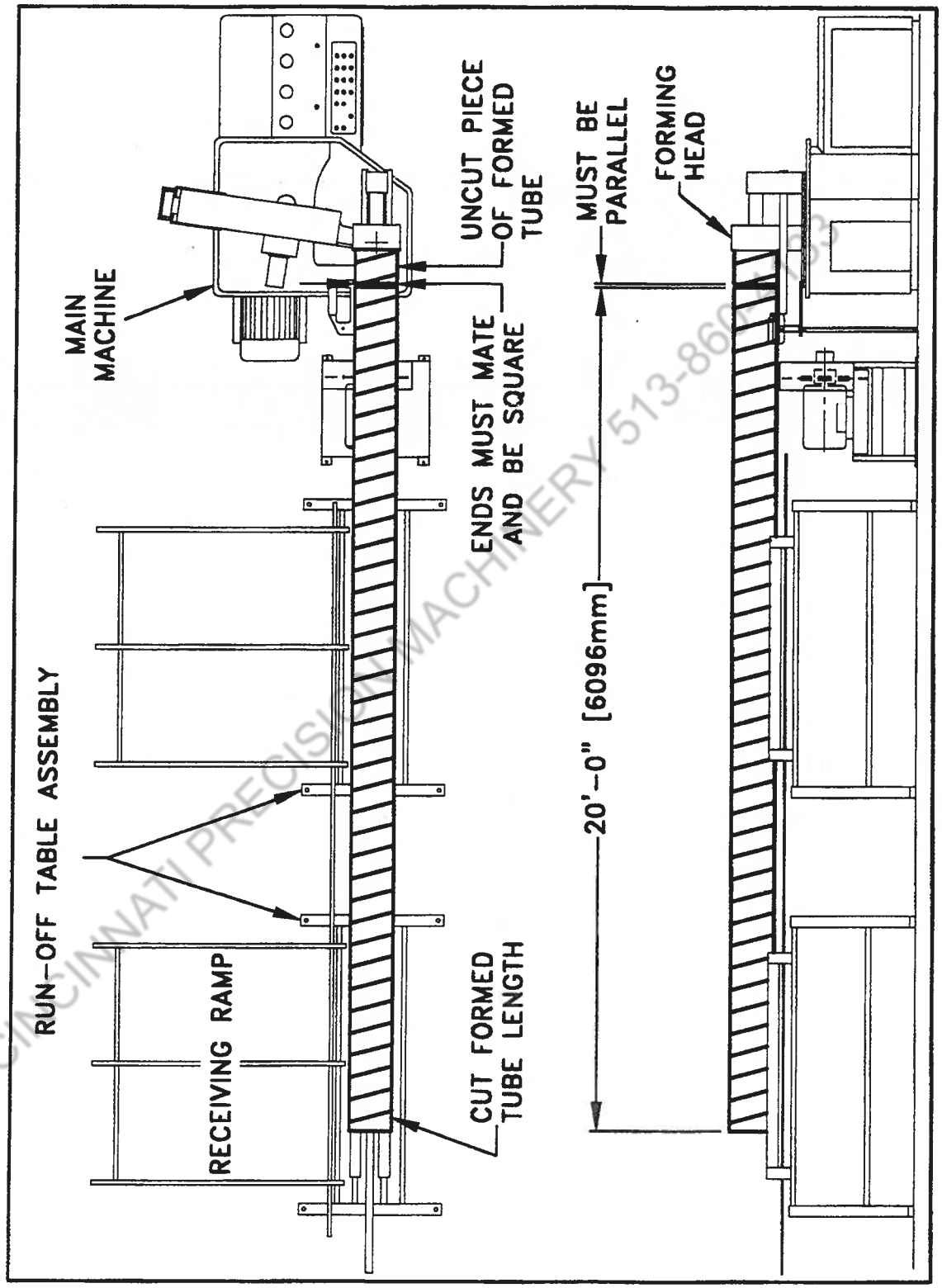

Fig. 42 - Alignment Check for Run-off Table Assembly

3. *All persons working with crane equipment shall wear standard safety headgear, eye protection, and (when required) gloves. Only those operators who are specifically trained shall be permitted to operate crane equipment for placing the HELIX-200.*

4. *Do not operate a crane until all stabilizers are extended and in firm contact with the ground or adequate support structure. Do not attempt to retract or extend the stabilizers while a load is suspended from the crane.*

5. *When raising a crane from the stowed position, and while operating the crane, be alert for overhead obstructions or power lines that might interfere with movement of the crane.*

6. *If the equipment is moved while it is attached to a pallet, it may be lifted by a forklift vehicle provided that the forklift is rated for the weight of the equipment, and has a fork length no more than 6 inches shorter than the pallet dimension when measured across from the forklift.*

7. *Do not transport, lift, or install a HELIX-200 optional equipment with electrical power and/or pneumatic power source already engaged. External AC power and/or pneumatic power source may be engaged only after the equipment have been fully installed and secured.*

WARNING: POWER DOWN THE HELIX-200 PRIOR TO ANY PROCEDURE TO INSTALL ANY OPTIONAL EQUIPMENT. EXTERNAL AC POWER AND/OR PNEUMATIC POWER SOURCE MAY BE ENGAGED ONLY AFTER THE OPTIONAL EQUIPMENT HAVE BEEN FULLY INSTALLED AND SECURED.

6.4.1 Installing a corrugating attachment

NOTE: WHEN REQUIRED, A CORRUGATING ATTACHMENT MAY BE INSTALLED TO PRODUCED AN EXTERNAL OR AN INTERNAL CORRUGATION. INSTALLATION FOR INTERNAL CORRUGATION REVERSES THE POSITION OF THE GROOVED (SUPPORTING) ROLLER VERSUS THE BEADED (CORRUGATING) ROLLER.

A corrugating attachment may be installed for external corrugation as follows: If not done already, install the forming head and properly set it up for tube forming per the instructions in Section 7.2.7. Identify the mounting pad to use; and loosen, without removing, the retaining nuts that hold the rollers and their respective handles in place. With the rollers pointed towards the run-off table and the grooved (supporting) roller on the outside, mount the corrugating unit onto the forming head; and position the corrugating

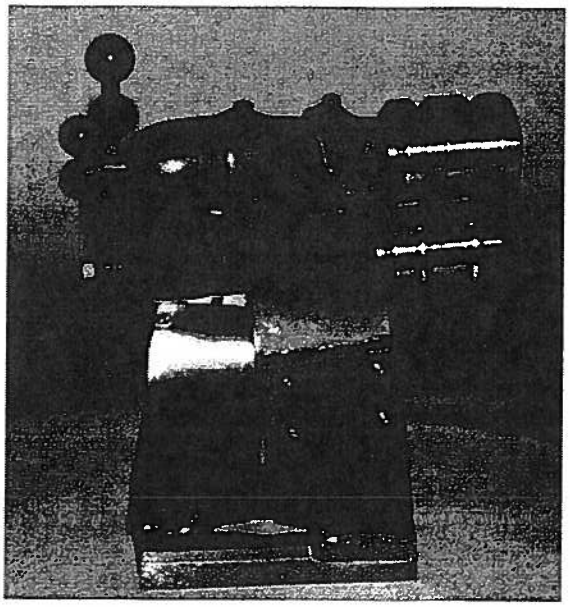

Fig. 43 - A Typical Corrugating Attachment Installed for External Corrugation

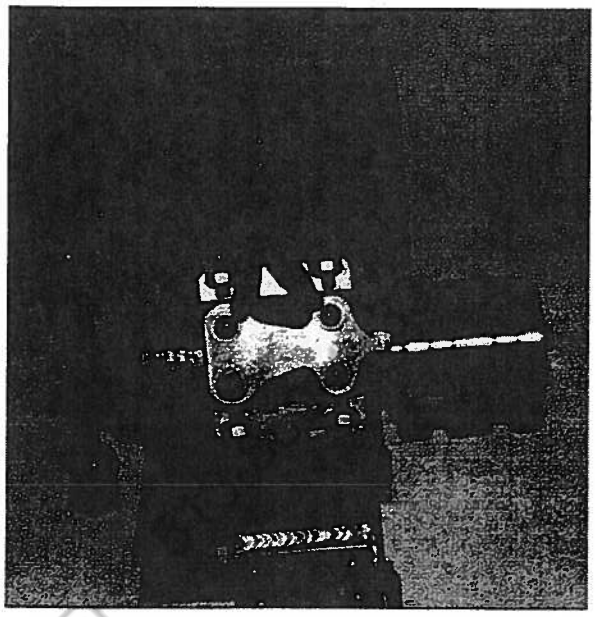

Fig. 44 - Corrugating Attachment Mounting Bolts

attachment such that the grooves and the beads on the attachment rollers approximately follow the same helical path as the lockseam and the helical openings in the forming head. Fasten the corrugating unit in place using the four mounting bolts (Figs. 43 and 44). Do not tighten the mounting bolts at this time. The corrugating attachment is now ready for setup adjustments. To install a corrugating attachment for internal corrugation, reverse the positions of the grooved (supporting) and the beaded (corrugating) rollers; and follow the instructions as provided.

NOTE: REFER TO SECTION 7.3.1 FOR THE INSTRUCTIONS TO MAKE THE SETUP ADJUSTMENTS FOR CORRUGATING ATTACHMENTS.

6.4.2 Installing the digital tube length control

When required, the optional digital tube length control is factory pre-installed on the run-off table assembly, and require minimal mechanical field installation once the run-off table assembly installation is completed. First disconnect the Pollak connection between the run-off table assembly and the main machine, if the connection was made as part of installing the standard equipment HELIX-200; and safely stow the connector away for later reinstallation. Connect and secure the two halves of the digital tube length control wiring conduit, as necessary, to complete the mechanical installation. Integration of the digital tube length control into the HELIX-200 circuitry is accomplished when the factory-labeled electrical wiring from the main machine terminal junction is

connected to the terminal junction box of the digital tube length control. If all installation processes, including optional equipment installations are complete, reconnect the male Pollak connector from the run-off table assembly into the matching Pollak socket of the main machine circuitry.

6.4.3 Installing the flying crimper

When required, the optional flying crimper is fully factory pre-installed and require no independent field installation. Installation of the main machine fully installs the optional flying crimper.

6.4.4 Installing the saw unit

NOTE: **THE MAIN MACHINE MUST BE FULLY INSTALLED - THAT IS, LEVELED AND ANCHORED - BEFORE INSTALLING THE SAW UNIT.**

WARNING: ***THE FORMED TUBE SUPPORT ROLLER ASSEMBLY PROVIDED WITH THE OPTIONAL SAW UNIT CANNOT BE USED (OR INSTALLED) WHEN AN OPTIONAL FLYING CRIMPER IS INSTALLED.***

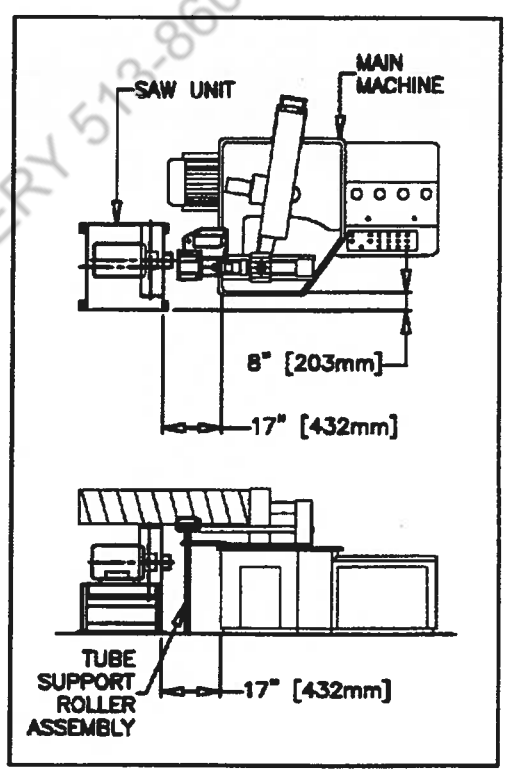

Fig. 45 - Saw Unit Mounting Position

NOTE: **WHEN INSTALLED, THE SAW UNIT AT ITS HIGHEST POINT - INCLUDING THE SAW BLADE SAFETY COVER - MUST BE BELOW THE BOTTOM OF THE PIPE DURING TUBEFORMING. FOR INSTALLATIONS THAT WILL USE A CUX CORRUGATING ATTACHMENT, THE NSTALLED HEIGHT MUST BE FURTHER BELOWTHE BOTTOM OF THE PIPE DURING TUBEFORMING.**

WARNING: ***TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON***

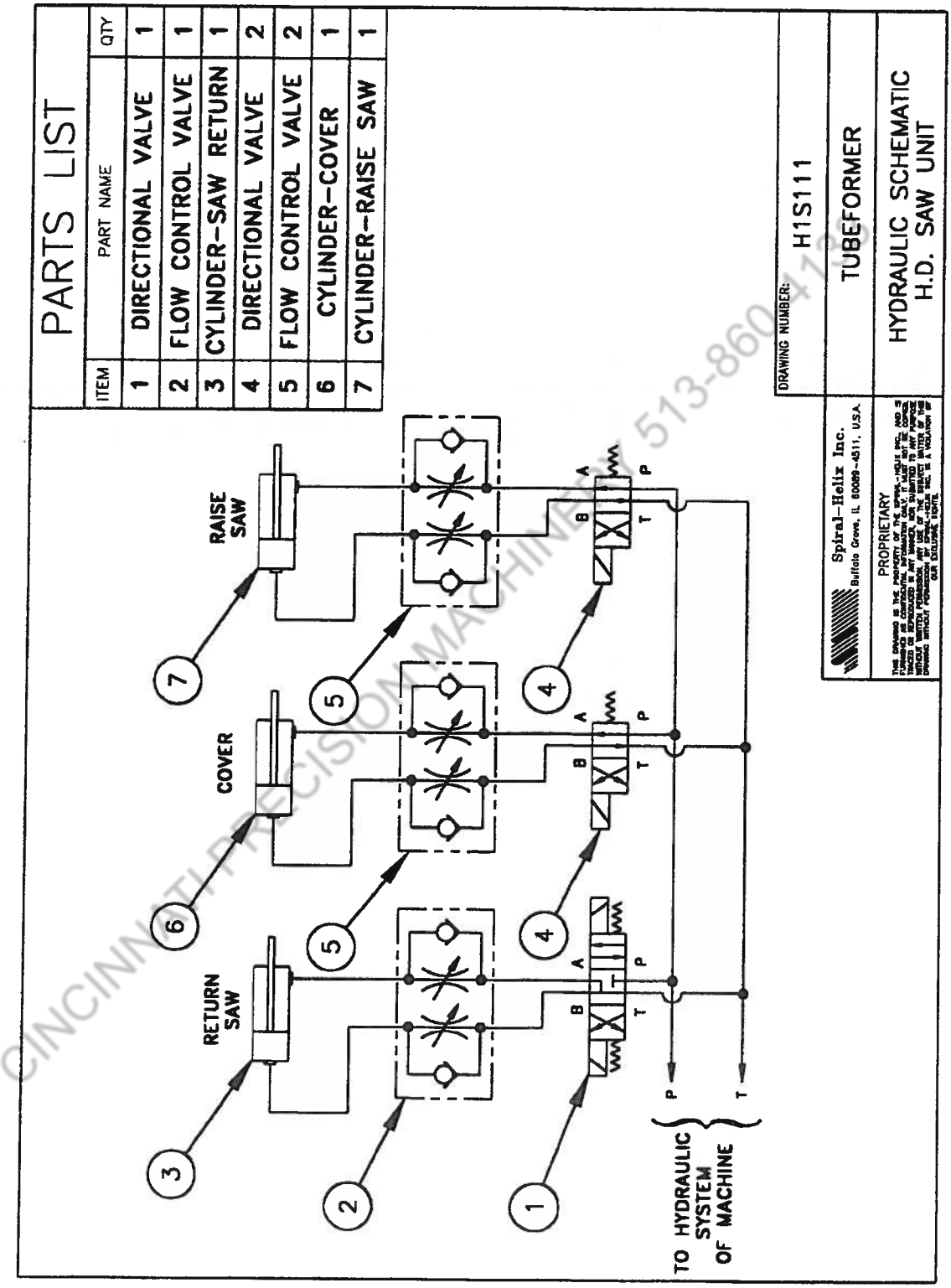

Fig. 46 - Saw Unit Hydraulic Schematic

THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.

6.4.4.1 If not done already, move the crated saw unit into approximate position; and remove the saw unit and its components from the palletized crate. Safely set the pallet, the crating material and packaging aside for reuse, or dispose of per local safety practices. Mount the four adjustable leveling feet to the unit and put rubber antiskid pads under the leveling feet. Move the saw unit into position (Fig. 45). Connect the two hydraulic hoses per the Saw Unit Hydraulic Schematic (Fig. 46). Being careful to observe all local safety practices, connect the factory pre-labeled wiring from the electrical conduits of the main machine electrical circuit into the saw unit terminal box(es). Loosen and remove the YELLOW safety cover locking bolt. Move the locking collar (Fig. 47) on the linear bar to allow the saw blade and motor assembly to move back and forth; and reposition the locking collar to make it into a stop block for preventing the saw blade from bottoming out on the side of the saw blade cover. Check the saw blade M16 locking bolt and the two KM14 lock nuts (Fig. 48), and make sure that the bolt and nuts are tight and secure. Make square cut adjustments per the instructions in Section 6.4.4.2; and anchor the saw unit.

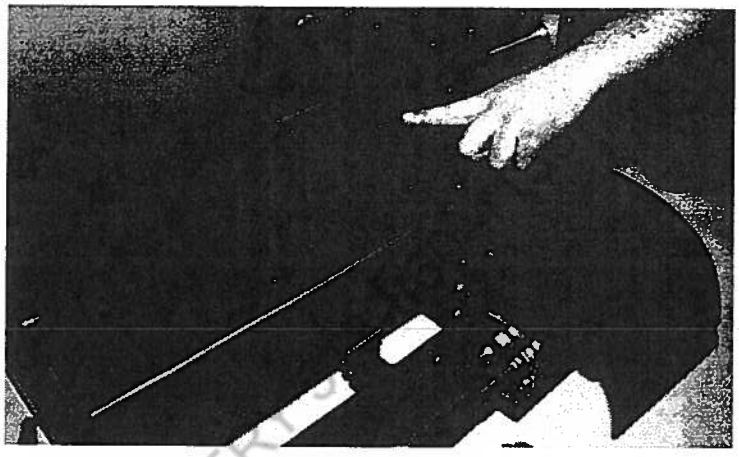

Fig. 47 - Locking Collar on Linear Bar

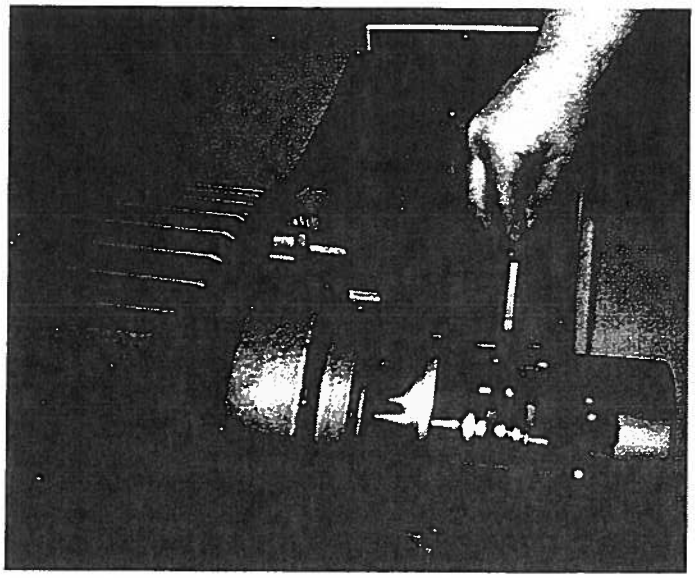

Fig. 48 - M16 Locking Bolt and KM14 Locking Nuts

6.4.4.2 Making a saw unit square cut adjustments

NOTE: THE SAW UNIT IS FACTORY ASSEMBLED WITH THE BASE PLATE BOLTS IN THE CENTER OF THE SQUARE CUT ADJUSTMENT SLOTS.

DANGER: TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL, ONLY TRAINED PERSONNEL MAY OPERATE THE HELIX-200.

DANGER: TO AVOID BODILY INJURY TO PERSONNEL AND POSSIBLE DAMAGE TO EQUIPMENT, KEEP CLEAR OF MOVING PARTS.

DANGER: TO AVOID BODILY INJURY TO PERSONNEL AND POTENTIAL DAMAGE TO EQUIPMENT, MAKE SURE THAT NO ONE IS IN THE CUTTER BLADE DANGER ZONE WHEN A SAW UNIT IS IN USE.

WARNING: BEWARE OF METAL PARTICLES FROM THE SAW BLADE WHEN THE SAW UNIT IS IN USE.

WARNING: KEEP UNTRAINED PERSONS AWAY FROM THE EQUIPMENT.

WARNING: TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.

CAUTION: Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.

CAUTION: Always wear protective goggles or appropriate eye protection gear; and always wear gloves when lifting or handling tubes.

NOTE: IN AN EMERGENCY, PUSH DOWN ON THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL LABELED "MAIN SWITCH". THIS WILL IMMEDIATELY STOP ALL MOTORS AND OPERATION OF THE HELIX-200.

Check the square cut adjustment slots to be sure the bolts are approximately in the center of the two square cut adjustment slots. Position both anchor plates (Fig. 49); and

fasten and secure one of the anchor plates. Power up the HELIX-200, and run a length of formed tube. Power up the saw unit. Make test cuts and check for a square cut; and make square cut adjustments as necessary. To make a square cut adjustment, first power down the saw unit and the HELIX-200. Pull the saw blade and motor assembly out to expose both sets of square cut adjustment nuts (Fig. 50); and adjust each pair of nuts as necessary to obtain a square cut. Fasten and secure the second anchor plate.

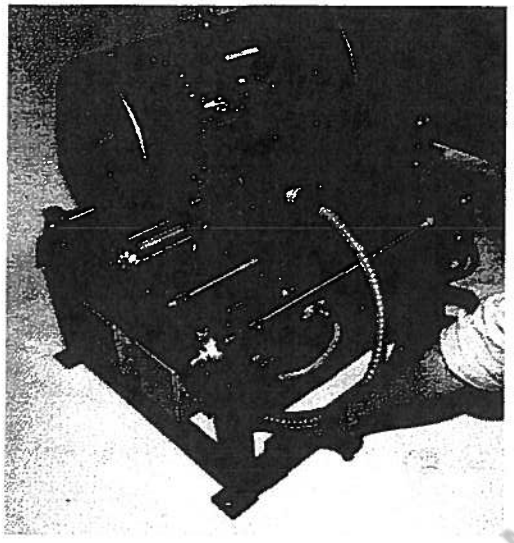

Fig. 49 - Saw Unit Anchor Plate (2 Places)

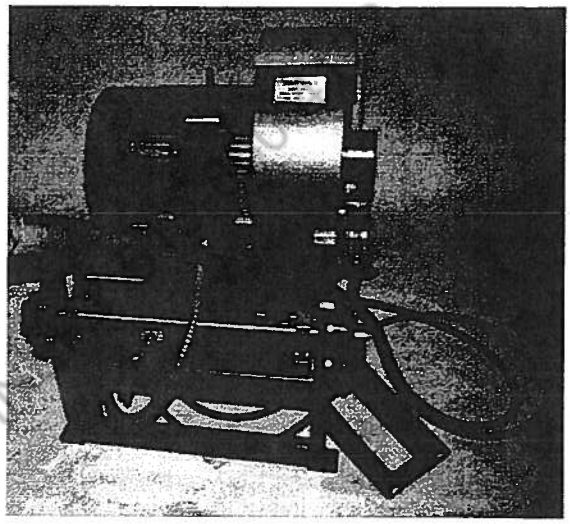

Fig. 50 - Saw Unit Square Cut Adjustment Bolt and Nut (4 Places)

7. OPERATING INSTRUCTIONS

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL, ONLY TRAINED PERSONNEL MAY OPERATE THE HELIX-200.***

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL, MAKE SURE THAT NO ONE IS TOUCHING THE STRIP MATERIAL BETWEEN THE DECOILER AND THE ROLLER HOUSING WHEN STARTING THE HELIX-200.***

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL AND POSSIBLE DAMAGE TO EQUIPMENT, KEEP CLEAR OF MOVING PARTS.***

WARNING: ***KEEP UNTRAINED PERSONS AWAY FROM SWITCHES, ESPECIALLY THOSE ON THE RUN-OFF TABLE ASSEMBLY.***

WARNING: ***TO AVOID OVERHEATING AND POSSIBLE DAMAGE TO EQUIPMENT, DO NOT LEAVE THE HELIX-200 IDLING FOR MORE THAN TEN MINUTES AT ANY TIME. THAT IS,DO NOT RUN THE HELIX-200 AT ZERO SPEED FOR MORE THAN TEN MINUTES AT ANY TIME.***

WARNING: ***TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.***

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

CAUTION: ***Always wear protective goggles or appropriate eye protection gear; and always wear gloves when lifting or handling tubes.***

NOTE: **IN AN EMERGENCY, PUSH DOWN ON THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL LABELED "MAIN SWITCH". THIS WILL IMMEDIATELY STOP ALL MOTORS AND OPERATION OF THE HELIX-200.**

7.1 Power-up and Power-down

7.1.1 AC power

The design of the HELIX-200 provides for two RED mushroom head operating AC power switches. The primary operating AC power switch is located on the operator panel and is labeled "MAIN SWITCH". The second operating AC power switch is provided as a portable unit with an override capability that allows it to deactivate all operations from a remote location. To power-up the HELIX-200, first turn ON the external AC power source. At the operator panel, pull up the RED mushroom head push button labeled "MAIN SWITCH". This lights up the BLUE POWER indicating light. The HELIX-200 is now under operating power, ready for use in the production of spiral tubes. To stop the operation of the HELIX-200, push down on the RED mushroom head "MAIN SWITCH". This deactivates all operating power, stopping all motors and control devices, and turns OFF the BLUE POWER indicating light. Turning OFF the external AC power to the HELIX-200 completely powers down the HELIX-200.

7.1.2 Emergency shut-down

In an emergency, operating AC power is interrupted by pushing down either the RED mushroom head "MAIN SWITCH" on the operator panel, or the remote RED mushroom head power switch (Fig. 51). This completely deactivates all operation of the HELIX-200.

WARNING: ***TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200 IF ANY WORK IS REQUIRED INSIDE THE ELECTRICAL COMPARTMENT OF THE MACHINE CABINET.***

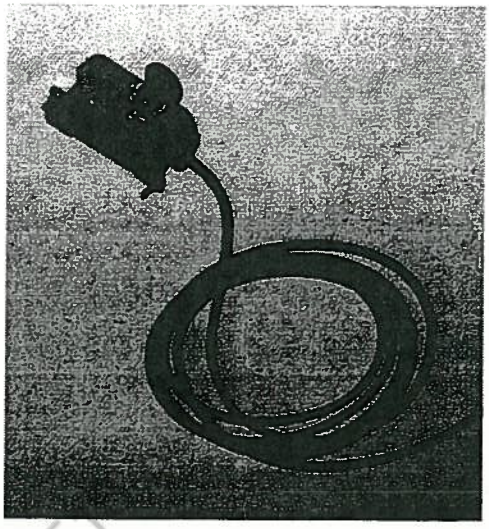

Fig. 51 - Remote RED Mushroom Head Power Switch

7.1.3 Hydraulic power

To power-up the HELIX-200 hydraulic system, turn the HYDRAULIC OFF-ON selector switch, located on the operator panel, to the ON position. This powers up the primary and the auxiliary hydraulic pumps. To power-down the hydraulic system, turn the HYDRAULIC OFF-ON selector switch to the OFF position.

7.1.4 Pneumatic power

Pneumatic power to the HELIX-200 may be provided by any clean, regulated source capable of 80 psi. To engage the pneumatic power, push up (slide up) the pneumatic quick-connect coupling; and push down (slide down) the pneumatic coupling to disengage the pneumatic power to the HELIX-200.

7.2 Setting Up the Standard HELIX-200

WARNING: ***TO AVOID OVERHEATING AND POSSIBLE DAMAGE TO EQUIPMENT, DO NOT LEAVE THE HELIX-200 IDLING FOR MORE THAN TEN MINUTES AT ANY TIME. THAT IS,DO NOT RUN THE HELIX-200 AT ZERO SPEED FOR MORE THAN TEN MINUTES AT ANY TIME.***

7.2.1 Roller housing and tube diameter selection

NOTE: **THE ROLLER HOUSING MUST BE POSITIONED FOR THE TUBE SIZE SELECTION BEFORE ANY OTHER SETUP ADJUSTMENT IS MADE.**

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE BODILY INJURY TO PERSONNEL, THE ROLLER HOUSING MUST BE POSITIONED ON THE TUBE SIZE SELECTOR SCALE TO CORRESPOND TO THE FORMING HEAD TO BE USED.***

Using the manual crank arm provided for the purpose, approximately position the roller housing on the tube size selector scale (Fig. 52) to correspond to the tube size to be produced.

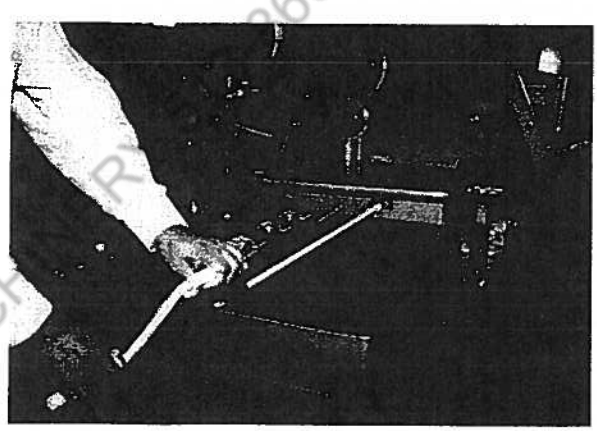

Fig. 52 - Manual Crank Arm for Positioning Roller Housing

7.2.2 Form roll unit and strip material dimensions

Refer to Table A to determine the form roll unit (Fig. 53) suitable for the strip material to be used. Mount and secure the form roll unit into position inside the roller housing using the two bolts provided for the purpose. Fig. 54 is typical of form roll units No. 0 through No. 4; and Fig. 57 is typical of form roll units No. 5 and No. 6.

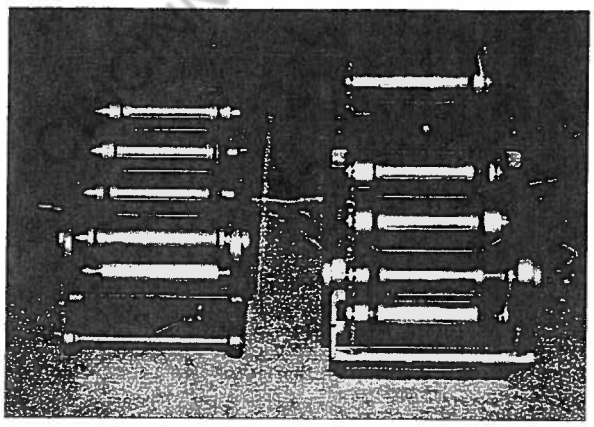

Fig. 53 - The two Versions of Form Roll Unit Design

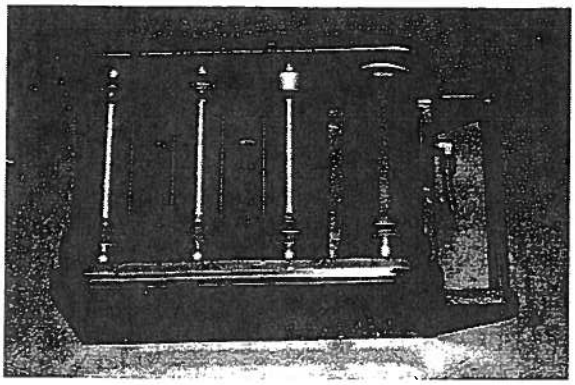

Fig. 54 - Typical Form Roll Units No. 0 through No. 4

7.3.3.3 Adjustments to obtain a complete circumference crimp

Adjust the crimp coverage along the circumference of the formed tube, as necessary. To change the amount or length of crimp coverage along the circumference of the tube, first loosen the two mounting bolts of the crimper over travel limit switch. To increase the amount or length of circumferential crimp coverage, move and reposition the crimper over travel limit switch (Fig. 89) away from the flying slitter cutter, and towards the flying slitter cutter to decrease the amount or length of the circumferential crimp coverage. Refasten the two mounting bolts to secure the crimper over travel limit switch.

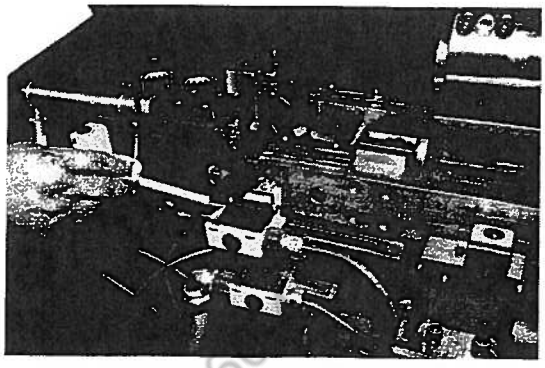

Fig. 89 - Crimper Over Travel Limit Switch

7.3.3.4 Lockseam crimp adjustment and self-compensation for strip material thickness variations

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE BODILY INJURY TO PERSONNEL, APPLY ONLY FINGER TIGHT TENSION TO EACH OF THE TENSION ADJUSTMENT NUTS ON THE SPRING WASHERS. DO NOT OVER TIGHTEN THE TENSION ADJUSTMENT NUTS.***

WARNING: ***EACH TENSION ADJUSTMENT NUT MAY BE ADJUSTED A MAXIMUM OF ONE SLOT MOVEMENT ONLY, AND MUST PRODUCE NO MORE THAN A FINGER TIGHT TENSION.***

NOTE: BOTH TENSION ADJUSTMENT NUTS MUST BE ADJUSTED BY THE SAME AMOUNT AND IN THE SAME DIRECTION.

Crimper self-adjustment and compensation for strip material thickness variations, including lockseam profile and thickness, is controlled by the amount of tension generated by the spring washers. The flying crimper is factory pre-installed with the correct settings for the tension adjustment nuts on the spring washers (Fig. 90), and require little or no production setup adjustments. However, if a production setup adjustment is required, proceed as follows:

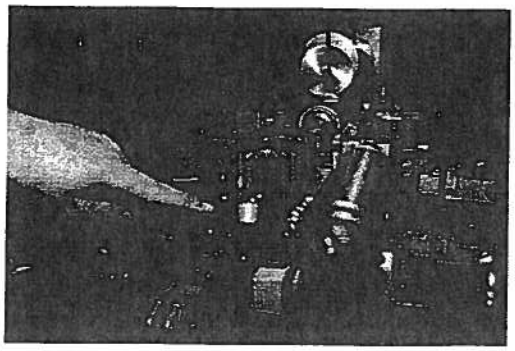

Fig. 90 - Spring Washer Tension Adjustment Nut

First remove the cotter pin from each lock nut or tension adjustment nut. Turn each tension adjustment nut a maximum of one slot movement to relieve or increase the tension in the spring washers, as necessary, making sure that both spring washer assemblies receive exactly the same adjustment. Replace each cotter pin to secure each tension adjustment nut or lock nut.

7.3.3.5 Adjustments for a square crimp

NOTE: A SQUARE CUTTING FLYING SLITTER AUTOMATICALLY ENSURES A SQUARE CRIMP.

No additional adjustments are necessary to obtain a square crimp if the flying slitter is properly setup and aligned to produce a square cut. However, if and when it is necessary to make setup adjustments for a square crimp, refer to the instructions in Section 7.2.10.3 to realign the flying slitter as necessary to obtain a square cut. A square cutting flying slitter automatically ensures a square crimp.

7.3.3.6 Flying crimper high speed start limit switch

The flying crimper high speed start limit switch (Fig. 91) is designed to prevent high speed operation of the HELIX-200 when the flying crimper is in the up-position and/or is active. No additional adjustments are necessary for the flying crimper high speed start limit switch. When required, the optional flying crimper is fully factory pre-installed and require no independent field installation. The factory pre-installation includes all necessary adjustments for the high speed start limit switch. Installation of the main machine fully installs the flying crimper, including the flying crimper high speed start limit switch.

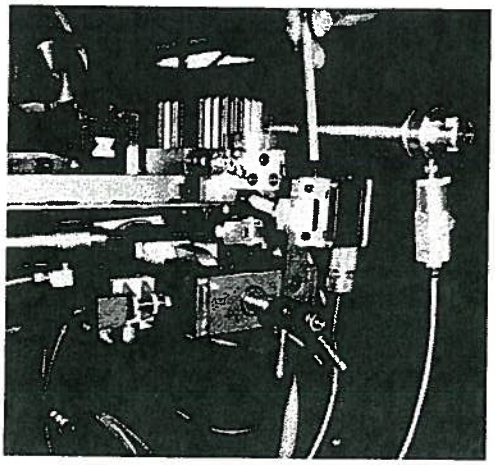

Fig. 91 - Flying Crimper High Speed Start Limit Switch

7.3.4 Saw unit

DANGER: TO AVOID BODILY INJURY TO PERSONNEL AND POTENTIAL DAMAGE TO EQUIPMENT, MAKE SURE THAT NO ONE IS IN THE CUTTER BLADE DANGER ZONE WHEN A SAW UNIT IS IN USE.

WARNING: BEWARE OF METAL PARTICLES FROM THE SAW BLADE WHEN THE SAW UNIT IS IN USE.

WARNING: KEEP UNTRAINED PERSONS AWAY FROM THE EQUIPMENT.

WARNING: TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.

CAUTION: Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.

CAUTION: Always wear protective goggles or appropriate eye protection gear; and always wear gloves when lifting or handling tubes.

NOTE: IN AN EMERGENCY, PUSH DOWN ON THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL LABELED "MAIN SWITCH". THIS WILL IMMEDIATELY STOP ALL MOTORS AND OPERATION OF THE HELIX-200.

WARNING: THE FORMED TUBE SUPPORT ROLLER ASSEMBLY PROVIDED WITH THE OPTIONAL SAW UNIT CANNOT BE USED (OR INSTALLED) WHEN AN OPTIONAL FLYING CRIMPER IS INSTALLED.

When a saw unit is required and no optional flying crimper is installed, mount and secure the formed tube support roller assembly. Select SAW at the SLITTER-SAW selector switch. If not done already, select MAN at the MAN-AUTO selector switch. Power up the HELIX-200 and run a length of formed tube. Adjust the formed tube support roller assembly so that the formed tube just touches both rollers and is evenly supported by the rollers along their full length. Make test cuts and check for a square cut. As necessary, make a saw unit square cut adjustments using the instructions in Section 6.4.4.2.

7.4 Making a Setup Run

WARNING: TO AVOID OVERHEATING AND POSSIBLE DAMAGE TO EQUIPMENT, DO NOT LEAVE THE HELIX-200 IDLING FOR MORE THAN TEN MINUTES AT ANY TIME. THAT IS, DO NOT RUN THE HELIX-200 AT ZERO SPEED FOR MORE THAN TEN MINUTES AT ANY TIME.

DANGER: *TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL, ONLY TRAINED PERSONNEL MAY OPERATE THE HELIX-200.*

DANGER: *TO AVOID BODILY INJURY TO PERSONNEL, MAKE SURE THAT NO ONE IS TOUCHING THE STRIP MATERIAL BETWEEN THE DECOILER AND THE ROLLER HOUSING WHEN STARTING THE HELIX-200.*

DANGER: *TO AVOID BODILY INJURY TO PERSONNEL AND POSSIBLE DAMAGE TO EQUIPMENT, KEEP CLEAR OF MOVING PARTS.*

DANGER: *TO AVOID BODILY INJURY TO PERSONNEL AND POTENTIAL DAMAGE TO EQUIPMENT, MAKE SURE THAT NO ONE IS IN THE CUTTER BLADE DANGER ZONE WHEN A SAW UNIT IS IN USE.*

WARNING: *BEWARE OF METAL PARTICLES FROM THE SAW BLADE WHEN THE SAW UNIT IS IN USE.*

WARNING: *KEEP UNTRAINED PERSONS AWAY FROM SWITCHES, ESPECIALLY THOSE ON THE RUN-OFF TABLE ASSEMBLY.*

WARNING: *TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.*

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

CAUTION: ***Always wear protective goggles or appropriate eye protection gear; and always wear gloves when lifting or handling tubes.***

NOTE: IN AN EMERGENCY, PUSH DOWN ON THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL LABELED "MAIN SWITCH". THIS WILL IMMEDIATELY STOP ALL MOTORS AND OPERATION OF THE HELIX-200.

7.4.1 Starting Up

If not done already, turn ON the external AC power; and pull out the RED mushroom head push button marked MAIN SWITCH, at the operator panel, to power up the machine controls. This lights up the BLUE colored POWER indicator light. At the MAN-AUTO operating mode selector switch, select MAN for manual operation. Turn ON the hydraulic pump by selecting ON at the HYDRAULIC OFF-ON selector switch; and turn ON the lubricating pump by selecting ON at the LUBRICATION OFF-ON selector switch.

NOTE: **THE FRONT GUIDE PLATES ARE HELD IN PLACE BY MEANS OF THE SUPPORT ARM, AND SHOULD NOT BE LOCKED DOWN BEFORE THE LEADING END OF THE STRIP MATERIAL ENTERS INTO THE FORMING HEAD.**

7.4.2 Setting the drive unit and feed rollers pressure

Refer to Table E for the drive unit and feed rollers pressure for the strip material and thickness in use; and set the drive unit pressure. Next, push down the GREEN colored SLOW SPEED push button; and turn the Slow Speed selector knob (potentiometer), from the zero graduation to 3, to start the drive unit and feed rollers running.

NOTE: **TABLE E PROVIDES REFERENCE VALUES FOR THE FEED ROLLERS PRESSURE. ACTUAL OPERATING VALUES MAY VARY SLIGHTLY.**

WARNING: ***IN ALL CASES AVOID USING HIGHER PRESSURE THAN IS NECESSARY.***

CAUTION: ***Insufficient pressure will cause the upper drive roller to spin without feeding the strip material forward.***

7.4.3 Setting the clinching roller pressure

NOTE: **THE CLINCHING ROLLER MUST NOT TOUCH THE SIDES OF THE OPENING IN THE BASE OF THE FORMING HEAD, AND MUST BE CAPABLE OF BEING MOVED FREELY UP AND DOWN HYDRAULICALLY.**

CAUTION: ***The clinching roller pressure setting must always be lower than the drive unit and feed rollers pressure setting, and must not exceed 90% of the drive unit and feed rollers pressure setting.***

TABLE E - DRIVE UNIT AND FEED ROLLERS
REFERENCE PRESSURE SETTING AND STRIP MATERIAL USAGE

	STRIP MATERIAL THICKNESS (Includes Maximum Tolerances)		USED ON HELIX-200 MODEL	HYDRAULIC PRESSURE, (BAR)		
	(Inches)	(Millimeters)		GALVANIZED STEEL	STAINLESS STEEL	NON-FERROUS METALS (ALUMINUM)
	0.0150 - 0.0169	0.380 - 0.430	200L; 200H	15 - 20	20 - 25	10 - 15
26ga.	0.0170 - 0.0197	0.431 - 0.500	200L; 200H	15 - 25	20 - 30	10 - 20
	0.0198 - 0.0236	0.501 - 0.600	200L; 200H	20 - 30	20 - 30	10 - 20
24ga.	0.0237 - 0.0276	0.601 - 0.700	200L; 200H	25 - 35	25 - 35	15 - 25
22ga.	0.0277 - 0.0315	0.701 - 0.800	200L; 200H	25 - 35	25 - 40	15 - 25
	0.0316 - 0.0354	0.801 - 0.900	200L; 200H	30 - 40	30 - 45	20 - 30
20ga.	0.0355 - 0.0394	0.901 - 1.000	200L; 200H	35 - 45	35 - 50	25 - 35
	0.0395 - 0.0433	1.001 - 1.100	200L; 200H	40 - 50	40 - 55	30 - 40
18ga.	0.0434 - 0.0492	1.101 - 1.250	200L; 200H	40 - 55	45 - 60	30 - 45
16ga.	0.0493 - 0.0650	1.251 - 1.650	200L; 200H	55 - 65	50 - 70	45 - 55
	0.0651 - 0.0728	1.651 - 1.850	200H	60 - 75		

NOTE: **TABLE F PROVIDES REFERENCE VALUES FOR THE CLINCHING ROLLER PRESSURE. ACTUAL OPERATING VALUES MAY VARY SLIGHTLY.**

WARNING: ***IN ALL CASES AVOID USING HIGHER PRESSURE THAN IS NECESSARY.***

Refer to Table F for the clinching roller pressure for the strip material and thickness in use; and set the clinching roller pressure. At the CLINCHING ROLLER DOWN-UP selector switch, select UP.

TABLE F - CLINCHING ROLLER REFERENCE PRESSURE SETTING AND STRIP MATERIAL USAGE

STRIP MATERIAL THICKNESS (Includes Maximum Tolerances)		USED ON HELIX-200 MODEL	HYDRAULIC PRESSURE, (BAR)		
(Inches)	(Millimeters)		GALVANIZED STEEL	STAINLESS STEEL	NON-FERROUS METALS (ALUMINUM)
0.0150 - 0.0169	0.380 - 0.430	200L; 200H	15 - 20	20 - 25	10 - 15
0.0170 - 0.0197	0.431 - 0.500	200L; 200H	15 - 25	20 - 30	10 - 20
0.0198 - 0.0236	0.501 - 0.600	200L; 200H	15 - 25	20 - 30	10 - 20
0.0237 - 0.0276	0.601 - 0.700	200L; 200H	20 - 30	25 - 35	15 - 25
0.0277 - 0.0315	0.701 - 0.800	200L; 200H	25 - 30	25 - 35	15 - 25
0.0316 - 0.0354	0.801 - 0.900	200L; 200H	30 - 40	30 - 40	20 - 30
0.0355 - 0.0394	0.901 - 1.000	200L; 200H	30 - 40	35 - 45	20 - 35
0.0395 - 0.0433	1.001 - 1.100	200L; 200H	35 - 45	40 - 50	25 - 40
0.0434 - 0.0492	1.101 - 1.250	200L; 200H	35 - 50	45 - 60	25 - 45
0.0493 - 0.0650	1.251 - 1.650	200L; 200H	50 - 60	50 - 70	30 - 55
0.0651 - 0.0728	1.651 - 1.850	200H	60 - 70		

7.4.4 Lock-down checks

Push down the RED colored STOP push button, located between the GREEN colored SLOW SPEED and HIGH SPEED push buttons, to temporarily stop the machine. If not done already, lock the upper front guide plate in place using the support arm to secure the support roller. If not done already, lock down the rear guide plates. Push down the GREEN colored SLOW SPEED push button to restart the drive unit running.

7.4.5 Fine tuning for a good lockseam

NOTE: AFTER THE LEADING END OF THE STRIP MATERIAL HAS GONE AROUND ONCE IN THE FORMING HEAD, WATCH THE FOLLOWING CAREFULLY AND MAKE FINE TUNING

ADJUSTMENTS AS NECESSARY TO ENSURE THAT THE FLANGE ENGAGES EASILY INTO THE CHANNEL.

7.4.5.1 Flange to channel engagement when a folding finger is used

Check the folding finger position and adjust the distance between the finger and the channel if necessary to get the proper angle for the flange.

7.4.5.2 When the flange tends to "climb" out

If the flange of the strip material has a tendency to climb up the channel on the channel's left side (Fig. 92), move the roller housing in the direction of a smaller tube size selection on the calibrated tube size selector scale using the manual crank arm provided for the purpose.

7.4.5.3 When the flange tends to "jump out"

If the flange of the strip jumps out of the channel on the channel's right side (Fig. 93), move the roller housing in the direction of a larger tube size selection on the calibrated tube size selector scale using the manual crank arm provided for the purpose.

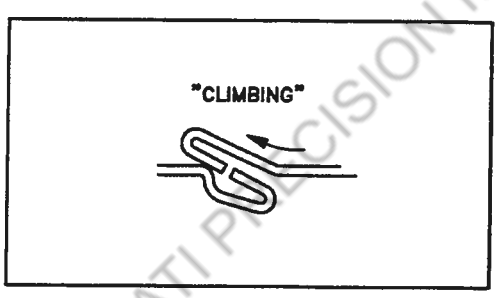

Fig. 92 - "Climbing" Flange

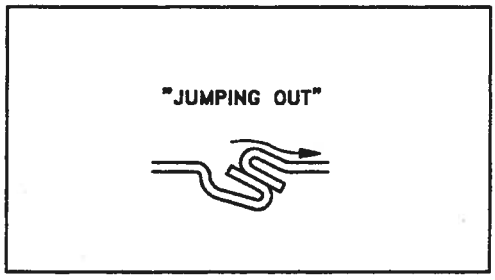

Fig. 93 - "Jumping Out" Flange

7.4.5.4 Flange height and the lockseam

As necessary, make fine tuning adjustments at the guide rollers of the form roll unit to obtain the correct flange height and a good lockseam. When the flange is the correct height and the folding finger is adjusted properly, a good lockseam is formed as shown in Fig. 94. Refer to Table B in Section 7.2.2.1 for the correct flange height for a good lockseam.

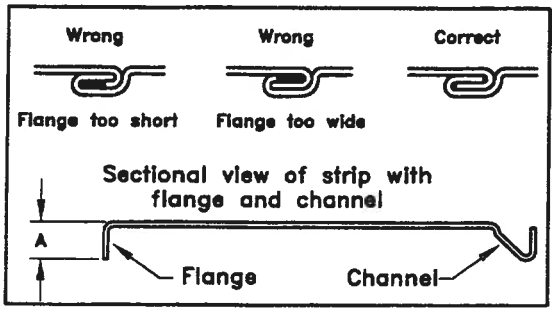

Fig. 94 - Preformed Strip Material Profile for a Good Lockseam

7.4.5.5 Clinching roller pressure and support roller pressure

NOTE: **THE CORRECT CLINCHING ROLLER PRESSURE AND SUPPORT ROLLER PRESSURE ARE BOTH CRITICAL FOR A GOOD LOCKSEAM.**

Either too much support roller pressure - that is, too much inside pressure, or too much clinching roller pressure - that is, too much outside pressure on the lockseam results in a poor lockseam (Fig. 95). As necessary, adjust the clinching roller pressure up or down to just match the support roller pressure.

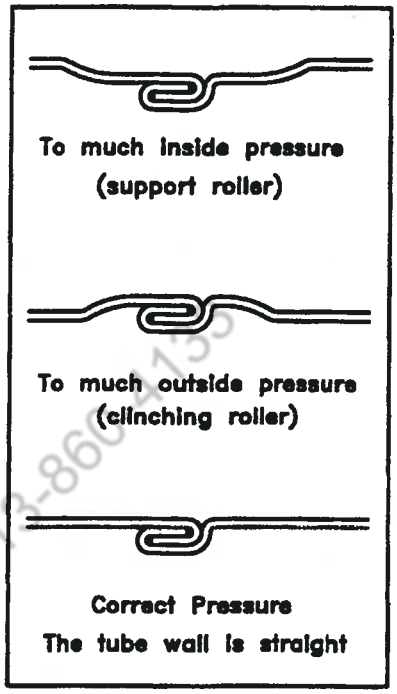

Fig. 95 - Clinching Roller Pressure and Support Roller Pressure for a Good Lockseam

CAUTION: ***The clinching roller pressure must always be less than the drive unit and feed rollers pressure for proper operation. The clinching roller pressure setting must not exceed 90% of the drive unit and feed rollers pressure setting.***

7.4.6 Fine tuning for a square cut

As necessary, realign the flying slitter carriage per the instructions in Section 7.2.10.3 to obtain a square cut.

7.5 Making a Production Run

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL, ONLY TRAINED PERSONNEL MAY OPERATE THE HELIX-200.***

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL, MAKE SURE THAT NO ONE IS TOUCHING THE STRIP MATERIAL BETWEEN THE DECOILER AND THE ROLLER HOUSING WHEN STARTING THE HELIX-200.***

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL AND POSSIBLE DAMAGE TO EQUIPMENT, KEEP CLEAR OF MOVING PARTS.***

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL AND POTENTIAL DAMAGE TO EQUIPMENT, MAKE SURE THAT NO ONE IS IN THE CUTTER BLADE DANGER ZONE WHEN A SAW UNIT IS IN USE.***

WARNING: ***BEWARE OF METAL PARTICLES FROM THE SAW BLADE WHEN THE SAW UNIT IS IN USE.***

WARNING: ***KEEP UNTRAINED PERSONS AWAY FROM THE EQUIPMENT.***

WARNING: ***KEEP UNTRAINED PERSONS AWAY FROM SWITCHES, ESPECIALLY THOSE ON THE RUN-OFF TABLE ASSEMBLY.***

WARNING: ***TO AVOID OVERHEATING AND POSSIBLE DAMAGE TO EQUIPMENT, DO NOT LEAVE THE HELIX-200 IDLING FOR MORE THAN TEN MINUTES AT ANY TIME. THAT IS, DO NOT RUN THE HELIX-200 AT ZERO SPEED FOR MORE THAN TEN MINUTES AT ANY TIME.***

WARNING: ***TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.***

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

CAUTION: ***Always wear protective goggles or appropriate eye protection gear; and always wear gloves when lifting or handling tubes.***

NOTE: **IN AN EMERGENCY, PUSH DOWN ON THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL LABELED "MAIN SWITCH". THIS WILL IMMEDIATELY STOP ALL MOTORS AND OPERATION OF THE HELIX-200. IN THE ALTERNATIVE, PUSH DOWN ON THE RED MUSHROOM HEAD EMERGENCY SWITCH.**

7.5.1 The hydraulic medium

NOTE: **CHECK THE HYDRAULIC TANK AND MAKE SURE THAT**

THE TANK IS FILLED TO, AT LEAST, THE TOP OF THE SIGHT GLASS BEFORE MAKING A PRODUCTION RUN.

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT, ESPECIALLY THE HYDRAULIC PUMPS, MAKE SURE THAT THE HYDRAULIC MEDIUM IS CLEAN, AND MEETS THE TEMPERATURE REQUIREMENTS OF THE OPERATING ENVIRONMENT.***

A clean, good quality hydraulic medium is critical for optimum performance of the HELIX-200. For best performance, check the hydraulic tank and make sure that the tank is filled, at least, to the top of the sight glass. Any good quality hydraulic oil may be used, but must be capable of cold weather starts to, at least, 32 degrees F (0 degrees C) and a maximum operating temperature no less than 160 degrees F (71 degrees C).

7.5.2 Lubricants

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT - ESPECIALLY THE DRIVE UNIT GEARING AND FEED ROLLERS, FORM ROLL UNIT ROLLERS, ALL BEARINGS, THE GUIDE PLATES, AND THE FORMING HEAD - MAKE SURE THAT THESE COMPONENTS, ASSEMBLIES AND SUBASSEMBLIES ARE PROPERLY GREASED AT ALL TIMES, AND THAT THE STRIP MATERIAL IS PROPERLY LUBRICATED DURING THE PRODUCTION RUN.***

NOTE: **PROPER LUBRICATION OF THE STRIP MATERIAL IS CRITICAL TO THE OPTIMUM PERFORMANCE OF THE HELIX-200. CHECK THE LUBRICANT TANK AND MAKE SURE THAT THE TANK IS FILLED TO, AT LEAST, THE TOP SIGHT GLASS BEFORE MAKING A PRODUCTION RUN.**

CAUTION: ***Make sure that all lubricants are clean when used.***

7.5.2.1 Drive unit gearing

NOTE: **CHECK THE DRIVE UNIT GEAR COMPARTMENT THROUGH THE SIGHT GLASS AND MAKE SURE THAT THE GEAR OIL LEVELS IN THE COMPARTMENT ARE ADEQUATE FOR PROPER LUBRICATION, AND THAT THE OIL IS CLEAN.**

Refer to Table G for a recommended listing of gear oils. Top off the gear oil as necessary, or drain and refill the gear compartment if the gear oil is dirty. Any gear oil that is equivalent to the recommended gear oil product listing may be used.

7.5.2.2 Bearing greases

NOTE: ALL BEARINGS MUST BE ADEQUATELY GREASED TO ENSURE OPTIMUM HELIX-200 PERFORMANCE.

Refer to Table G for the recommended listing of lubricating grease products for bearings. Any lubricating grease that is equivalent to the recommended grease for bearings product listing may be used.

7.5.2.3 When galvanized steel strip material is used

NOTE: THE RECOMMENDED WATER SOLUBLE STRIP MATERIAL LUBRICANT IS SPIRALUBE FROM SPIRAL-HELIX, INC.

Water soluble lubricating oil may be used as the strip material lubricant when the strip material is galvanized steel. The recommended water to oil ratio is a low concentration of 8 to 1 - when prime, lockseam-quality thin stock is in use, down to a richer concentration of 6 to 1 or less - when heavier and/or secondary lockseam-quality stock is in used. Refer to Table G for a listing of additional recommended water soluble lubricating oils for strip materials.

7.5.2.4 When stainless steel, aluminum, plastic coated, paint grip and aluminized strip material is used

CAUTION: Use of secondary lockseam-quality strip material stock is NOT recommended.

When the strip material is stainless steel, or aluminum, or plastic coated, and/or paint grip and aluminized steel, water soluble lubricating oil may be used only in very concentrated form with a recommended water to oil ratio of a minimum concentration of 3 to 1, and a ratio of 2 to 1 preferred. When the preferred concentration of 2 to 1 is inadequate for the strip material type and the operating conditions, consider increasing the richness of the water soluble lubricating mixture to a 1 to 1 ratio or better. If strip material lubrication problems persist with the richest possible concentration of the water soluble lubricant, then hydraulic oil may be used as the strip material lubricant. The greater the deviation from prime lockseam-quality strip material stock, the richer the concentration when water soluble lubricating oil is used, and the heavier the viscosity when hydraulic oil is used as the strip material lubricant.

NOTE: WHEN HYDRAULIC OIL IS USED AS THE STRIP MATERIAL LUBRICANT, THE LUBRICANT TANK AND THE STRIP MATERIAL LUBRICATING SYSTEM MUST BE DRAINED OF ANY WATER SOLUBLE LUBRICANT PRIOR TO FILLING THE TANK WITH HYDRAULIC OIL.

CAUTION: ***Do not add any water when hydraulic oil is used as the strip material lubricant.***

7.5.2.5 When a saw unit is required

CAUTION: ***When running aluminum and other non-ferrous strip materials, keep the saw blade lubricated with motor oil to prevent material build-up on the saw blade.***

7.5.2.6 Refer to Table G for a recommended listing of gear oils. Top off the gear oil as necessary, or drain and refill the gear box if the gear oil is dirty. Any gear oil that is equivalent to the recommended gear oil product listing may be used.

TABLE G - A REFERENCE LISTING OF LUBRICANTS

BRAND	GEAR OIL FOR SPUR GEARS	GREASE FOR BEARINGS	WATER SOLUBLE LUBRICATING OILS FOR FORMING HEADS
SPIRAL-HELIX			*SPIRALUBE*
MOBIL	Mobilgear 630	Mobilux Grease EP2	Mobilmet 170
TEXACO		Multifak EP2	Soluble Oil D
SHELL	Gearlube Spirex HD 80W90	Alvania EP2	Dromus Oil B (Not Available in U.S.A.)

7.5.3 Recommended operating speeds

NOTE: **THE TABULATED REFERENCE MAXIMUM ALLOWABLE SPEED ASSUMES IDEAL CONDITIONS WHERE THE LUBRICANT IS OF THE IDEAL CONCENTRATION OR VISCOSITY, THE STRIP MATERIAL STOCK IS CLEAN, AND THE VARIATION IN STRIP MATERIAL THICKNESS IS MINIMAL.**

CAUTION: ***For optimum performance, do not exceed the recommended maximum operating speed.***

Refer to Table H for the recommended maximum operating speeds.

TABLE H - RECOMMENDED MAXIMUM OPERATING SPEED VERSUS STRIP MATERIAL TYPE

STRIP MATERIAL TYPE	RECOMMENDED MAXIMUM OPERATING SPEED FOR							
	* PRIME STOCK				** SECONDARY STOCK			
	HELIX-200L		HELIX-200H		HELIX-200L		HELIX-200H	
	ft/min	m/min	ft/min	m/min	ft/min	m/min	ft/min	m/min
Galvanized Steel	175	53.3	240	73.2	140	42.7	200	61.0
Aluminum	120	36.6	160	48.8	100	30.5	130	39.6
Other Non-ferrous Metals	120	36.6	160	48.8	100	30.5	130	39.6
Plastic Coated, Paint Grip and Aluminized Steel	120	36.6	160	48.8	100	30.5	130	39.6
Stainless Steel	60	18.3	80	24.4	50	15.2	65	19.8

NOTES:

*** PRIME STOCK is defined as a coil of lockseam quality strip material that is free of rust and corrosion. Use of prime stock is preferred.**

**** SECONDARY STOCK is defined as a coil of lockseam quality strip material that is not free of rust and corrosion. Use of secondary stock is generally not recommended.**

LOCKSEAM QUALITY stock is defined as a coil of strip material that has uniform hardness and uniform thickness throughout, is free of dirt and debris, and meets the requirements of the relevant ANSI Specifications, and ASTM and ISO Specifications for Lock Forming and Drawing Qualities.

7.5.4 Pre-production check list for a good lockseam

The following is provided as a guide to obtaining a good lockseam:

1. Make sure that the correct forming head is installed for the tube size selection;

2. Make sure that the roller housing is positioned correctly on the tube size selector scale to correspond approximately to the tube size selection;

3. Make sure that the clinching roller is properly aligned;

4. Make sure that the support roller is properly aligned;

5. Make sure that the run-off table assembly is properly aligned;

6. When required, make sure that a folding finger assembly is installed and is adjusted to obtain the correct strip material profile;

7. When required, make sure that the correct flange roller assembly is installed, and is engaged during the production run;

8. Make sure that the drive unit and feed rollers pressure setting is within the recommended range, and be prepared to use the minimum pressure necessary to drive and feed the strip material;

9. Make sure that the clinching roller pressure setting is within the recommended range, and be prepared to use the minimum pressure necessary to effect a good lockseam; and

10. Make sure that the support arm pressure is the minimum sufficient to support and counter balance the clinching pressure during lockseaming.

7.5.5 The production run

NOTE: **FOR EACH PRODUCTION RUN USE A WIRE BRUSH, AS NECESSARY, TO KEEP THE DRIVE UNIT AND FEED ROLLERS FREE FROM STRIP MATERIAL RESIDUE BUILD UP.**

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

CAUTION: ***Always wear protective goggles or appropriate eye protection gear; and always wear gloves when lifting or handling tubes.***

NOTE: **IN AN EMERGENCY, PUSH DOWN ON THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL LABELED "MAIN SWITCH". THIS WILL IMMEDIATELY STOP ALL MOTORS AND OPERATION OF THE HELIX-200. IN THE ALTERNATIVE, PUSH DOWN ON THE RED MUSHROOM HEAD EMERGENCY SWITCH.**

7.5.5.1 If not done already, setup the HELIX-200 and any optional equipment per the instructions in Sections 7.2 and 7.3 and their respective subsections; and make the qualifying setup run per the instructions in Section 7.4 and its subsections.

CAUTION: ***Make sure that the control knobs (potentiometers) for both SLOW and HIGH SPEED control are set to their respective zero graduations before proceeding to Section 7.5.5.2***

7.5.5.2 If not done already, select AUTO at the MAN-AUTO selector switch for automatic operation. If not done already, select ON at the HYDRAULIC OFF-ON selector switch; and select ON at the LUBRICATION OFF-ON selector switch. If not done already, select UP at the CLINCHING ROLLER DOWN-UP selector switch. Make sure that the flange roller is engaged when a flange roller is required. If not done already, select ON at the COUNTER OFF-ON selector switch.

7.5.5.3 When optional equipment are installed

When a digital tube length control is installed and is required for the particular production run, if not done already, select ON at the POWER ON-OFF selector switch. When a flying crimper is installed and is required for the particular production run, if not done already, select ON at the CRIMPER OFF-ON selector switch. When a saw unit is installed and is required for the particular production run, select SAW at the SLITTER-SAW selector switch.

7.5.5.4 Power up the HELIX-200. Push down the GREEN colored SLOW SPEED button, and gradually turn the SLOW SPEED control knob (potentiometer) to increase the operating speed.

NOTE: **MAKE SURE THAT TUBE FORMING PROCEEDS WITH GOOD LOCKSEAMS BEFORE PROCEEDING.**

7.5.5.5 Bring the HELIX-200 up to full speed at the recommended operating speed level.

CAUTION: ***Make sure not to exceed the recommended operating speed level when a maximum operating speed recommendation is made.***

7.5.5.6 Upon successful completion of a production run

NOTE: **IN THE AUTOMATIC OPERATING MODE, THE HELIX-200 IS SELF CONTROLLING AND STOPS OPERATIONS AT THE END OF THE PRODUCTION RUN.**

Upon the completion of any production run, power down the HELIX-200 as follows: First turn the speed control knob (potentiometer) down to the zero graduation; and select MAN at the MAN-AUTO selector switch. Select DOWN at the CLINCHING ROLLER DOWN-UP selector switch, OFF at the HYDRAULIC OFF-ON selector switch, OFF at the LUBRICANT OFF-ON selector switch; and select OFF at the COUNTER OFF-ON selector switch. When a flange roller is used, disengage the flange roller. When optional equipment are used: select OFF at the POWER ON-OFF selector switch, if a digital tube length control was used; select OFF at the CRIMPER OFF-ON selector switch, if a flying crimper was used; and select SLITTER at the SLITTER-SAW selector switch, if a saw unit was used. As necessary, power down the HELIX-200.

WARNING: ***UNLOAD THE RECEIVING RAMP AND THE RUN-OFF TABLE ASSEMBLY AFTER EACH PRODUCTION RUN.***

8. TROUBLE SHOOTING

DANGER: ***AN ELECTRICAL SHOCK HAZARD EXISTS WHEN WORKING WITH EITHER AC OR DC POWER. TO AVOID THE RISK OF INJURY TO PERSONNEL OR EQUIPMENT DAMAGE, ALL LOCAL SAFETY PRACTICES MUST BE FOLLOWED AND APPROVED SAFETY GEAR MUST BE WORN WHEN ANY WORK IS TO BE DONE INSIDE THE ELECTRICAL SYSTEM COMPARTMENT. POWER DOWN THE HELIX-200 AND DISCONNECT THE EXTERNAL AC POWER SOURCE BEFORE DOING ANY WORK WITHIN THE ELECTRICAL SYSTEM COMPARTMENT.***

CAUTION: ***Power down the HELIX-200 before initiating any trouble shooting adjustments involving moving assemblies, subassemblies and/or components.***

8.1 What To Do

The HELIX-200 is designed for trouble free operation and minimal maintenance. However, from time to time, problems may arise when operating the HELIX-200. In such cases, first document the problem and refer to the appropriate sections and subsections of this manual for a solution. In the event the problem encountered is not covered in this manual, call SPIRAL-HELIX, INC for a solution; and be prepared to describe your problem in full.

8.2 When the Main Electrical Motor Will Not Start

8.2.1 There are two possibilities when the main electrical motor will not start, namely: the main electric motor overload sensor has been tripped and requires resetting; or the 110 VAC control voltage is not available; or both. In either or both cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.2.2 and/or Section 8.2.3.

8.2.2 When the main electric motor overload sensor has been tripped

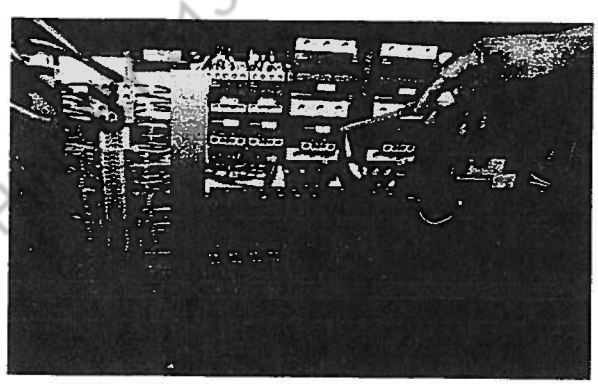

Fig. 96 - Main Electric Motor Overload Sensor

If not done already, check and make sure that the external AC power source is engaged, and that the HELIX-200 powers up (that is, the BLUE colored power ON light indicator comes on when the RED mushroom head MAIN SWITCH is pulled). Power down the external AC power source following approved local safety practices; and push down the RED mushroom head MAIN SWITCH button. Being careful to observe all safety practices, access the electrical system compartment; and check the main electric motor overload sensor (Fig. 96). Push first the RED reset button, and then push the BLUE reset button to reset the overload sensor. If all maintenance procedures inside the electrical system compartment are completed, lock and secure the electrical system compartment. Re-engage the external AC power source per approved local safety practices; and power up the HELIX-200. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.2.3 When the 110 VAC control voltage is not available

DANGER: ***AN ELECTRICAL SHOCK HAZARD EXISTS WHEN WORKING WITH EITHER AC OR DC POWER. TO AVOID THE RISK OF INJURY TO PERSONNEL OR EQUIPMENT DAMAGE, ALL LOCAL SAFETY PRACTICES MUST BE FOLLOWED AND APPROVED SAFETY GEAR MUST BE WORN WHEN ANY WORK IS TO BE DONE INSIDE THE ELECTRICAL SYSTEM COMPARTMENT. POWER DOWN THE HELIX-200 AND DISCONNECT THE EXTERNAL AC POWER SOURCE BEFORE DOING ANY WORK WITHIN THE ELECTRICAL SYSTEM COMPARTMENT.***

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL, ONLY TRAINED PERSONNEL MAY OPERATE THE HELIX-200.***

WARNING: ***TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.***

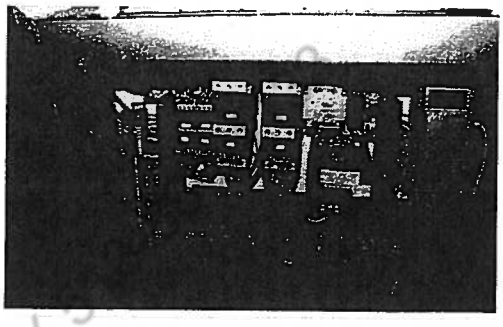

Fig. 97 - 6.3 Amp Transformer Protection Fuses

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

If not done already, check and make sure that the external AC power source is available. Disengage the external AC power source per approved local safety practices. At the terminal blocks inside the electrical system compartment, check the two 6.3 Amp transformer protection fuses (Fig. 97) and the 6.25 Amp control voltage fuse (Fig. 98). Replace any of the fuses as necessary. If all maintenance procedures inside the electrical system compartment are completed, lock and secure the electrical system compartment. Re-engage the external AC power source per approved local safety practices; and power up the HELIX-200. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

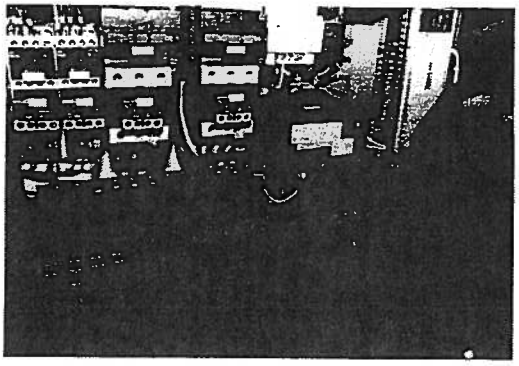

Fig. 98 - 6.25 Amp Control Voltage Protection Fuse

8.3 When the Main Hydraulic Pump Motor Will Not Run

CAUTION: ***Make sure that both the SLOW SPEED and the HIGH SPEED knobs (potentiometers) are dialed down to near zero speed when trouble shooting the hydraulic motor.***

8.3.1 There are four possibilities when the main hydraulic pump motor will not run, namely: the RED mushroom head remote emergency stop switch is engaged; or the hydraulic motor overload sensor has been tripped; or the flying slitter over travel limit switch is tripped; or the decoiler safety sensor is tripped; or any combination of the four. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.3.2, Section 8.3.3, Section 8.3.4 and/or Section 8.3.5.

8.3.2 When the remote emergency stop switch is engaged

If not done already, check and make sure that external AC power source is engaged, and that the HELIX-200 is powered up (that is, the BLUE colored power ON light indicator is lit). If not done already, select ON at the HYDRAULIC OFF-ON selector switch. If the hydraulic pump motor does not run, check the RED mushroom head remote emergency stop switch (Fig. 99) and pull out the RED mushroom head button, as necessary, to disengage the remote stop switch. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

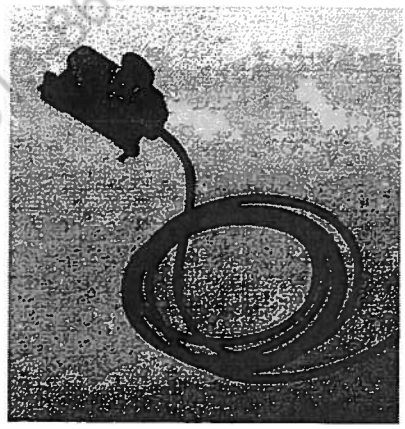

Fig. 99 - RED Mushroom Head Remote Emergency Stop Switch

8.3.3 When the hydraulic pump motor overload sensor has been tripped

If not done already, check and make sure that the external AC power source is engaged, and that the HELIX-200 powers up (that is, the BLUE colored power ON light indicator comes on when the RED mushroom head MAIN SWITCH is pulled). Power down the external AC power source following approved local safety practices; and push down the RED mushroom head MAIN SWITCH button. If not done already, select OFF at the HYDRAULIC OFF-ON selector switch; and dial down both the SLOW SPEED and the HIGH SPEED control knobs (potentiometers). Being careful to observe all safety practices, access the electrical system compartment; and check the hydraulic pump motor overload sensor (Fig. 100). Push first the RED reset button, and then push the BLUE reset button to reset the overload sensor. If all maintenance procedures inside the electrical system

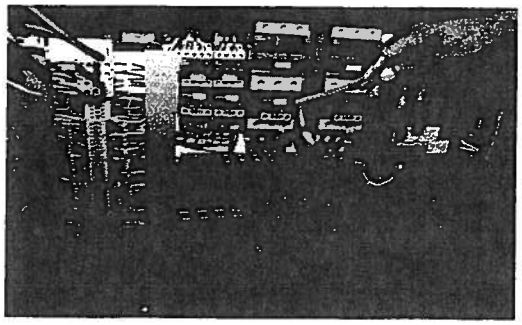

Fig. 100 - Main Hydraulic Pump Motor Overload Sensor

compartment are completed, lock and secure the electrical system compartment. Re-engage the external AC power source per approved local safety practices; and power up the HELIX-200. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.3.4 When the flying slitter over travel limit switch is tripped

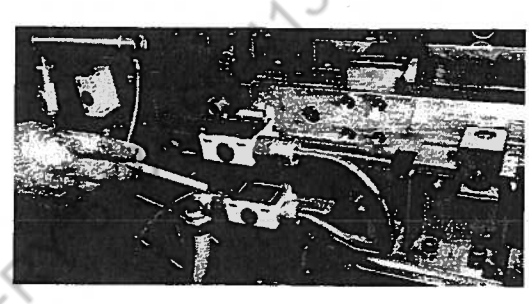

Fig. 101 - Flying Slitter Over Travel Limit Switch

If not done already, power down the HELIX-200 and select MANual at the MAN-AUTO selector switch. Check the RED mushroom head remote emergency stop switch and disengage the switch, as necessary. Check the flying slitter over travel limit switch (Fig. 101), and move the slitter off the limit switch. At the speed control knobs (potentiometers), dial down the speed of the strip material by at least one graduation. Resume tubeforming operations and check the flying slitter travel. If the slitter over travel persists when the strip material speed is well within the recommended operating speeds, reposition the over travel limit switch. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.3.5 When the decoiler safety sensor is tripped

NOTE: **THE DECOILER SAFETY SENSOR IS A GAP SENSOR, AND IS MOST LIKELY TO BE TRIPPED ONLY WHEN THE OPERATING SPEED IS TOO HIGH FOR THE STARTUP OF A PARTICULAR SETUP AND/OR PRODUCTION RUN AND CONDITIONS. CHECK SECTION 7.5.3 TABLE H FOR THE RECOMMENDED OPERATING SPEED, AND DIAL DOWN THE OPERATING SPEED AT STARTUP AS NECESSARY.**

DANGER: ***TO AVOID DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO PERSONNEL, ONLY TRAINED PERSONNEL MAY OPERATE THE HELIX-200.***

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL, MAKE SURE THAT NO ONE IS TOUCHING THE STRIP MATERIAL BETWEEN THE DECOILER AND THE ROLLER HOUSING WHEN STARTING THE HELIX-200.***

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL AND POSSIBLE DAMAGE TO EQUIPMENT, KEEP CLEAR OF MOVING PARTS.***

WARNING: ***IN THE EVENT OF A DECOILER SAFETY SENSOR BEING TRIPPED, DO NOT RESTART THE HELIX-200 UNTIL THE OPERATING SPEED SETTING HAS BEEN DIALED DOWN TO A VALUE IN KEEPING WITH THE RECOMMENDED VALUE.***

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

If not done already, check the RED mushroom head remote emergency stop switch and disengage the switch, as necessary. If not done already, select OFF at the HYDRAULIC OFF-ON selector switch; and dial down both the SLOW SPEED and the HIGH SPEED control knobs (potentiometers). If not done already, access the electrical system compartment and reset the hydraulic motor overload sensor per the instructions in Section 8.3.3. If not done already, check the flying slitter over travel limit switch; and make any necessary adjustments per the instructions in Section 8.3.4. Check the decoiler and make sure that it is on track and level, with neither a forward lean nor a backward lean. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

CAUTION: ***The operating speed setting must not exceed the recommended values at any time or for any reason. To avoid the risk of damage to equipment or the potential for injury to personnel, operating speeds below the recommended values are always preferred.***

8.4 When Flying Slitter Does Not Start or When the Flying Slitter Does Not Complete a Cutting Sequence

8.4.1 There are three possibilities when the flying slitter does not start or when the flying slitter does not complete a cutting sequence, namely: the air pressure is turned off; or the production counter has counted out - that is, the actual production count is equal to the preset production count; or the flying slitter runs into the slitter over travel limit switch; or any combination of the three. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.4.2, Section 8.4.3 and/or Section 8.4.4.

8.4.2 When the air pressure is turned off

If not done already, power down the HELIX-200, and select MANual at the MAN-AUTO selector switch. Check the factory air supply source, and the pneumatic piping and connections; and make sure that the air supply is ON, and that all pneumatic piping

and connections to the HELIX-200 are secure. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.4.3 When the production counter has counted out

CAUTION: ***Make sure that the HELIX-200 is in the manual operating mode by selecting MANual at the MAN-AUTO selector switch before any work to reprogram the production counter is initiated.***

If not done already, power down the HELIX-200; select OFF at the HYDRAULIC OFF-ON selector switch; and select MANual at the MAN-AUTO selector switch. If not done already, select ON at the COUNTER OFF-ON selector switch (Fig. 102), and record the number displayed when the production counter display is activated. This is the actual production count from the production run just completed. Press the **P1** button once only, and record the number displayed. This is the production preset count programmed for the production run. Compare the actual production count to the preset production count. If the actual and the preset counts are equal, press the **R** button to zero out the actual production count register or memory. If necessary, reprogram the production preset count per the instructions in Section 7.2.9. If all trouble shooting procedures are completed and successful, select ON at the HYDRAULIC OFF-ON selector switch to restart the hydraulic motor; and resume production tubeforming operations.

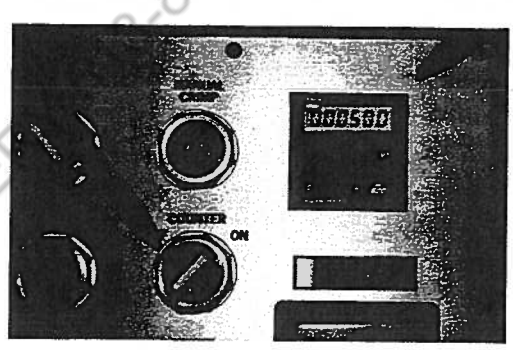

Fig. 102 - Production Counter Controls at Operator Panel

8.4.4 When the flying slitter runs into the slitter over travel limit

NOTE: **THE PROBLEM OF THE FLYING SLITTER RUNNING INTO THE SLITTER OVER TRAVEL LIMIT SWITCH AND CAUSING THE FLYING SLITTER NOT TO START, OR CAUSING THE FLYING SLITTER NOT TO COMPLETE A CUTTING SEQUENCE, IS MOST LIKELY TO OCCUR WHEN RUNNING SMALL DIAMETER FORMED TUBES, AND LEAST LIKELY TO OCCUR WHEN RUNNING LARGE DIAMETER FORMED TUBES.**

CAUTION: ***Make sure that the HELIX-200 is in the manual operating mode by selecting MANual at the MAN-AUTO selector switch before any work to reprogram the production counter and/or any work on the flying slitter is initiated.***

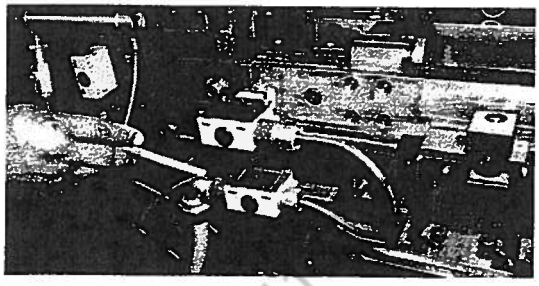

Fig. 103 - Flying Slitter Over Travel Limit Switch

The primary source for the flying slitter over travel is setting the strip material and tubeforming speed above the recommended operating speed levels; and may be remedied by dialing down the operating speed setting. If not done already, power down the HELIX-200; select OFF at the HYDRAULIC OFF-ON selector switch; and select MANual at the MAN-AUTO selector switch. If not done already, check the actual production count for the production run against the preset production count, and reset the actual production count register, as necessary, per the instructions in Section 8.4.3. If not done already, check the RED mushroom head remote emergency stop switch and disengage the switch, as necessary. Check the operating speed setting against the recommended operating speeds in Section 7.5.3 Table H, and reset the operating speed, as necessary; and then dial down the speed of the strip material by at least one graduation. Check the flying slitter over travel limit switch (Fig. 103), and move the slitter off the limit switch. Resume tubeforming operations and check the flying slitter travel. If the slitter over travel persists when the strip material speed is well within the recommended operating speeds, reposition the over travel limit switch. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.5 When the Lockseam is Not Tight

8.5.1 There are three possibilities when the lockseam is not tight, namely: the clinching roller and the support roller are not in the center of the forming head; or the roller housing is not positioned for the correct tube size selection; or the preformed strip material profile is incorrect; or any combination of the three. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.5.2, Section 8.5.3 and/or Section 8.5.4.

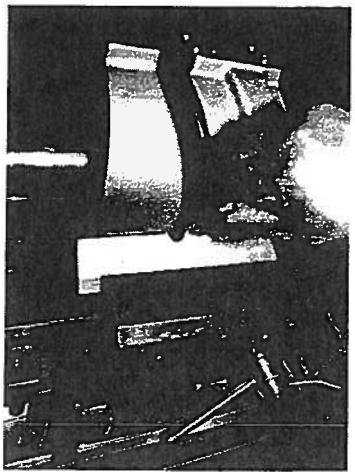

Fig. 104 - Typical Center Opening in a Forming Head

8.5.2 When the clinching roller and the support roller are not in the center of the forming head

If not done already, power down the HELIX-200. Check the position of the forming head relative to the clinching roller by measuring the distance of each face of the clinching roller from the corresponding edge of the center opening in the forming head (Fig. 104). As necessary,

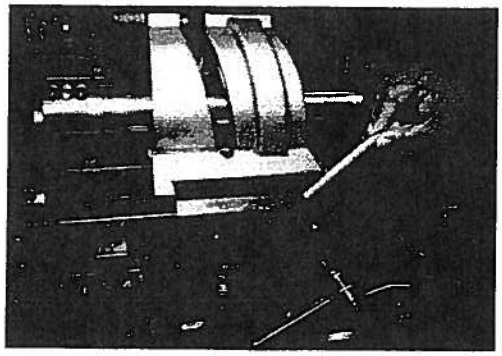

Fig. 105 - Forming Head Front Lockpiece and Mounting Screws

Fig. 106 - Roller Housing and the Tube Size Selector Scale

loosen the mounting screws securing the forming head front lockpiece (Fig. 105), and re-center the forming head **approximately** on the clinching roller. Refasten the mounting screws to secure the forming head and the front lockpiece. Power up the HELIX-200, and make a test tubeforming run to ensure a tight lockseam. If all trouble shooting is completed and successful, resume production tubeforming operations.

8.5.3 When the roller housing is not positioned for the correct tube size selection

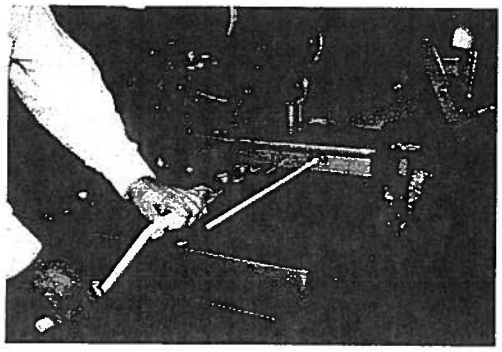

Fig. 107 - Manual Crank Arm to Reposition Roller Housing

If not done already, check the position of the forming head relative to the clinching roller; and, as necessary, re-center the forming head **approximately** on the clinching roller per the instructions in Section 8.5.2. If the problem of poor quality lockseam persists, power down the HELIX-200 and check the position of the roller housing on the tube size selector scale (Fig. 106). As necessary, use the manual crank arm (Fig. 107) to reposition the roller housing. **The final position of the roller housing must be approximately that of the required tube size on the tube size selector scale.** Power up the HELIX-200 and make a test tubeforming run to ensure a tight lockseam. If all trouble shooting is completed and successful, resume production tubeforming operations.

8.5.4 When the preformed strip material profile is incorrect

NOTE: A GOOD QUALITY FORMED TUBE REQUIRES A TIGHT LOCKSEAM. THE QUALITY OF THE LOCKSEAM BEGINS

WITH THE CORRECT PRE-FORMED STRIP MATERIAL PROFILE.

Refer to Table B in Section 7.2.2.1 for the correct flange height for a good lockseam. If not done already, power down the HELIX-200; and select OFF at the HYDRAULIC OFF-ON selector switch, and select OFF at the LUBRICATION OFF-ON selector switch. Select DOWN at the CLINCHING ROLLER DOWN-UP selector switch; and rotate the formed tube out of the forming head. Check the dimensions of the strip material profile, especially the flange height.

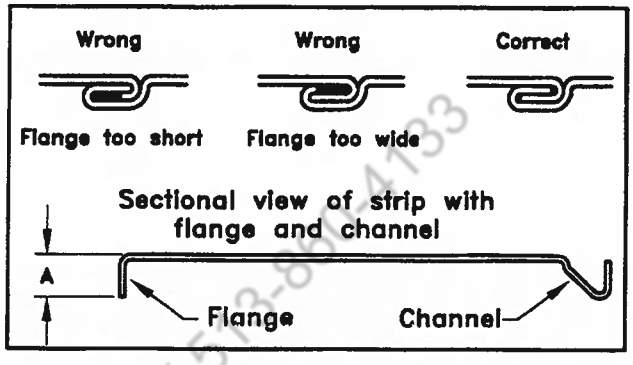

Fig. 108 - Preformed Strip Material Profile for a Good Lockseam

As necessary, make fine tuning adjustments at the guide rollers of the form roll unit to obtain the correct flange height for a good lockseam (Fig. 108 and Table B in Section 7.2.2.1). Power up the HELIX-200. Select ON at the HYDRAULIC OFF-ON selector switch, and select ON at the LUBRICANT OFF-ON selector switch. Dial up the SLOW SPEED control knob to the 3 graduation, and make a short test run without allowing the adjusted preformed strip material to reach the forming head. Check the dimensions of the preformed strip material profile; and make further adjustments as necessary. As necessary, trim the leading edge of the preformed strip to make it easy to guide it into the forming head. When a folding finger is required, make sure that it is properly adjusted for the correct gap for a good lockseam. When a flange roller is required, make sure that the correct flange roller is installed and is engaged. Select UP at the CLINCHING ROLLER DOWN-UP selector switch; and complete the test tubeforming run to ensure that the problem has been solved. If all trouble shooting procedures are completed and are successful, resume production tubeforming operations.

CAUTION: ***When a folding finger is required, make sure that it is installed and setup for the correct gap for a good lockseam; and similarly, when a flange roller is required, make sure that the correct flange roller assembly is installed and is engaged, before proceeding with production tubeforming operations.***

8.6 When the Flying Slitter Cuts Poorly

8.6.1 There are five possibilities when the flying slitter cuts poorly, namely: the overlap between the upper and lower cutters is not enough; or the knife gap between the upper and the lower cutters is incorrect; or the support arm does not exert enough downward pressure at the support roller;or the cutters are dull; or the lower cutter eccentric is

wrong; or any combination of the five. In any of these cases, the remedies are simple, and require no special skills. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.6.2, Section 8.6.3, Section 8.6.4 and/or Section 8.6.5.

8.6.2 When the overlap between the upper and the lower cutters is not enough

If not done already, power down the HELIX-200, and check the overlap between the upper and the lower cutters (Fig. 109). As necessary, adjust the overlap between cutters per the instructions in Section 7.2.10.1. Power up the HELIX-200. Make a test tubeforming run, and check the cutting operation for a good cut. If all trouble shooting is completed and successful, resume production tubeforming operations.

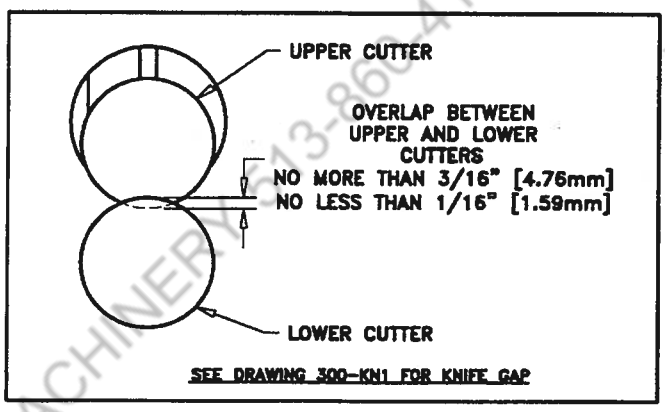

Fig. 109 - Overlap Between the Upper and the Lower Cutters

8.6.3 When the knife gap between the upper and lower cutters is incorrect

If not done already, power down the HELIX-200. If not done already, check the overlap between the upper and the lower cutters; and make any necessary adjustments per the instructions in Section 8.6.2. Check the knife gap between the upper and the lower cutters (Fig. 110). Refer to Section 7.2.10.2 and Table D for the recommended knife gap for the strip material thickness in use; and, as necessary, adjust the knife gap per the instructions in Section 7.2.10.2. Power up the HELIX-200. Make a test tubeforming run, and check the cutting operation for a good cut. If all trouble shooting is completed and successful, resume production tubeforming operations.

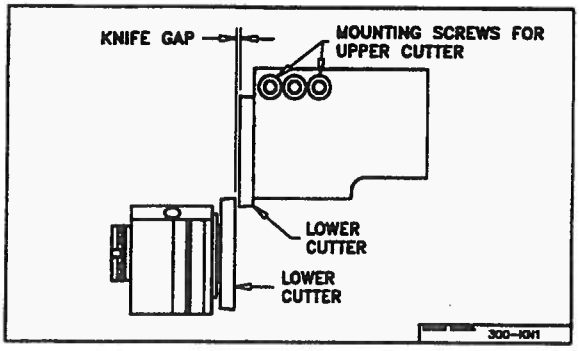

Fig. 110 - Knife Gap Between the Upper and the Lower Cutters

8.6.4 When the support arm does not exert enough pressure at the support roller

If not done already, power down the HELIX-200. If not done already, check the overlap between the upper and the lower cutters; and make any necessary adjustments per the

instructions in Section 8.6.2. If not done already, check the knife gap between the upper and the lower cutters; and make any necessary adjustments per the instructions in Section 8.6.3. At the forming head base assembly, loosen the support arm locking handle (Fig. 111), and use the support arm adjustable handle (Fig. 112) to lower the support arm slightly more over the support roller. Refasten the support arm locking handle to lock and secure the support arm. Power up the HELIX-200. Make a test tubeforming run, and check the cutting operation for a good cut. If all trouble shooting is completed and successful, resume production tubeforming operations.

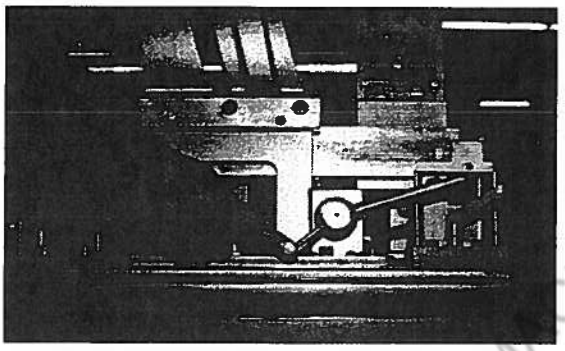

Fig. 111 - Support Arm Locking Handle

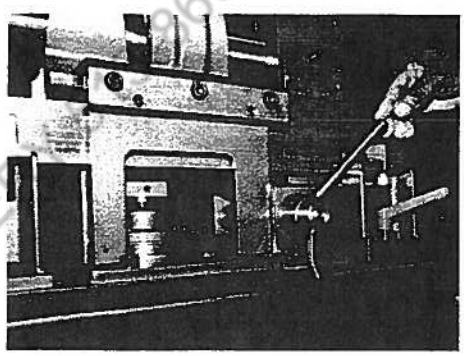

Fig. 112 - Support Arm Adjustable Handle

8.6.5 When the cutters are dull or when the lower cutter eccentric is wrong

Refer to the Flying Slitter Operations Manual for the solution to remedy the problem either when the cutters are dull or when the lower cutter eccentric is wrong.

8.7 When there is Burr on the End of a Formed Tube After Cutting

8.7.1 There are three possibilities when there is burr on the end of a formed tube after cutting, namely: the knife gap between the upper and the lower cutters is too much; or the support arm exerts too much downward pressure at the support roller; or the cutters are dull; or any combination of the three. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.7.2, Section 8.7.3, and/or Section 8.7.4.

8.7.2 When the knife gap between the upper and the lower cutters is too much

If not done already, power down the HELIX-200. Check the knife overlap and the knife gap between the upper and the lower cutters; and make any necessary adjustments in both the knife overlap and the knife gap per the instructions in Section 8.6.3. If all trouble shooting procedures are complete and successful, resume production tubeforming operations.

8.7.3 When the support arm exerts too much downward pressure at the support roller

If not done already, power down the HELIX-200. If not done already, check the overlap between the upper and the lower cutters; and make any necessary adjustments per the instructions in Section 8.6.2. If not done already, check the knife gap between the upper and the lower cutters; and make any necessary adjustments per the instructions in Section 8.6.3. At the forming head base assembly, loosen the support arm locking handle (Fig. 111), and use the support arm adjustable handle (Fig. 112) to raise the support arm slightly above the support roller. Refasten the support arm locking handle to lock and secure the support arm. Power up the HELIX-200. Make a test tubeforming run, and check the cutting operation for a good cut. If all trouble shooting is completed and successful, resume production tubeforming operations.

8.7.4 When the cutters are dull

Refer to the Flying Slitter Operations Manual for the solution to remedy the problem when the cutters are dull.

8.8 When Strip Material Lubricant is Not Being Pumped

8.8.1 There are four possibilities when the strip material lubricant is not being pumped, namely: the strip material lubricant tank is empty; or the strip material lubricant pump motor overload sensor is tripped; or the filter plate inside the lubricant tank is clogged; or the strip material lubrication line is clogged; or any combination of the four. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.8.2, Section 8.8.3, Section 8.8.4 and/or Section 8.8.5.

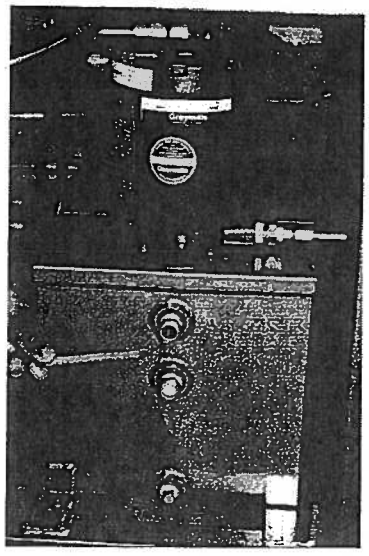

Fig. 113 - Strip Material Lubricant Tank Sight Glasses

8.8.2 When the strip material lubricant tank is empty

If not done already, power down the HELIX-200; and select OFF at the HYDRAULIC OFF-ON selector switch. At both the SLOW SPEED and the HIGH SPEED control knobs (potentiometers), dial down the speed knobs to the zero graduations for zero speed. If not done already, select OFF at the LUBRICATION OFF-ON selector switch. Check the lubricant tank through the sight glasses (Fig. 113) and confirm that the tank is empty or near empty.

Drain the tank and the strip material lubrication system of any residual lubricant. Thoroughly clean the lubricant tank and the filter plate inside the tank; and make sure that the lubrication system piping is free of debris and clogging agents. Refill the lubricant tank. Power up the HELIX-200; and select ON at the LUBRICATION OFF-ON selector switch. Let the equipment run for at least two minutes to completely recharge the strip material lubrication system. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.8.3 When the strip material lubricant pump motor overload sensor is tripped

DANGER: ***AN ELECTRICAL SHOCK HAZARD EXISTS WHEN WORKING WITH EITHER AC OR DC POWER. TO AVOID THE RISK OF INJURY TO PERSONNEL OR EQUIPMENT DAMAGE, ALL LOCAL SAFETY PRACTICES MUST BE FOLLOWED AND APPROVED SAFETY GEAR MUST BE WORN WHEN ANY WORK IS TO BE DONE INSIDE THE ELECTRICAL SYSTEM COMPARTMENT. POWER DOWN THE HELIX-200 AND DISCONNECT THE EXTERNAL AC POWER SOURCE BEFORE DOING ANY WORK WITHIN THE ELECTRICAL SYSTEM COMPARTMENT.***

WARNING: ***TURN OFF THE EXTERNAL AC POWER TO THE HELIX-200, AND PUSH DOWN THE RED MUSHROOM HEAD BUTTON ON THE OPERATOR PANEL BEFORE INITIATING ANY WORK INSIDE THE ELECTRICAL COMPARTMENT OF THE HELIX-200 MACHINE CABINET.***

CAUTION: ***Follow all local safety practices and procedures, and observe all general safety precautions against injury to personnel and damage to equipment when operating the HELIX-200. Wear all locally approved safety gear suitable for working in a manufacturing setting.***

If not done already, power down the HELIX-200. If not done already, select OFF at the HYDRAULIC OFF-ON selector switch, select OFF at the LUBRICATION OFF-ON selector switch, and dial down the control knobs to the zero graduations at both the SLOW SPEED and the HIGH SPEED control knobs (potentiometers). If not done already, check the strip material lubricant tank, through the sight glasses, and make sure that the tank is filled with lubricant to at least the top sight glass. If the lubricant tank has little or no lubricant, drain both the lubricant tank and the lubrication system and recharge the system per the instructions in Section 8.8.2. Being careful to observe all safety practices, access the electrical system compartment, and check the strip material lubricant pump motor overload sensor (Fig. 114). Push first the RED reset button, and then push the BLUE reset button to reset the overload sensor. If all maintenance procedures inside the electrical system compartment are completed, lock and secure the

electrical system compartment; and re-engage the external AC power source per approved local safety practices. Power up the HELIX-200; and select ON at the LUBRICATION OFF-ON selector switch. Let the equipment run for at least two minutes to completely recharge the strip material lubrication system. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

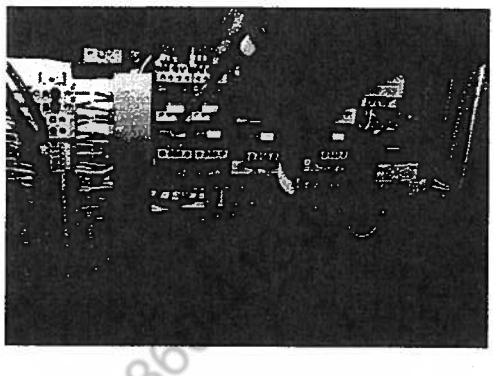

Fig. 114 - Strip Material Lubricant Pump Motor Overload Sensor

8.8.4 When the filter plate inside the lubricant tank is clogged

If not done already, power down the HELIX-200; and select OFF at the HYDRAULIC OFF-ON selector switch. At both the SLOW SPEED and the HIGH SPEED control knobs (potentiometers), dial down the speed knobs to the zero graduations for zero speed. If not done already, select OFF at the LUBRICATION OFF-ON selector switch. Check the lubricant tank through the sight glasses (Fig. 113) and confirm that the tank has not been empty or near empty. Drain the tank and the strip material lubrication system of any residual lubricant. Thoroughly clean the lubricant tank, with special attention to the filter plate inside the tank; and make sure that the lubrication system piping is free of debris and clogging agents. Refill the lubricant tank. Power up the HELIX-200; and select ON at the LUBRICATION OFF-ON selector switch. Let the equipment run for at least two minutes to completely recharge the strip material lubrication system. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.8.5 When the strip material lubrication line is clogged

If not done already, power down the HELIX-200; and select OFF at the HYDRAULIC OFF-ON selector switch. At both the SLOW SPEED and the HIGH SPEED control knobs (potentiometers), dial down the speed knobs to the zero graduations for zero speed. If not done already, select OFF at the LUBRICATION OFF-ON selector switch. Check the lubricant tank through the sight glasses (Fig. 113) and confirm that the problem does not arise from an empty or near empty tank. Check the lubrication system to confirm the presence of debris and/or clogging agents. Drain the lubricant tank and the strip material lubrication system of all lubricant. Thoroughly clean the lubricant tank, with special attention to the filter plate inside the tank. Where necessary, replace any length of piping that is still clogged after draining the lubrication system of lubricant; and refill the lubricant tank. Power up the HELIX-200; and select ON at the LUBRICATION OFF-ON selector switch. Let the equipment run for at least five minutes to completely recharge the strip material lubrication system. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.9 Difficulties When Running Thin-walled Strip Material

8.9.1 When the formed tube is not rigid

8.9.1.1 When running thin-walled strip material, there are four possibilities when the formed tube is not rigid, namely: the folding finger is not working properly; or the flange roller is not working properly; or the clinching roller is not working properly; or the lockseam is not tight; or any combination of the four. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.9.1.2, Section 8.9.1.3, Section 8.9.1.4 and/or Section 8.9.1.5.

8.9.1.2 When the folding finger is not working properly

If not done already, power down the HELIX-200; and dial down the operating speed to zero at both the SLOW SPEED and the HIGH SPEED control knobs. If not done already, select OFF at the HYDRAULIC OFF-ON selector switch, OFF at the LUBRICATION OFF-ON selector switch, and DOWN at the CLINCHING ROLLER DOWN-UP selector switch. Check the folding finger pressure against the preformed strip material channel; and, as necessary, replace the folding finger if the tip of the finger is either worn out or broken, and/or make adjustments in the gap between the finger and the lower front guide plate (Figs. 115and 116). Power up the HELIX-200; and select ON at the HYDRAULIC OFF-ON selector switch, ON at the LUBRICATION OFF-ON selector switch, UP at the CLINCHING ROLLER DOWN-UP selector switch, and dial up the SLOW SPEED control knob to the 3 graduation. Make a test tubeforming run to ensure that the formed tube is rigid. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

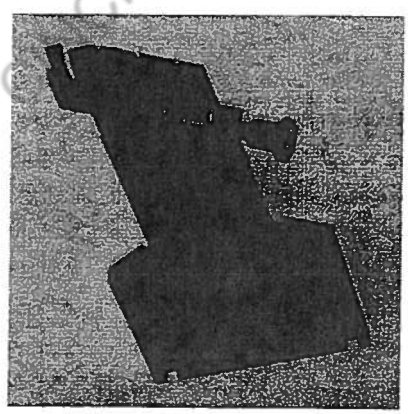

Fig. 115 - Folding Finger Assembly and the Lower Front Guide Plate

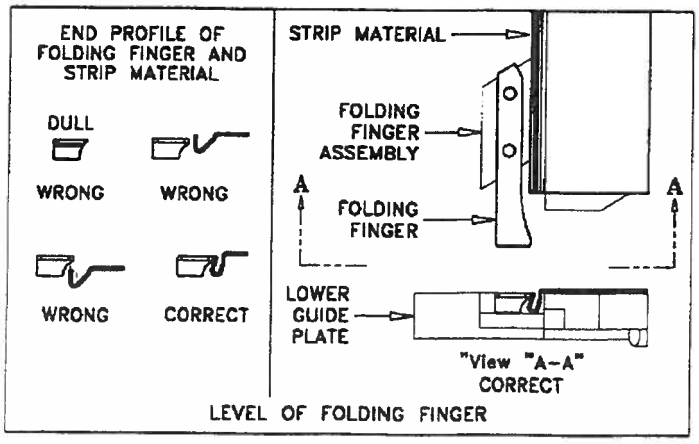

Fig. 116 - Correct Level of Folding Finger

8.9.1.3 When the flange roller is not working properly

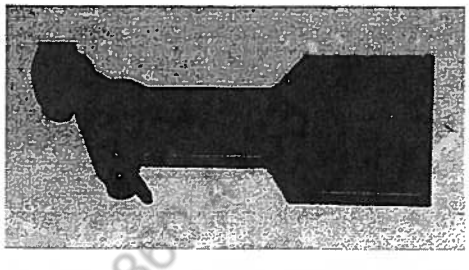

Fig. 117 - Upper Front Guide Plate with Roller Holder Plate Assembly Installed

If not done already, power down the HELIX-200; and dial down the operating speed to zero at both the SLOW SPEED and the HIGH SPEED control knobs. If not done already, select OFF at the HYDRAULIC OFF-ON selector switch, OFF at the LUBRICATION OFF-ON selector switch, and DOWN at the CLINCHING ROLLER DOWN-UP selector switch. If not done already, check the folding finger; and, as necessary, replace the finger or make adjustments per the instructions in Section 8.9.1.2. Uninstall the upper front guide plate and the roller holder plate assembly (Fig. 117); and check the flange roller assembly. Refer to Section 7.2.3.2 for the correct flange roller assembly to use. As necessary, replace the flange roller assembly to ensure that the correct flange roller is installed; and realign the support roller with the upper front guide plate. Reinstall the upper front guide plate with the installed roller holder plate assembly; and make sure that the flange roller is properly engaged. Power up the HELIX-200; and select ON at the HYDRAULIC OFF-ON selector switch, ON at the LUBRICATION OFF-ON selector switch, UP at the CLINCHING ROLLER DOWN-UP selector switch, and dial up the SLOW SPEED control knob to the 3 graduation. Make a test tubeforming run to ensure that the formed tube is rigid. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

CAUTION: ***Make sure that the correct flange roller assembly is installed for the strip material in use, before proceeding with production tubeforming operations.***

8.9.1.4 When the clinching roller is not working properly

NOTE: THE CONDITION OF THE CLINCHING ROLLER BALL BEARINGS IS VERY IMPORTANT ; AND BAD BALL BEARINGS WILL ALLOW THE CLINCHING ROLLER TO WALK. REPLACE THE BALL BEARINGS IF THEY ARE BAD. ALSO REPLACE THE BALL BEARINGS IF THE BEARINGS DO NOT RUN FREELY.

If not done already, power down the HELIX-200; and dial down the operating speed to zero at both the SLOW SPEED and the HIGH SPEED control knobs. If not done already, select OFF at the HYDRAULIC OFF-ON selector switch, OFF at the LUBRICATION OFF-ON selector switch, and DOWN at the CLINCHING ROLLER DOWN-UP selector switch. If not done already, check the folding finger; and, as

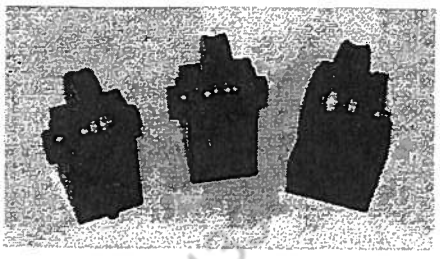

Fig. 118 - Versions of the Clinching Roller Assembly

necessary, replace the finger or make adjustments per the instructions in Section 8.9.1.2. If not done already, check the flange roller assembly; and, as necessary, replace the flange roller assembly, and/ or make adjustments per the instructions in Section 8.9.1.3. Check the clinching roller assembly (Fig. 118); and refer to Section 7.2.6 and its subsections for the correct clinching roller assembly. As necessary, replace the clinching roller; and make the necessary adjustments per the instructions in Section 7.2.6 and its subsections. Power up the HELIX-200; and select ON at the HYDRAULIC OFF-ON selector switch, ON at the LUBRICATION OFF-ON selector switch, UP at the CLINCHING ROLLER DOWN-UP selector switch, and dial up the SLOW SPEED control knob to the 3 graduation. Make a test tubeforming run to ensure that the formed tube is rigid. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

CAUTION: ***Make sure that the correct clinching roller assembly is installed for the strip material in use, and make sure that the clinching roller has been realigned with the roller housing before proceeding with production tubeforming operations.***

8.9.1.5 When the lockseam is not tight

NOTE: **MAKE SURE THAT THE FOLDING FINGER IS INSTALLED AND ADJUSTED FOR THE CORRECT LEVEL AND GAP BETWEEN THE FINGER AND THE LOWER FRONT GUIDE PLATE; THAT THE CORRECT FLANGE ROLLER ASSEMBLY IS INSTALLED AND PROPERLY ENGAGED; THAT THE CORRECT SUPPORT ROLLER IS INSTALLED AND PROPERLY ALIGNED WITH THE UPPER FRONT GUIDE PLATE; THAT THE CORRECT CLINCHING ROLLER IS INSTALLED, PROPERLY SET UP AND PROPERLY ALIGNED WITH THE ROLLER HOUSING; AND THAT THE DOWNWARD PRESSURE OF THE SUPPORT ARM IS JUST SUFFICIENT TO COUNTER BALANCE THE UPWARD PRESSURE OF THE CLINCHING ROLLER.**

If the correct subassemblies and assemblies have been installed when running thin-walled strip material and lockseam problems persist, there are three primary factors that may affect why the lockseam is not tight. These factors include: the clinching roller and the support roller are not in the **approximate** center of the forming head; or the roller housing is not positioned for the correct tube size selection; or the preformed strip material profile is incorrect; or any combination of the three. In any of these cases, the remedies

are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. **Refer to the instructions in Section 8.5 and its subsection 8.5.2, subsection 8.5.3, and/or subsection 8.5.4 to remedy the problem.** If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.9.2 When the strip material or the formed tube buckles in the forming head

NOTE: THE STRIP MATERIAL MUST FEED SQUARELY INTO THE ROLLER HOUSING AT ALL TIMES, AND FOR ALL POSITIONS OF THE ROLLER HOUSING.

8.9.2.1 When running thin-walled strip material, there are six possibilities when the strip material or the formed tube buckles in the forming head, namely: the drive unit and feed rollers pressure setting is too high; or the strip material is not squarely fed into the roller housing resulting in the strip material not feeding perpendicular to the drive unit and feed rollers; or the roller housing is not positioned for the correct tube size selection; or the upper drive roller of the drive unit and feed rollers is in bad condition; or the wrong inlays are in use; or the wrong inlays are used under the guide plates or not at all; or any combination of the six. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. Refer to the instructions in Section 8.9.2.2, Section 8.9.2.3, Section 8.9.2.4, Section 8.9.2.5, and/or Section 8.9.2.6.

8.9.2.2 When the drive unit and feed rollers pressure setting is too high

If not done already, dial down the operating speed to zero at both the SLOW SPEED and the HIGH SPEED control knobs (potentiometers). Check the drive unit and feed rollers pressure setting against the reference values in Section 7.4.2 Table E; and, as necessary, dial down the drive unit and feed rollers pressure setting in keeping with the instructions in Section 7.4.2. As necessary, make a corresponding adjustment in the support arm pressure, as well as the clinching roller pressure setting, for any reduction in the drive unit and feed roller pressure setting. Dial up the SLOW SPEED control knob (potentiometer) from the zero graduation to 3; and make a short test tubeforming run. If all trouble shooting procedures are completed and successful, dial up the operating speed to the recommended production levels and resume production tubeforming operations.

8.9.2.3 When the strip material is not squarely fed into the roller housing

DANGER: TO AVOID BODILY INJURY TO PERSONNEL, MAKE SURE THAT NO ONE IS TOUCHING THE STRIP MATERIAL BETWEEN THE DECOILER AND THE ROLLER HOUSING WHEN STARTING THE HELIX-200.

DANGER: ***TO AVOID BODILY INJURY TO PERSONNEL AND POSSIBLE DAMAGE TO EQUIPMENT, KEEP CLEAR OF MOVING PARTS.***

If not done already, check the drive unit and feed rollers pressure setting; and, as necessary, adjust the drive unit and feed rollers pressure setting per the instructions in Section 8.9.2.2. If not done already, power down the HELIX-200; and select OFF at the HYDRAULIC OFF-ON selector switch, and OFF at the LUBRICATION OFF-ON selector switch. Check the strip material at the entrance to the roller housing. If the strip material is not feeding squarely into the roller housing, cut the strip at a point prior to the entrance of the roller housing. Remove any strip material and formed tube from the HELIX-200. Trim the leading edge of the coil of strip material and reload the coil of strip material per the instructions in Section 7.2.5 and its subsections. Power up the HELIX-200; and select ON at the HYDRAULIC OFF-ON selector switch and select ON at the LUBRICATION OFF-ON selector switch. Dial up the SLOW SPEED control knob (potentiometer) from the zero graduation to 3; and make a short test tubeforming run. If all trouble shooting procedures are completed and successful, dial up the operating speed to the recommended production levels and resume production tubeforming operations.

CAUTION: ***Do not resume production tubeforming operations unless the strip material feeds squarely into the roller housing, and remains perpendicular to the drive unit and feed rollers.***

8.9.2.4 When the roller housing is not positioned for the correct tube size selection

If not done already, check the drive unit and feed rollers pressure setting; and as necessary, make adjustments in the pressure setting per the instructions in Section 8.9.2.2. If not done already, check to make sure that the strip material feeds squarely into the roller housing; and, as necessary, make adjustments per the instructions in Section 8.9.2.3 to feed the strip material squarely into the roller housing. If not done already, check the position of the forming head relative to the clinching roller; and, as necessary, re-center the forming head on the clinching roller per the instructions in Section 8.5.2. If the problem of buckling in the forming head or a problem of poor quality lockseam persists, power down the HELIX-200 and check the position of the roller housing on the tube size selector scale (Fig. 119). As necessary, use the manual crank arm

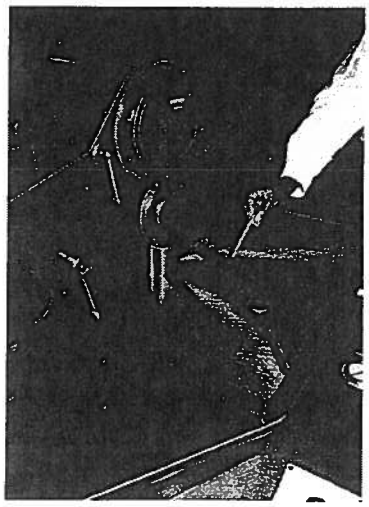

Fig. 119 - Roller Housing and the Tube Size Selector Scale

(Fig. 120) to reposition the roller housing. **The final position of the roller housing must be approximately that of the required tube size on the tube size selector scale.** Power up the HELIX-200; and make a test tubeforming run to ensure a tight lockseam. If all trouble shooting is completed and successful, resume production tubeforming operations.

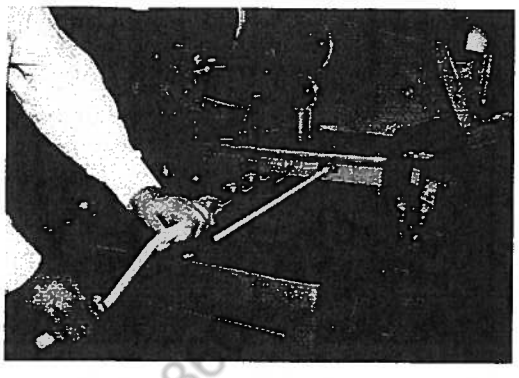

Fig. 120 - Manual Crank Arm to Reposition Roller Housing

8.9.2.5 When the upper drive roller of the drive unit and feed rollers is in bad condition

NOTE: FOR OPTIMUM PERFORMANCE, THE UPPER DRIVE ROLLER OF THE DRIVE UNIT AND FEED ROLLERS MUST BE IN GOOD CONDITION, AND THE KNURLED SURFACES SHARP.

If not done already, check the drive unit and feed rollers pressure setting; and as necessary, make adjustments in the pressure setting per the instructions in Section 8.9.2.2. If not done already, check to make sure that the strip material feeds squarely into the roller housing; and, as necessary, make adjustments per the instructions in Section 8.9.2.3 to feed the strip material squarely into the roller housing. If not done already, check the position of the forming head relative to the clinching roller; and, as necessary, re-center the forming head **approximately** on the clinching roller per the instructions in Section 8.5.2. If not done already, check the position of the roller housing; and, as necessary, make adjustments per the instructions in Section 8.9.2.4. If the problem of buckling in the forming head or a problem of poor quality lockseam persists, power down the HELIX-200 and check the surfaces of the upper drive roller of the drive unit and feed rollers. As necessary, replace the upper drive roller if any portion of the knurled surfaces of the upper drive roller is damaged; and make sure that the drive unit and feed rollers are properly regapped and setup per the instructions in Section 7.2.4 and its subsections. Power up the HELIX-200; and make a test tubeforming run to ensure the resolution of the problem, and the production of a tight lockseam. If all trouble shooting is completed and successful, resume production tubeforming operations.

8.9.2.6 When the wrong inlays are in use, or when the wrong inlays are used under the guide plates or not at all

If not done already, check the drive unit and feed rollers pressure setting; and as necessary, make adjustments in the pressure setting per the instructions in Section 8.9.2.2. If not done already, check to make sure that the strip material feeds squarely into the roller housing; and, as necessary, make adjustments per the instructions in Section 8.9.2.3 to

feed the strip material squarely into the roller housing. If not done already, check the position of the forming head relative to the clinching roller; and, as necessary, re-center the forming head on the clinching roller per the instructions in Section 8.5.2. If not done already, check the position of the roller housing; and, as necessary, make adjustments per the instructions in Section 8.9.2.4. If not done already, check the knurled surfaces of the upper drive roller of the drive unit and feed rollers; and as necessary, refer to the instructions in Section 8.9.2.5 to replace the upper drive roller if any portion of the knurled surfaces of the upper drive roller is damaged. If the problem of buckling in the forming head or a problem of poor quality lockseam persists, power down the HELIX-200 and inspect the guide plate and inlays assembly. Refer to Table C in Section 7.2.3 for the correct inlays to be used, and replace the inlays as necessary. Be sure to reinstall any subassemblies, and components that may have been removed, and secure them as necessary. Power up the HELIX-200; and make a test tubeforming run to ensure the resolution of the problem, and the production of a tight lockseam. If all trouble shooting is completed and successful, resume production tubeforming operations.

8.9.3 When the strip material flange and the channel do not properly interlock

NOTE: **AN IMPROPER INTERLOCK BETWEEN THE STRIP MATERIAL FLANGE AND CHANNEL MAY OCCUR EITHER AS A "CLIMBING" FLANGE OR A "JUMPING OUT" FLANGE (FIG. 121).**

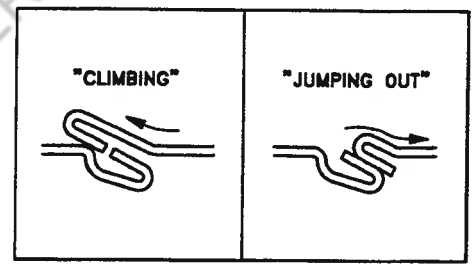

Fig. 121 - When the Strip Flange and Channel do not Properly Interlock

If not done already, power down the HELIX-200. Uninstall the upper front guide plate and the roller holder plate assembly; and check the installation of the support roller and the roller holder plate assembly to the upper front guide plate. As necessary, adjust the position of the support roller to ensure that the support roller is parallel to the edge of the upper front guide plate to within 0 degree to +1/2 degree (Figs. 122). Reinstall the upper front guide plate and the roller holder plate assembly; and secure the guide plate assembly. Power up the

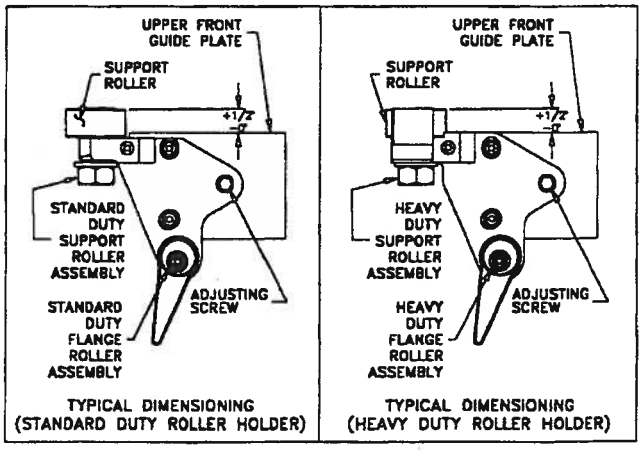

Fig. 122 - Support Roller to Upper Front Guide Plate Alignment

HELIX-200 and make a test tubeforming run to verify the problem solution. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

8.9.4 When the strip material buckles between the form roll unit and the drive unit and feed rollers (Fig. 123)

If not done already, power down the HELIX-200. Check the position of the roller housing on the tube size selector scale; and, as necessary, use the manual crank arm to reposition the roller housing for the correct tube size selection. Check the gap, from end-to-end, between the upper (drive) roller and the lower (pinch) roller of the drive unit and feed rollers (Fig. 124); and, as necessary, adjust the gap between the rollers so that the lower (pinch) roller is parallel to the upper (drive) roller from end-to-end. Power up the HELIX-200 and make a test tubeforming run to verify the problem solution. If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

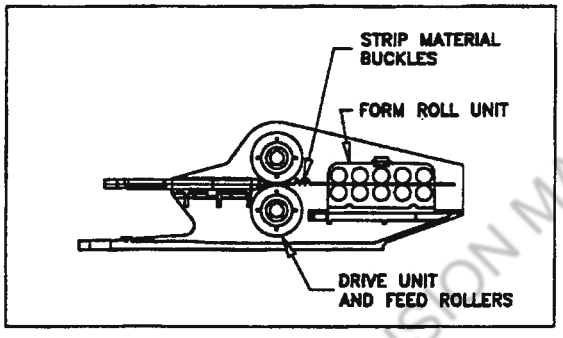

Fig. 123 - Strip Material Buckling Between Form Roll Unit and Drive Unit and Feed Rollers

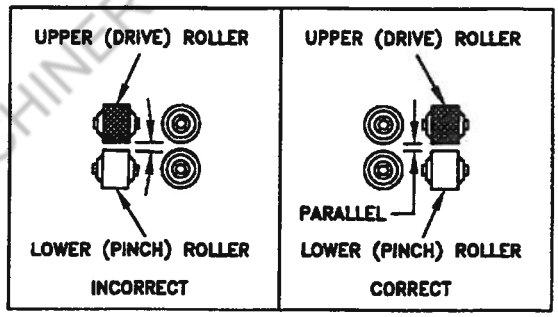

Fig. 124 - Gap Between Corresponding Upper (Drive) Roller and Lower (Pinch) Roller

8.9.5 When the run-off table assembly is not properly setup for thin-walled tubing

NOTE: WHEN RUNNING THIN-WALLED FORMED TUBES, IT IS VERY IMPORTANT THAT THE RUN-OFF TABLE ASSEMBLY IS SETUP CORRECTLY TO SUPPORT THE FORMED TUBE UNIFORMLY ALONG ITS ENTIRE LENGTH.

If not done already, power down the HELIX-200; and check the supporting rollers of the run-off table assembly. As necessary, adjust the rollers to uniformly support the formed tube along the entire length of the formed tube. Power up the HELIX-200, and make a test tubeforming run to produce at least three full production lengths of formed tube to ensure that the problem has been resolved. If all trouble shooting procedures are completed and are successful, resume production tubeforming operations.

8.10 Difficulties When Running Heavy Gauge Strip Material

NOTE: STRIP MATERIAL 0.0401 INCH (1.021 MM OR 19 GAUGE) AND THICKER IS CONSIDERED HEAVY GAUGE STRIP MATERIAL FOR PURPOSES OF SPIRAL TUBEFORMING.

8.10.1 When there is difficulty in bending or working the strip material during spiral tubeforming

NOTE: VERY SMALL DIFFERENCES IN MATERIAL HARDNESS EITHER ALONG THE LENGTH OR ACROSS THE WIDTH OF HEAVY GAUGE STRIP MATERIAL, OR BOTH, RESULTS IN POOR QUALITY SPIRAL TUBEFORMING.

Several factors affect the ease with which a given heavy gauge strip material may be worked during spiral tubeforming. Chief among these factors is consistency in material hardness either along the length of the strip or across the width of the strip, or both. If the strip material is difficult to bend or requires excessive clinching pressure, the primary cause is poor strip quality resulting from high material hardness or inconsistency in the hardness from length to length and/or across the width of the strip. Refer to Section 7.2.5.1 of this manual for a definition of lockseam quality; and replace the coil of strip material. If all trouble shooting is completed, resume production tubeforming operations.

8.10.2 When the lockseam is not tight

NOTE: MAKE SURE: THAT WHEN REQUIRED, THE FOLDING FINGER IS INSTALLED AND ADJUSTED FOR THE CORRECT LEVEL AND GAP BETWEEN THE FINGER AND THE LOWER FRONT GUIDE PLATE; THAT WHEN REQUIRED, THE CORRECT FLANGE ROLLER ASSEMBLY IS INSTALLED AND PROPERLY ENGAGED; THAT THE CORRECT SUPPORT ROLLER IS INSTALLED AND PROPERLY ALIGNED WITH THE UPPER FRONT GUIDE PLATE; THAT THE CORRECT CLINCHING ROLLER IS INSTALLED, PROPERLY SET UP AND PROPERLY ALIGNED WITH THE ROLLER HOUSING; AND THAT THE DOWNWARD PRESSURE OF THE SUPPORT ARM IS JUST SUFFICIENT TO COUNTER BALANCE THE UPWARD PRESSURE OF THE CLINCHING ROLLER.

If the correct subassemblies and assemblies have been installed when running heavy gauge or thick-walled strip material and lockseam problems persist, there are three primary factors that may affect why the lockseam is not tight, namely: the clinching roller and the support roller are not in the **approximate** center of the forming head; or the roller housing is not positioned for the correct tube size selection; or the preformed

strip material profile is incorrect; or any combination of the three. In any of these cases, the remedies are simple, and require no special skills or tools. The recommended approach is to examine each possibility in turn until the problem is resolved. **Refer to the instructions in Section 8.5.2, Section 8.5.3 and/or Section 8.5.4 to remedy the problem.** If all trouble shooting procedures are completed and successful, resume production tubeforming operations.

9. MAINTENANCE

DANGER: ***AN ELECTRICAL SHOCK HAZARD EXISTS WHEN WORKING WITH EITHER AC OR DC POWER. TO AVOID THE RISK OF INJURY TO PERSONNEL OR EQUIPMENT DAMAGE, ALL LOCAL SAFETY PRACTICES MUST BE FOLLOWED AND APPROVED SAFETY GEAR MUST BE WORN WHEN ANY WORK IS TO BE DONE INSIDE THE ELECTRICAL SYSTEM COMPARTMENT. POWER DOWN THE HELIX-200 AND DISCONNECT THE EXTERNAL AC POWER SOURCE BEFORE DOING ANY WORK WITHIN THE ELECTRICAL SYSTEM COMPARTMENT.***

WARNING: ***UNLESS OTHERWISE INSTRUCTED FOR A SPECIFIC MAINTENANCE PROCEDURE, DISCONNECT THE HELIX-200 FROM THE EXTERNAL AC POWER SOURCE AS WELL AS THE PNEUMATIC POWER SOURCE BEFORE INITIATING ANY SCHEDULED MAINTENANCE PROCEDURE.***

9.1 The HELIX-200 is designed to require minimal maintenance. Items that must be maintained include: All Bearings including Drive Unit lower pinch roller bearings, needle bearings, and so on; surfaces of Drive unit and feed rollers; Run-off table assembly; Decoiler; Flying Slitter cam followers; Roller Housing adjusting screws; Lubricant Tank and Filter Plate(s); Air Regulator oilers; and Hydraulic filter and oil changes.

9.2 Follow all electronic manufacturers' maintenance procedures and schedules. Minimal monthly regreasing must be done on the decoiler, the run-off table assembly, the flying slitter cam followers, and the roller housing position adjusting screw. Every three months, at the same time as the monthly regreasing of the roller housing position adjusting screw is performed, visually inspect the main machine cabinet and its compartments for signs of corrosion or damage, and perform the following: visually inspect electrical wiring in the electrical compartment to be sure that there is no physical damage, and that all

connections are secure and free of dirt and corrosion; visually inspect pneumatic piping in the pneumatic compartment to be sure that there is no physical damage, and that all connections are secure and free of dirt and corrosion; examine all accessible hydraulic connections and make sure that the connections are tight and free of dirt and corrosion; and check the oil cooler's air intake and exhaust for any obstructions, and clear the obstructions as necessary. Perform other maintenance and/or replacement procedures as required by local practices and codes. **Refer to the relevant sections and subsections of this document in this chapter on maintenance for more detailed information on maintenance and replacement schedules.**

9.3 Components Requiring Weekly Maintenance

NOTE: FOR EACH PRODUCTION RUN USE A WIRE BRUSH, AS NECESSARY, TO KEEP THE DRIVE UNIT AND FEED ROLLERS FREE FROM STRIP MATERIAL RESIDUE BUILD UP.

NOTE: SCHEDULE AT THE SAME TIME ALL ITEMS, COMPONENTS, ASSEMBLIES AND SUBASSEMBLIES REQUIRING WEEKLY MAINTENANCE, AND PERFORM ALL THE WEEKLY MAINTENANCE PROCEDURES AT THE SAME TIME.

9.3.1 Regrease all flying slitter needle bearings once a week.

9.3.2 On a weekly basis, at the same time as the needle bearings are regreased, visually inspect the pneumatic system compartment to be sure that there is no physical damage, and that the pneumatic system piping and connections are secure, and free of dirt and corrosion. Clean and oil all air regulators once a week.

9.3.3 On a weekly basis, at the same time as the needle bearings are regreased, visually inspect the drive unit and feed rollers, and use a wire brush as necessary to keep them free from strip material build up.

9.4 Components Requiring Monthly Maintenance

NOTE: SCHEDULE AT THE SAME TIME ALL ITEMS, COMPONENTS, ASSEMBLIES AND SUBASSEMBLIES REQUIRING MONTHLY MAINTENANCE, AND PERFORM ALL THE MONTHLY MAINTENANCE PROCEDURES AT THE SAME TIME.

9.4.1 On a monthly basis, visually inspect for damage and corrosion, and regrease the following: the run-off table assembly and the receiving ramps; the decoiler; the flying slitter cam followers; and the roller housing position adjusting screw.

9.4.2 On a monthly basis, at the same time as the regreasing of the roller housing position adjusting screw, use a directed high pressure air source to clean and clear the fan blades, the grille works and all accessible passageways of the oil cooler to keep them free of dirt and obstructions.

9.5 Components Requiring Maintenance Every Three Calendar Months

NOTE: SCHEDULE AT THE SAME TIME ALL ITEMS, COMPONENTS, ASSEMBLIES AND SUBASSEMBLIES REQUIRING MAINTENANCE EVERY THREE CALENDAR MONTHS, AND PERFORM ALL THE SCHEDULED MAINTENANCE PROCEDURES AT THE SAME TIME.

9.5.1 Every three calendar months, at the same time as the monthly inspection and regreasing of the roller housing position adjusting screw, visually inspect the main machine cabinet and its compartments for signs of corrosion and damage. As necessary, repair any signs of corrosion and damage.

9.5.2 Every three calendar months, at the same time as the visual inspection of the main machine cabinet, visually inspect the electrical wiring in the electrical compartment to be sure that there is no physical damage, and that all connections are tight and free of dirt and corrosion. Visually inspect all fuses and make sure that they are free of dirt and corrosion, and that there is no damage.

9.5.3 Every three calendar months, at the same time as the visual inspection of the main machine cabinet, visually inspect all accessible hydraulic piping and connections to be sure that there is no physical damage, and that all connections are tight and free of dirt and corrosion.

9.6 Components Requiring Half Yearly Maintenance

NOTE: SCHEDULE AT THE SAME TIME ALL ITEMS, COMPONENTS, ASSEMBLIES AND SUBASSEMBLIES REQUIRING MAINTENANCE EVERY SIX CALENDAR MONTHS, AND PERFORM ALL THE SCHEDULED MAINTENANCE PROCEDURES AT THE SAME TIME.

9.6.1 Every six calendar months, at the same time as the monthly inspection and regreasing of the roller housing position adjusting screw, drain the strip material lubrication system and the lubricant tank. Thoroughly clean the lubricant tank and the filter plate, and refill the lubricant tank.

9.6.2 Every six calendar months, at the same time as the half yearly draining and refilling of

the strip material lubricating system, drain all motor gear boxes and compartments of motor oil. Replace any corresponding filters, and recharge the motor gear boxes and compartments.

9.7 Components Requiring Yearly Maintenance

NOTE: SCHEDULE AT THE SAME TIME ALL ITEMS, COMPONENTS, ASSEMBLIES AND SUBASSEMBLIES REQUIRING YEARLY MAINTENANCE, AND PERFORM ALL THE YEARLY MAINTENANCE PROCEDURES AT THE SAME TIME.

9.7.1 On a yearly basis, at the same time as the monthly inspection and regreasing of the roller housing position adjusting screw, drain the hydraulic system and the hydraulic tank; and replace all hydraulic filters. Refill the hydraulic tank with clean fluid, and recharge the hydraulic system.

9.7.2 On a yearly basis, at the same time as the yearly draining and recharging of the hydraulic system, visually inspect the bearings of the lower pinch roller of the drive unit and feed rollers for damage, and replace as necessary. Regrease the bearings of the lower pinch roller of the drive unit.

9.7.3 On a yearly basis, at the same time as the yearly draining and recharging of the hydraulic system, visually inspect the oil cooler's intake and exhaust for any obstructions, and clear the obstructions. Using a directed high pressure air source, clean the fan blades, the grille works and all accessible passageways of the oil cooler to keep them free of dirt and obstructions.

9.8 Local Practices and Codes

Where mandated by local practices and codes, perform all necessary maintenance and/ or replacement procedures as required by the local practices and codes.

10. SPARE PARTS

For a complete listing of HELIX-200 Spare Parts, refer to the latest revision of the SPIRAL-HELIX Document Number 60400201. When in doubt, consult the SPIRAL-HELIX, INC. Customer Service Department.

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Notice

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