

*Models 2070-1 / 2070-2 / 2071*

# **Antenna Positioner**

## MANUAL



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Model 2071 with Bore-Sight shown on cover.

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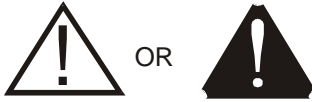
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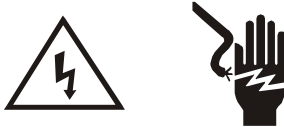
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**NOTICE:** This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

**SAFETY SYMBOL DEFINITIONS**



**REFER TO MANUAL** When product is marked with this symbol refer to instruction manual for additional information.



**HIGH VOLTAGE** Indicates presence of hazardous voltage. Unsafe practice could result in severe personal injury or death.



**PROTECTIVE EARTH GROUND (SAFETY GROUND)**  
Indicates protective earth terminal. You should provide uninterruptible safety earth ground from the main power source to the product input wiring terminals, power cord, or supplied power cord set.



**CAUTION** Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.



**WARNING** Denotes a hazard. Failure to follow instructions could result in SEVERE personal injury and/or property damage. Included text gives proper procedures.

**GENERAL SAFETY CONSIDERATIONS**



**BEFORE POWER IS APPLIED TO THIS INSTRUMENT, GROUND IT PROPERLY** through the protective conductor of the AC power cable to a power source provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal could result in personal injury.



**BEFORE SERVICING: CONTACT ETS-LINDGREN** - servicing (or modifying) the unit by yourself may void your warranty. If you attempt to service the unit by yourself, disconnect all electrical power before starting. There are voltages at many points in the instrument which could, if contacted, cause personal injury. Only trained service personnel should perform adjustments and/or service procedures upon this instrument. *Capacitors inside this instrument may still be CHARGED even when instrument is disconnected from its power source.*



**ONLY QUALIFIED PERSONNEL** should operate (or service) this equipment.



**MOVING BOOM** Keep clear during tower operation. A falling boom can cause serious injury.



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# INTRODUCTION

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The ETS-Lindgren Model 2070-1, 2070-2 and 2071 antenna towers are portable mast and platform systems designed for use in EMI compliance testing at elevations from one to six meters above the ground level. The mast, carrier, boom, platform, drive belts and guying system are non-conductive and non-magnetic. The antenna carrier is raised and lowered by a fractional horsepower electric motor with a gear reducer and electric brake. The electronics are contained in a shielded enclosure and the unit receives signals via fiber-optic cables. The electric drive unit is located at the base of the tower.

The mast sections of the tower are constructed of square fiberglass tubing for strength, rigidity and weatherability. The mast consists of three or four sections, depending on whether a four or six meter height is desired (refer to assembly instructions.) Mylar rope guy lines are provided for outdoor installations and must be firmly anchored to provide vertical stability. The carrier is made of non-metallic material, primarily nylon and delrin.

The motor system drives the carrier up and down using a polyurethane Kevlar reinforced timing belt. Rollers on the carrier provide friction-free, smooth travel. The motor typically positions the carrier within two centimeters of the desired location. To prevent over-travel in either direction of movement, the mechanical limits can be set with dual knobs located outside the motor cover. Soft limits can be set within the mechanical limits using the Model 2090 Positioning Controller.

This manual covers the model 2070-1, 2070-2 and 2071 antenna towers. When a section specifically pertains to one model it will be noted. Otherwise the section refers to all three models.

ETS-Lindgren's Model 2070-1, 2070-2 and 2071 antenna towers are identical in their rugged construction, toothed belt drives and important safety features. The units are differentiated by features that configure the carrier and boom.

The Model 2070-1 is manually polarized. The Model 2070-2 and 2071 feature centerline air polarization, which enhances measurement accuracy. In addition, the Model 2071 features ETS-Lindgren's patented Bore Sight system that provides direct antenna aim onto and EUT during scanning.

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# STANDARD CONFIGURATION

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- Dual-Voltage Motor : 100/115 VAC or 220/240 VAC
- Castered platform for portability
- Sectional mast
- Manual polarization antenna mount
- Input frequency 50 Hz or 60 Hz
- Ten meter fiber-optic control cable
- Maximum loading 10.4 kg (23 lbs)
- Overall height 7 meters (23 ft) with all sections of mast installed, sections can be removed for lower heights
- Base dimensions 1.2 m (48 inch) x 1.2 m (48 inch)
- Cold weather motor base
- Weight 86 kg (190 lbs)

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# MODEL 2070 OPTIONS

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**Model 2090 Positioning Controller:** This controller provides control for two separate devices (EMCO towers and turntables) in any combination, plus the control of four auxiliary devices via a fiber optic interface. The unit includes a GPIB connection and is compatible with most popular EMI measurement software.

**Hand Control Unit:** This sturdy, hand-held controller will allow the user to manually operate the tower remotely and independently from the Model 2090 Positioning Controller. The hand control unit attaches conveniently to the motor base unit of the antenna tower. Functions include UP, DOWN, POLARIZATION, and HAND/MAIN (2090) control selection.

**Universal Antenna Mount:** This option is a versatile and sturdy mount for most common antennas.

**Rohde and Schwarz Antenna adapter:** This option permits the mounting of the Rohde and Schwarz antennas.

**Shield Room Feed Through:** This option allows the customer to take the fiber-optic control cable from the control room to the shield room and still maintain shielding attenuation. The pieces are made of brass for conductivity and provide attenuation of greater than 100 dB at 10 GHz. A single 25 mm (1 inch) hole is required to mount this option.

**Additional Fiber Optic Cable:** Various lengths of fiber optic cable are available by custom order. The standard length provided is 10 m (32.8 ft).

**Coaxial Take-Up Reel:** This spring loaded reel keeps the cable out of the way during ascent and descent of the carrier. It also helps to assure consistency in readings during testing. A cold weather version of this option is also available.

# WHY A BORE-SIGHT TOWER? / INTRODUCTION

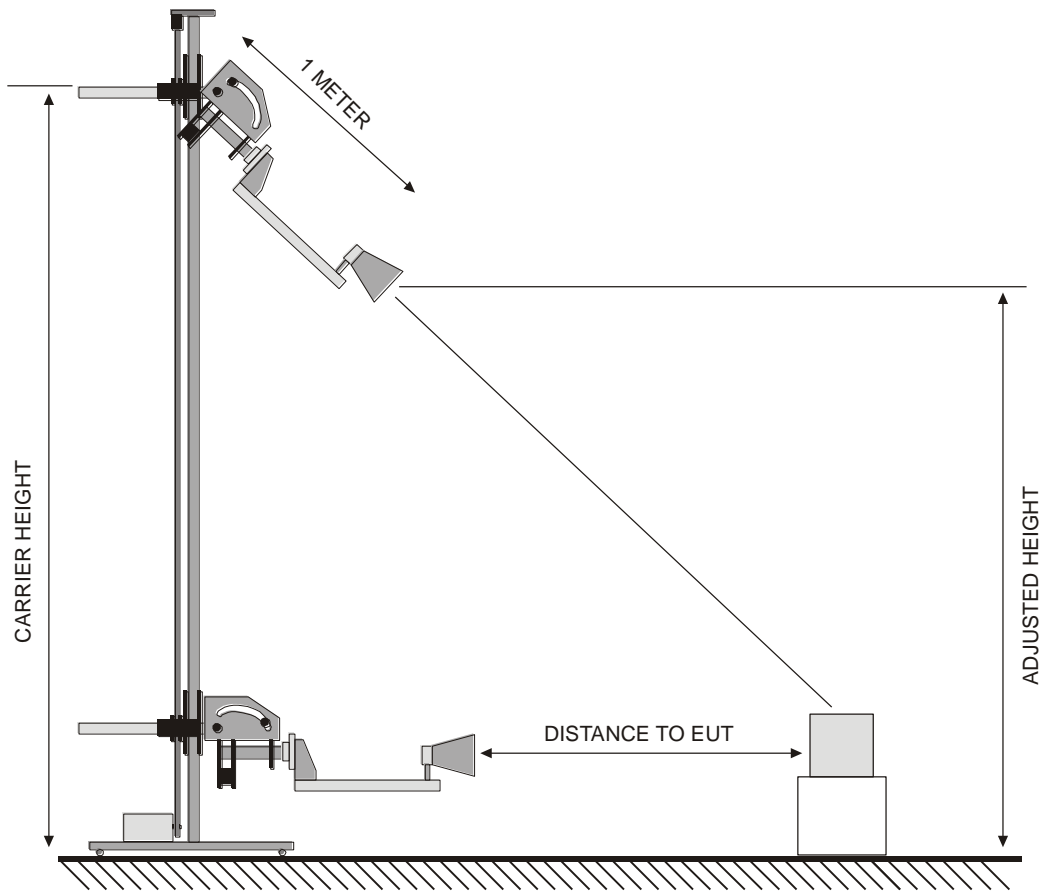
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The Model 2071 Bore-Sight Tower was developed to meet the requirements of radiated emission standards. The majority of mounting fixtures on towers position the antenna parallel to the ground plane and maintain this orientation while the carrier ascends and descends. The Bore Sight Tower positions the antenna so it is pointed at the EUT during the ascent and descent of the tower.

Bore Sight operation is necessary to meet measurement standard requirements such as VDE 0876 and ANSI C63.4-1992. During scans, the Bore Sight system maintains constant directional positioning while varying the angle between the antenna and the mast. The unit can be positioned to aim an antenna directly at the EUT, in accordance with ANSI C63.4-1992.

The ANSI C63.4-1992 standard requires a height scan of the measuring antenna. Maximum field might not be found when using a standard tower if a high gain antenna is used to measure emission from an EUT. The beam or major lobe of the pattern of any antenna used shall be large enough to encompass the EUT according to the C63.4 requirement for measurements. The beam or major lobe is large enough when measuring with dipoles, however other types of antennas may violate the requirement. C63.4 recommends a horn to be used as the measuring antenna.



**Figure 1. Bore-Sight Tower**

# PRECAUTIONS

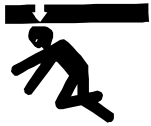
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Read this manual completely before starting installation.



As with any electrical equipment, do not attempt to service this unit until all electrical power has been disconnected.

Stay clear of all moving components on this equipment.



Do not, at any time, stand underneath the carrier whether moving or stationary.

Disconnect all air supply lines when servicing pneumatic components.

Service equipment in accordance with the maintenance schedule provided.



Do not make any modifications to this unit without consulting the factory directly.

Always use guy ropes provided for outdoor installations and check them periodically for wear.

Only use replacement parts and fasteners ordered directly from the factory.



This equipment should be operated only by qualified personnel.

# ELECTRICAL INSTALLATION

The tower motor base is provided with an input AC power cord that is approximately 2.45 M (8 feet) long. This power cord is suitable for portable or indoor applications without modification.



If this equipment is to be installed outdoors, a qualified, licensed electrician should perform the installation. In the event that modifications are required, the installation should be compliant with all local and national electrical safety codes.



**WARNING** As with all electrical devices, power should be disconnected prior to servicing the equipment.

Whenever possible the motor should be powered from a separate branch circuit of adequate capacity to keep voltage drop to a minimum during startup and running. For longer runs, increase the wire size in accordance with the wire selection guide shown below. Never use smaller than 14 AWG for any installation.

<b>Length of wire @ 115V</b>	0-15.24 m (0-50 ft)	15.24-30.48m (50-100 ft)	30.48-60.96 m (100-200 ft)
<b>Wire gauge required</b>	14 AWG	10 AWG	8 AWG

<b>Length of wire @ 220V</b>	0-15.24 m (0-50 ft)	15.24-30.48m (50-100 ft)	30.48-60.96 m (100-200 ft)
<b>Wire gauge required</b>	14 AWG	14 AWG	14 AWG

If the power cord needs to be replaced, it is recommended that this alteration be performed at the factory. However, if it is necessary to modify the electrical cord on site, a qualified, licensed electrician should perform this operation.

### To remove the power input cord:

1. Disconnect the power cord from the supply mains.



2. Remove the clamps that secure the enclosure cover plate in place and lift the lid.
3. Loosen the plastic strain relief that is around the power cord on the exterior of the unit.
4. Using a Phillips head screwdriver locate and remove the ten screws around the edge of the motor base face plate. Gently remove the face plate and set it down in front of the opening. **IMPORTANT** Do not pull the faceplate away quickly as there are wires that connect to the faceplate that should remain intact during this procedure.
5. The large green circuit board inside the enclosure is connected to the enclosure via an L-shaped bracket. It will be necessary to remove the bracket and circuit board assembly in order to gain access to the wires connected to the base of the filter. Locate the two screws that secure the L-shaped bracket in place, loosen and remove them. Then **CAREFULLY** slide the circuit board assembly and the bracket upwards so the unit rests on top of the encoder assembly. Do not yank or force the circuit board while pulling it upward as rough handling will likely loosen or damage the internal wiring of the motor base.
6. Remove the two screws that secure the protective earth wires to the enclosure, so you can gain access to the bottom terminals on the power filter. Note the toothed washer between each terminal ring and the enclosure body as these will need to be replaced in the same location when it is time to reassemble the unit.
7. Again using a Phillips head screwdriver locate and remove the four screws on the side of the enclosure by the belt tension idler, this will release the power filter from the side of the enclosure. Do not attempt to pull the power filter out of the enclosure as it is connected to several wires in the unit. Instead tilt the filter so you can see the terminals on the base.

The electrical wiring color code used by ETS-Lindgren for this unit is:

**Brown – Hot**

**Blue – Neutral**

**Green with yellow stripe – Protective Earth**

8. Note which terminal is hot and which one is neutral. Remove the heat shrink tubing and unsolder the hot and neutral terminals. Remove the power cord from the enclosure.
9. The strain relief is properly sized for a standard ½ inch electrical conduit fitting. If the unit will be exposed to moist environmental conditions an appropriate metal (with rubber coating) conduit fitting should be attached in the strain relief hole. Moisture should not be allowed to penetrate the motor base enclosure as it could damage the components inside.
10. Keep the lead length inside the enclosure to no longer than 4 inches to maintain good EMC performance. The distance from the opening in the conduit fitting to the filter should remain less than 10 cm (4 inches).
11. Insert the end of the new cord into the enclosure through the conduit fitting. Solder the new hot and neutral wires to the corresponding terminals. Insulate the connections either with heat shrink tubing as they were before or with electrical tape.
12. Reconnect both protective earthings, with one terminal ring per grounding point. Remember to include the tooth washers between the terminal ring and the enclosure body when inserting and tightening the screws.

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**CAUTION** Properly terminate the safety ground wires in the positions provide for connection of the protective earth conductor.

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13. Tilt the power filter back into place, align the holes on the enclosure with the holes on the filter plate, insert and tighten the four screws that hold the filter in place.
14. Carefully slide the circuit board back into the enclosure, taking care not to pull any wires loose, or leave any wires under the L-shaped bracket. Secure the board and bracket on the base of the enclosure using the two screws you removed earlier.

15. Next, slide the front panel back into place and reinsert the ten screws that secure it in place. Don't forget to also reattach the P-clip that is held in place by one of the screws.
16. Finally close the lid, move the clamps that secure it back into place, and tighten the screw in each clip to firmly seal the lid in place.

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**CAUTION** Prior to applying power, check the position of the voltage select switches on the front of the enclosure.

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## CONNECTING THE MODEL 2090 POSITIONING CONTROLLER

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Any combination of primary devices (towers, turntables, reverberation paddles, MAPS, etc.) can be connected to the two Device Interface ports located on the rear panel of the controller. For easy set up of an EMC facility, it is recommended that the tower be connected to the Device 1 interface port. The controllers default settings are for a tower connected to the Device 1 interface port and a turntable connected to the Device 2 port.

Primary device connection is accomplished by way of a dual fiber cable included with the device. This cable terminates into two ST connectors that are identical at both ends. The cable is symmetrical; either end can be connected to the controller. A fiber optic cable that is connect to the IN port of a device should, at the other end, be connected to the primary OUT port of the motor base. A fiber connected to the OUT port of the device should, at the other end, be connected to the primary IN port of the motor base. Older motor base designs have only one fiber optic connector pair, while the newest motor base interface provides a secondary interface reserved for future expansion.

NOTE: Fiber optic cabling for each device should not be allowed to hang unsupported from the rear panel of the controller. The fibers and connectors are easily broken if twisted or bent too much. Keep the fiber optic cables as straight as possible from the connector to the protective sheath.

Using the Model 2090 Position Controller (or hand controller), rotate the motor base shaft to verify proper operation. Find the travel (mechanical) limit adjustment knobs on the side of the motor base enclosure. To increase the amount of travel in either direction, turn the knob in the direction indicated by the positive (+) sign. To decrease the amount of travel in either direction, turn the knob in direction indicated by the minus (-) sign.

Run the motor base down to the lower limit CCW and then back it off from the lower limit just a bit. This step will help after the tower is assembled and it is time to set the vertical travel limits. Disconnect the power for the Model 2090 and the motor base before proceeding with the assembly of the tower. Disconnect the fiber optic cables from the units so they will not be damaged during installation.

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**CAUTION** The limits must be set whether or not the soft limits in the 2090 controller are used. Failure to do so may cause damage due to overrun of the tower. Ensure the travel limit settings will not cause damage to user installed cables and equipment mounted on the tower.

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# ASSEMBLY INSTRUCTIONS FOR A TOWER WITHOUT A BORE-SIGHT

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## MODELS 2070-1 AND 2070-2

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**Tools needed for assembly:**

300mm adjustable wrench (provided)

Sawhorse or work bench

Medium sized level

1. The tower should be assembled in the location where it will be used unless there is a doorway to accommodate the unit. If movement to another location is necessary, partial disassembly of the unit will be required for it to fit through most doorways.
2. Uncrate all parts. NOTE: Do not discard any packing material until the unit is fully assembled as you may discard something you will need. Check all parts for any shipping damage.

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**CAUTION** Set voltage select switches to 110V or 220V depending on your power source.

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3. The Motor Base Unit of the Antenna Tower allows for the selection of either 110V or 220V mains input voltage. This selection should be made during installation and prior to connecting the Motor Base Unit to the power mains. Review and follow the instructions in the “Electrical Installation” section before applying power to the unit.
4. Tilt the lower mast section to a vertical position and insert the vertical locking pin attached to the mast support angles.
5. Carefully slide the carrier unit onto the lower mast section in a position so that the belt clamp on the carrier is directly over the drive pulley on the motor base.
6. Install the next mast section taking care to align the identification markers (circles) on the mast.
7. Tilt the mast down by pulling the vertical locking pin, lifting the carrier and leaning the mast over, until the mast rests on the sawhorse.

8. Install the remaining mast sections with the pulley on the top mast section facing the pulley on the motor. **NOTE:** Install the pulley section only for 4 meter height, the center and pulley sections for 6 meter height.
9. **NOTE:** Skip this step for indoor installations. In the top cap of the mast there are three rope holes. Insert the guy ropes through these holes and knot the ends so they will not slide back through the holes. Unwind the ropes so they can be accessed when the tower is returned to the vertical position.
10. Install the drive belt with the teeth always facing each other. Feed the belt through the outer clamp slot on the carrier, around the mast pulley and back down so both ends can be accessed when the tower is vertical. Temporarily tape the two ends together so the drive belt does not slide out of the pulley while the mast is being raised.
11. Slowly raise the mast to the vertical position, taking care so it does not collide with anything, and insert the vertical locking pin attached to the mast support angles at the base.
12. **NOTE:** Skip this step for indoor installations. Anchor the guy ropes so that when they are tight, they will not interfere with the operation of the tower as the carrier raises and lowers. In all outdoor installations use the guy ropes supplied. At this point the tower should be perfectly level.
13. Connect fiber optic cables between the motor and the Model 2090 Positioning Controller and supply power to the controller and the motor. **CAUTION:** Make sure the voltage select switches are set to the correct voltage before applying power to either unit. See the Electrical Installation section for more information on selecting the voltage. **IMPORTANT:** The fiber optic cable must be looped through the “P” clip installed on the front panel of the motor base. Failure to do so will increase the chance of the fiber optic cable being accidentally pulled thus breaking the fiber optic connectors. If you have a hand-held controller, you may connect it at this time.
14. Turn the down limit switch knob on the side of the motor base in the positive (+) direction until it stops, then turn it in the minus (-) direction two complete turns.

15. Using the Model 2090 Positioning Controller or the hand control unit, run the motor in the down direction until it reaches the mechanical limit.
16. Attached to one end of the boom unit is a cable guide which reduces the stress on the antenna feed cable. The cable guide must be removed to install the boom. Remove the bolts that hold the cable guide in place, and set the unit to the side. Slide the end of the boom that the cable guide was attached to through the receptacle hole on the carrier so that the cable guide will be on the same side of the tower as the motor base. When the center block reaches the carrier, tighten the hand knobs provided to secure the boom in place. For the Model 2070-2 with air polarization, instead of hand knobs there are two set screws located in the boom collar on the carrier. Tighten these two screws at this time to secure the boom in place. Reinstall the cable guide.
17. Block the carrier so that the reference point on the largest antenna you use will be set at 1 meter. Use a piece of wood under the carrier to support it at this height.
18. Carefully pull the belt tension idler on the motor base back and insert a screwdriver through the hole in the guard plate to secure it in place.
19. Continue routing the drive belt around the motor pulley, and through the inner clamp slot on the carrier, until approximately ten centimeters (three inches) of belt is through the clamp. If you have not done so yet, remove the tape that was placed on the drive belt in step 10.
20. After the belt is threaded in place, it is ready for tightening. During tightening, the tension idler wheel should be out of the way and should not press against the belt. To disengage the idler from the belt, carefully pull the belt tension idler back and insert a screwdriver through the hole in the guards plate to secure it in place. An alternative is to remove the tension spring.
21. To tighten the drive belt, the short end of the belt coming up from the motor pulley can be pulled upwards and the upper clamp block (the one with a single groove) can be installed to lock this end of the belt in place. The other end of the belt from

the top pulley should be inserted into the smooth side of the clamp block and can be pulled downward by pressing down with a foot. NOTE: The clamp blocks should be oriented so the one with a single groove is on top of the carrier clamp and the one with two grooves is on the bottom. On both clamp blocks the set screws should be oriented so they can be tightened against the middle clamp. The center plate on each clamp block should be oriented so it engages the teeth of the drive belt, and so the grooves on the sides are aligned.

22. The drive belt needs to be tensioned with approximately 100-150 lbs of pull on each end and the clamp nuts tightened to secure the belt. Use 11 N-m (100 in-lbs) torque on the ½ inch flanged heavy nuts and approx 7 N-m (60 in-lbs) on the jam nuts. **IMPORTANT:** On older towers, the clamp nuts are 3/8 inch and require 6 N-m (50 in-lbs).
23. The lower tooth clamp block can now be installed on the belt. Use a screwdriver to tighten the setscrews in the upper and lower tooth clamps against the main clamp. If the gap is more than 10 mm the tooth clamp can be moved closer. **IMPORTANT:** The setscrews on the tooth clamps should be tight against the main clamp to help prevent the belt from loosening.
24. The belt tension idler should now be carefully moved into place against the drive belt, and the spring re-installed if it was removed. The tension idler should be free on its pivot and the spring should force it against the belt.
25. With the proper belt tension and with no load on the boom, the idler should be stopped at approximately 30 mm (1.2 in) from reaching the end of its travel against the motor pulley. If the idler where is against the pulley, the belt needs to be retightened to prevent slack when loads are applied to the boom. As the boom is loaded the tension idler needs to move closer and take up the slack as the mast deflects under load.
26. The tower is ready to operate after the upper mechanical limit is set. See section on setting the mechanical limits.

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**CAUTION** Do not operate the tower until after setting the upper mechanical limit.

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# ASSEMBLY INSTRUCTIONS FOR THE BORE-SIGHT TOWER

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## MODEL 2071

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**Tools needed for assembly:**

300mm adjustable wrench (provided)

Saw horse or work bench

Medium sized level

1. The tower should be assembled in the location where it will be used unless there is a doorway to accommodate the unit. If movement to another location is necessary, partial disassembly of the unit will be required for it to fit through most doorways.
2. Uncrate all parts. NOTE: Do not discard any packing material until the unit is fully assembled as you may discard something you will need. Check all parts for any shipping damage.

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**CAUTION** Set voltage select switches to 110V or 220V depending on your power source.

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3. The Motor Base Unit of the Antenna Tower allows for the selection of either 110V or 220V mains input voltage. This selection should be made during installation and prior to connecting the Motor Base Unit to the power mains. Review and follow the instructions in the “Electrical Installation” section before applying power to the unit.
4. Tilt the lower mast section to a vertical position and insert the vertical locking pin attached to the mast support angles.
5. Carefully slide the carrier unit onto the lower mast section in a position so that the belt clamp on the carrier is directly over the drive pulley on the motor base.

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**CAUTION** Do not allow the air lines to become entangled in the assembly or twisted around the mast during the assembly process.

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6. Install the next mast section taking care to align the identification markers (circles) on the mast.

7. Tilt the mast down by pulling the vertical locking pin, lifting the carrier and leaning the mast over, until the mast rests on the saw horse.
8. Install the remaining mast sections with the pulley on the top mast section facing the pulley on the motor. NOTE: Install the pulley section only for 4 meter height, the center and pulley sections for 6 meter height.
9. NOTE: Skip this step for indoor installations. In the top cap of the mast there are three rope holes. Insert the guy ropes through these holes and knot the ends so they will not slide back through the holes. Unwind the ropes so they can be accessed when the tower is returned to the vertical position.
10. Install the drive belt with the teeth always facing each other. Feed the belt through the outer clamp slot on the carrier, around the mast pulley and back down so both ends can be accessed when the tower is vertical. Temporarily tape the two ends together so the drive belt does not slide out of the pulley while the mast is being raised.
11. Slowly raise the mast to the vertical position, taking care so it does not collide with anything, and insert the vertical locking pin attached to the mast support angles at the base.
12. NOTE: Skip this step for indoor installations. Anchor the guy ropes so that then they are tight, they will not interfere with the operation of the tower as the carrier raises and lowers. In all outdoor installations use the guy ropes supplied. At this point the tower should be perfectly level.
13. Connect fiber optic cables between the motor and the Model 2090 Positioning Controller and supply power to the controller and the motor. **CAUTION:** Make sure the voltage select switches are set to the correct voltage before applying power to either unit. See the Electrical Installation section for more information on selecting the voltage and connecting fiber optic cables. **IMPORTANT:** The fiber optic cable must be looped through the “P” clip installed on the front panel of the motor base. Failure to do so will increase the chance of the fiber optic cable being accidentally pulled, thus breaking the fiber optic connectors. If you have a hand-held controller, you may connect it at this time.

14. Turn the down limit switch knob on the side of the motor base in the positive (+) direction until it stops, then turn it in the minus (-) direction two complete turns.
15. Using the Model 2090 Positioning Controller or the hand control unit, run the motor in the down direction until it reaches the mechanical limit.
16. Locate the boom section that has a cable guide attached at one end. To connect this piece, slide it into the receptacle slot, and around the threaded rod, on the carrier above the motor base. Secure the boom section in place by tightening the four retaining nuts to approximately 11 N-m (100 inch-pounds).
17. To complete the boom assembly, locate the remaining boom piece. On the front of the bore-sight unit there are two knobs that must be removed to attach the boom. Align the holes on the boom bracket with the holes for the knobs you just removed and insert and tighten the knobs to secure the boom in place.
18. Install knobs, poly springs and thrust washers, with spacers between cams and boom. NOTE: To disengage the Bore-Sight, move these knobs to the stop block through the extra hole provided in the cam.

---

**WARNING** Always securely tighten any antenna mount when using the Bore-Sight to prevent injury to personnel and damage to antennas or the antenna positioner.

---

19. The starting height for antennas is typically 1 meter above the ground plane. Position the carrier so that the centerline of the polarization is set at about one meter when the lower limit is reached. Beyond this point the lower limit should not be adjusted down except in small increments. Use a piece of wood under the carrier to support it at this height.
20. Remove the pinch plates/rollers by removing the four 3/8-16 nuts retaining them.
21. Now that you have exposed the bore sprocket, you will need to turn it until the extra hole in the cam and the stop block are in perfect alignment. NOTE: While doing this, the stop knobs, poly springs and thrust washers should be in the bore-sight position. Be careful not to turn this sprocket again while

- performing the rest of the assembly as this will result in the misalignment of the Bore-Sight system.
22. Carefully pull the belt tension idler on the motor base back and insert a screwdriver through the hole in the guard plate to secure it in place.
  23. Route the belt coming from the mast pulley around the top idler, around the bore sprocket, and around the lower idler.
  24. Continue routing the drive belt around the motor pulley, and through the inner clamp slot, on the carrier clamp block, until approximately ten centimeters (three inches) of the belt are through the clamp.
  25. Remove all the slack to the nearest tooth between the motor and the bore sprocket. Tighten the belt by pulling the short end tight to the motor sprocket. Using your foot put approximately 45 kg (100 lbs) pressure on the starting end of the drive belt.
  26. With the short end of the belt coming up from the motor pulley and through the inner slot on the clamp block, the upper toothed clamp block (the one with a single groove in the side) can be installed to lock this end of the belt in place. **NOTE:** The clamp blocks should be oriented so the one with a single groove is on top of the carrier clamp block and the one with two grooves is on the bottom. On both clamp blocks the set screws should be oriented so they can be tightened against the carrier clamp. The center plate on each of the toothed clamp blocks should be oriented so it engages the teeth of the drive belt and so the grooves on the side line up.
  27. The drive belt needs to be tensioned with approximately 100-150 lbs of pull on each end and the carrier clamp nuts tightened to secure the belt. Use 11 N-m (100 inch-pounds) torque on the ½ inch flanged heavy nuts and approximately 7 N-m (60 inch-pounds) on the jam nuts. **IMPORTANT:** On older towers, the clamp nuts are 3/8 inch and require 6 N-m (50 inch-pounds).
  28. The lower toothed clamp block can now be installed on the belt. Once it is secured in place, use a screwdriver to tighten the two setscrews in the upper and lower tooth clamps against the main clamp. If the gap is more than 10 mm the tooth clamp can be moved closer. **CAUTION:** The setscrews in the tooth

clamps should be tight against the main clamp to help prevent the belt from loosening.

29. The belt tension idler should now be carefully moved into place against the drive belt, and the spring reinstalled if it was removed. The tension idler should be free on its pivot and the spring should force it against the belt.
30. Replace the pinch plates/rollers removed in step 21 Tighten the four screws to 6.7 N-m or 60 inch-pounds.
31. The tower is ready to operate after the upper mechanical limit is set. (See section on setting the mechanical limits.)

---

**CAUTION** Do not operate the tower until after the upper mechanical limit is set.

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# THE AIR POLARIZATION ASSEMBLY

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The automated air polarization assembly includes variable speed polarization cycling using flow control valves. The air cylinder is made of non-conductive material and will polarize the largest antenna recommended for the tower. The polarization speed range is 3° to 30° per second.

An air supply of 414-551 kPa (60-80 psi) is needed for this feature. It is important to have clean and dry air; so we recommend the use of a 40 micron filter in close proximity to the motor base.

Ten meters of UV stabilized air hose is included as well as a 1/8 inch NPT fitting. A metric fitting for a 4 mm tube may be supplied by the customer.

The air cylinder assembly drawing 103794 has been included in the manual for reference and part replacement requirements.

To connect the air line to the motor base, simply push the hose provided onto the fitting on the front of the motor base. The air supply pressure should be 414-551 kPa (60-80 psi). The air cylinder uses a special o-ring lubricant; during maintenance this lubricant should be applied to prevent excessive wear of the o-rings.

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## MODEL 2070-2

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The air polarization assembly is designed for convenience and ease of addition to a tower which does not have the polarization option.

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## MODEL 2071

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The Bore-Sight Tower includes an adjustment for centerline polarization, which is changed by loosening the two adjustment knobs on the face plate and sliding the boom up and down to center the antenna-in-use with the rotational centerline.

This assembly mounts directly on the cams in use with 12 each 3/8-16x1” bolts. Coax cable used on the antenna can be routed through the rotation tube directly into the antenna.

---

# SETTING MECHANICAL LIMITS

---

The mechanical limits on the 2070 antenna positioner have been changed for user convenience and ease of operation. These limit adjustments are located outside the motor enclosure, opposite the motor output pulley. The lower-limit switch should be set according to the assembly instruction and should remain set the same with only minor adjustments for Bore-Sight alignment, if you have the Model 2071. Before the upper mechanical limit is set, you will need to understand the symbols located above the limit adjustment knobs.

To increase the amount of travel in either direction, turn the top of the knob in the direction indicated by the positive (+) sign. To decrease the amount of travel in either direction you must turn the top of the knob in the minus (-) direction.

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**WARNING** You should never be directly underneath the carrier at any time. A falling carrier/boom assembly can cause serious injury.

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Turn the upper limit in the (-) direction until the carrier will stop one meter below your absolute top position. (Remaining this far away from your upper limit position will ensure that you do not damage the tower while setting the travel limits.) Then, running the carrier up and down, adjust the upper limit in the (+) direction until the desired upper limit is reached.

Whether or not the soft limits present in the Model 2090 Positioning Controller are used, you must set the mechanical limits for safety.



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# ABOUT THE BRAKE

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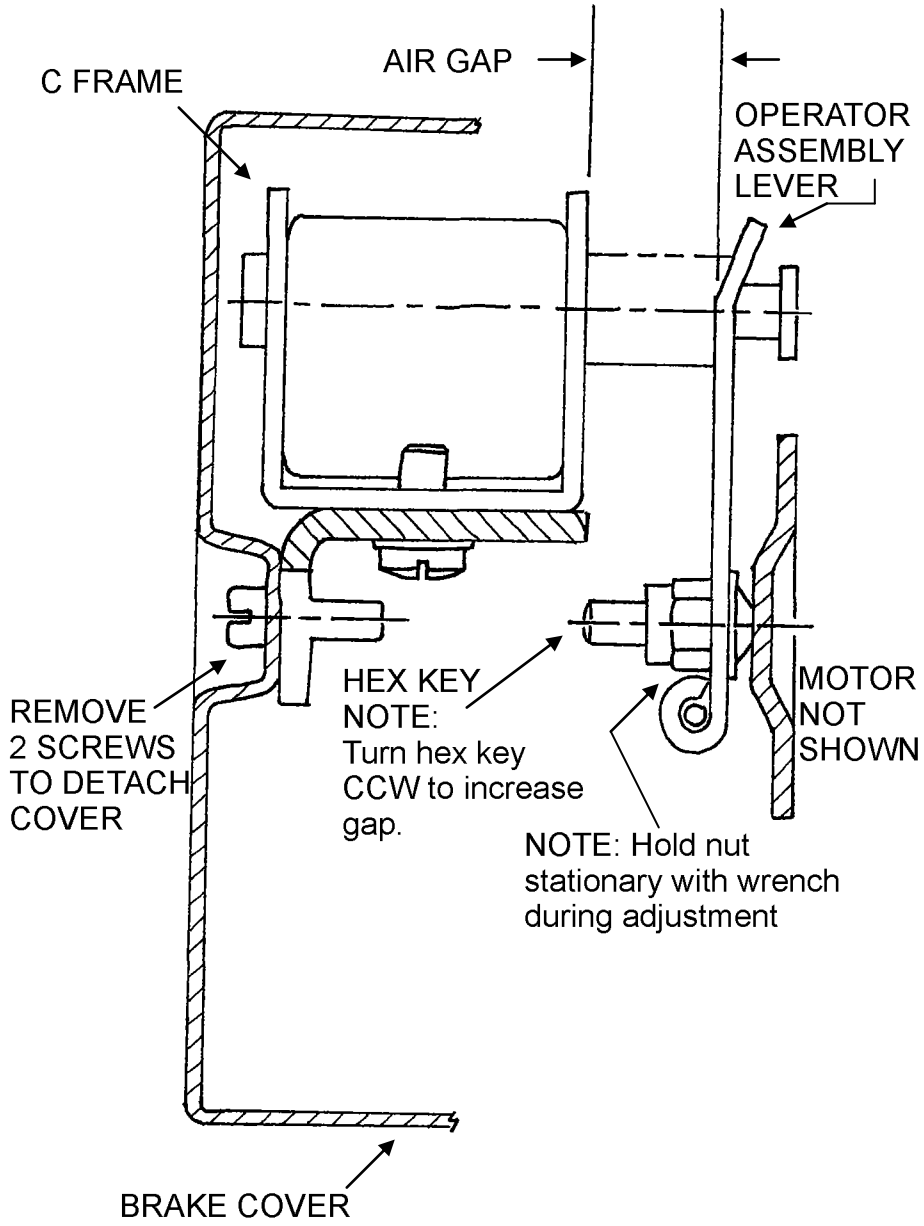
**CAUTION** Before making any adjustments, disconnect power from the unit.

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The tower uses a fractional horsepower motor with gear reduction. This motor is supplied with a safety brake which holds the carrier at the right position until another command is received. To adjust the brake, remove the brake access cover and open the top of the motor enclosure. Disconnect the air hoses from the solenoid valve which is routed in back of the brake. Remove the brake cover (attached by the two slotted screws). Insert an Allen wrench into the adjusting screw and turn clockwise until the air gap is approximately 8.7 mm (11/32 in). This gap is measured between the operator assembly lever and the “C” frame at the center line of the plunger.

NOTE: The dimension for the air gap is a nominal position. Observe the motor starting characteristics after adjusting the gap. The motor should start quickly. If not, increase the air gap by turning the adjusting screw counter-clockwise increments.

After the adjustment is complete, replace the brake cover, reconnect the air lines, close and clamp the top of the motor enclosure and replace the brake access cover.



# OPERATION

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## EDITING MODEL 2090 POSITIONING CONTROLLER CONFIGURATION PARAMETERS

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To edit a configuration parameter, press the **PARAM** key to display the current parameter. Pressing the **PARAM** key repeatedly will scroll down through the parameter list, showing each parameter in turn. While viewing a parameter, the **STEP** keys (**INC/DEC**) may be used to scroll up or down the parameter list. This reduces the effort necessary to scan through a long parameter list using the **PARAM** key. Pressing any of the **LIMIT/POSITION** selection keys will return the display to that selection. Pressing any of the remaining motion keys will return the display to the current position and execute that motion. Pressing the **PARAM** key again will return to the last displayed parameter in the list, allowing easy transition between parameter adjustment and device operation.

Once the desired limit, position or parameter is visible in the display window, pressing **INCRM**, **DECRM**, or **ENTER** will toggle into edit mode. The lowest adjustable digit will flash on and off. Pressing the **LOCAL** key for that device will switch the flashing digit to the next higher digit. In this way, it is possible to rapidly adjust any digit of a multi-digit parameter or limit.

## TOWER ENCODER CALIBRATION

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**C** Refers to the encoder calibration parameter. This setting is used to convert the encoder count values returned from a motor base into the corresponding centimeter or degree position reading. For towers, the number represents the number of encoder counts per meter. Using this parameter, a variety of standard, retrofit, and custom devices can be used. The setting for the Model 2070 series towers is :     2000

If the given value does not appear to work correctly, the encoder calibration value can be determined using the following procedure:

1. Set the encoder calibration value to 1000.
2. Insure that the tower is positioned to allow at least a meter of travel in the upward direction at an easily measurable height, and then set the current position reading to 000.0. *NOTE: It will be necessary to adjust the lower limit setting to allow this.*
3. Using the **STEP** keys, adjust the height of the carrier until it is one meter above the start point.
4. Record the reading of the display, ignoring the decimal point (i.e. 200.0 would be 2000). This is the encoder calibration value. *NOTE: If the value is below 1000, the resolution of the encoder is low and thus the 2090 will not provide 0.1 cm resolution, even though the display shows that digit. If the value has gone past 9999, the encoder has too many counts per meter and the 2090 can not correct for it. In this case, contact ETS-Lindgren for assistance.*
5. Enter this value for the encoder calibration value and reset the limits and position information.
6. Test the tower by moving it a known distance and comparing the display to the measured distance traveled. It may be necessary to adjust the encoder calibration value up or down slightly depending on the result.

## ANTENNA MOUNTING INSTRUCTIONS

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Antennas can be mounted to the assembly using either the 7/8-14 thread which is common on EMCO antennas, or the 1/4-20 thread which is another common size. The antenna should be mounted on the boom as close to the carrier as possible. Insert the mounting knobs through the holes on the boom and align the mounting holes on the antenna with the threaded end of the mounting knobs. Secure the antenna in place by tightening the threaded knobs into the receptacle mounting holes on the antenna.

## PRE-OPERATIONAL CHECKS

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Ensure that the voltage select switches on the motor base are set to the correct voltage.

Check to ensure that the power lines are connected for both the tower, controller and any other equipment you will be using to test.

Check the fiber optic cables, to ensure they are connected.

Ensure the antenna connected to the boom is securely mounted in place.

Connect the feed cable to the antenna.

Before moving the carrier on the mast up or down using the Model 2090 Controller or the Hand Control Unit ensure that there are no people standing near the boom.

## START-UP AND SAFE SHUTDOWN

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After completing the pre-operational checks, the Model 2090 can be turned on by pressing the power button. Please refer to the Model 2090 Positioning Controller operational manual for instructions on controlling the unit.

To shut the tower down, move the carrier to an accessible height for the removal of the antenna. Make sure the unit has come to a complete stop. Press the power button on the Model 2090 Positioning Controller to turn it off.

# HAND CONTROL UNIT INSTRUCTIONS

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To connect the hand control unit, remove the connector cap on the motor base (see 37). Plug the cable receptacle from the hand control unit into the motor base and screw connectors completely together. The unit is now ready to operate.

To allow the hand control unit to operate, simply push the control switch from MAIN to HAND. After this is done, any of the functions (UP, DOWN, and POLARITY) can be accessed.

**IMPORTANT** DO NOT PUSH THE UP AND DOWN BUTTONS AT THE SAME TIME. ALSO, BE SURE THAT THE MOTOR IS COMPLETELY STOPPED BEFORE REVERSING DIRECTION WITH THE UNIT.

When you are ready to switch back for automated testing, simply toggle the control switch from HAND to MAIN.

# SPECIFICATIONS

## ELECTRICAL

<b>Model</b>	<b>2070-1 / 2070-2 / 2071</b>
<b>Voltage</b>	115 / 230
<b>Amp</b>	3.4 / 2.6
<b>Line</b>	50 / 60
<b>Frequency</b>	
<b>Phase</b>	Single

## PHYSICAL

<b>Model</b>	<b>2070-1</b>	<b>2070-2</b>	<b>2071</b>
<b>Polarization</b>	Manual	3° – 30° per sec.	3° – 30° per sec.
<b>Scan Height</b>		7.0 m 22.96 ft	
<b>Weight</b>		86.2 kg 190.0 lb	
<b>Cross-Boom Loading</b>		10.4 kg 23.0 lb	
<b>Linear Velocity</b>		15.2 cm 6.0 in	

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# MAINTENANCE REQUIREMENTS

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## EVERY THREE MONTHS

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1. Inspect belt for wear and cracking.
2. Grease all parts identified as (AA –see drawings) if applicable.
3. Check all screws and bolts to insure that they remain tight per assembly instructions.
4. Inspect bolts and hardware for breakage.

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## EVERY SIX MONTHS

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1. Grease all parts identified as (BB-see drawings) if applicable.
2. Check guy ropes for tightness, cracking and de-lamination if applicable.
3. Check connecting control and all cables for degradation from environment and use. (Replace if necessary to insure safety per local electrical codes.)

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## EVERY TWELVE MONTHS

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Grease all carrier rollers, air cylinder and encoder center shaft (located inside motor cover).

Note: Use high grade silicone grease on all parts except air cylinder. Use only o-ring lubricant on air cylinder!

The air cylinder on the air polarization unit uses a special O-ring lubricant that can be purchased from any seal or bearing store. It can also be purchased from ETS-Lindgren please contact our Sales Department and request item number 890437.

During maintenance this lubricant should be used to prevent excessive wear of the o-rings. With proper care this unit should operate for years with trouble-free service.



# WARRANTY

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ETS-Lindgren L.P., hereinafter referred to as the Seller, warrants that standard EMCO products are free from defect in materials and workmanship for a period of two (2) years from date of shipment. Standard EMCO Products include the following:

- ❖ Antennas, Loops, Horns
- ❖ GTEM cells, TEM cells, Helmholtz Coils
- ❖ LISNs, PLISNs, Rejection cavities & Networks
- ❖ Towers, Turntables, Tripods, & Controllers
- ❖ Field Probes, Current Probes, Injection Probes

If the Buyer notifies the Seller of a defect within the warranty period, the Seller will, at the Seller's option, either repair and/or replace those products that prove to be defective.

There will be no charge for warranty services performed at the location the Seller designates. The Buyer must, however, prepay inbound shipping costs and any duties or taxes. The Seller will pay outbound shipping cost for a carrier of the Seller's choice, exclusive of any duties or taxes. If the Seller determines that warranty service can only be performed at the Buyer's location, the Buyer will not be charged for the Seller's travel related costs.

This warranty does not apply to:

- ❖ Normal wear and tear of materials
- ❖ Consumable items such as fuses, batteries, etc.
- ❖ Products that have been improperly installed, maintained or used
- ❖ Products which have been operated outside the specifications
- ❖ Products which have been modified without authorization
- ❖ Calibration of products, unless necessitated by defects

**THIS WARRANTY IS EXCLUSIVE. NO OTHER WARRANTY, WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE REMEDIES PROVIDED BY THIS WARRANTY ARE THE BUYER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT IS THE SELLER LIABLE FOR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO, DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.**

*Note: Please contact the Seller's sales department for a Return Materials Authorization (RMA) number before shipping equipment to us.*

# EUROPEAN COMMUNITY DECLARATION OF CONFORMITY

The EC Declaration of Conformity is the method by which EMC Test Systems, L.P. declares that the equipment listed on this document complies with the EMC directive.

**Factory:**

EMC Test Systems, L.P.  
P.O. Box 80589  
Austin, Texas USA  
78708-0589

**Issued by:**

EMC Test Systems, L.P.  
P.O. Box 80589  
Austin, Texas USA  
78708-0589

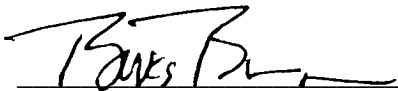
**The products manufactured under the EMCO product name and listed below are eligible to bear the EC Mark:**

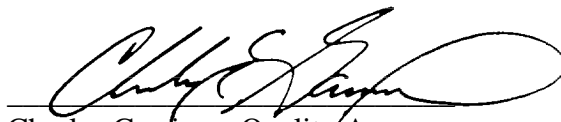
Model 2070 series Antenna Positioning Mast

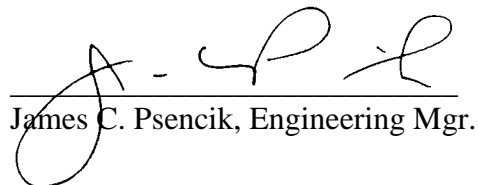
**Applicable Requirements:**

<u>Standard</u>	<u>Criteria</u>
EN55022	Class B
IEC 801-2	Level 2 4/8kV
IEC 801-3	Level 2 3V/m
IEC 801-4	Level 2 .5 I/O, 1kV AC

## Authorized Signatories

  
Bruce Butler, General Manager

  
Charles Garrison, Quality Assurance

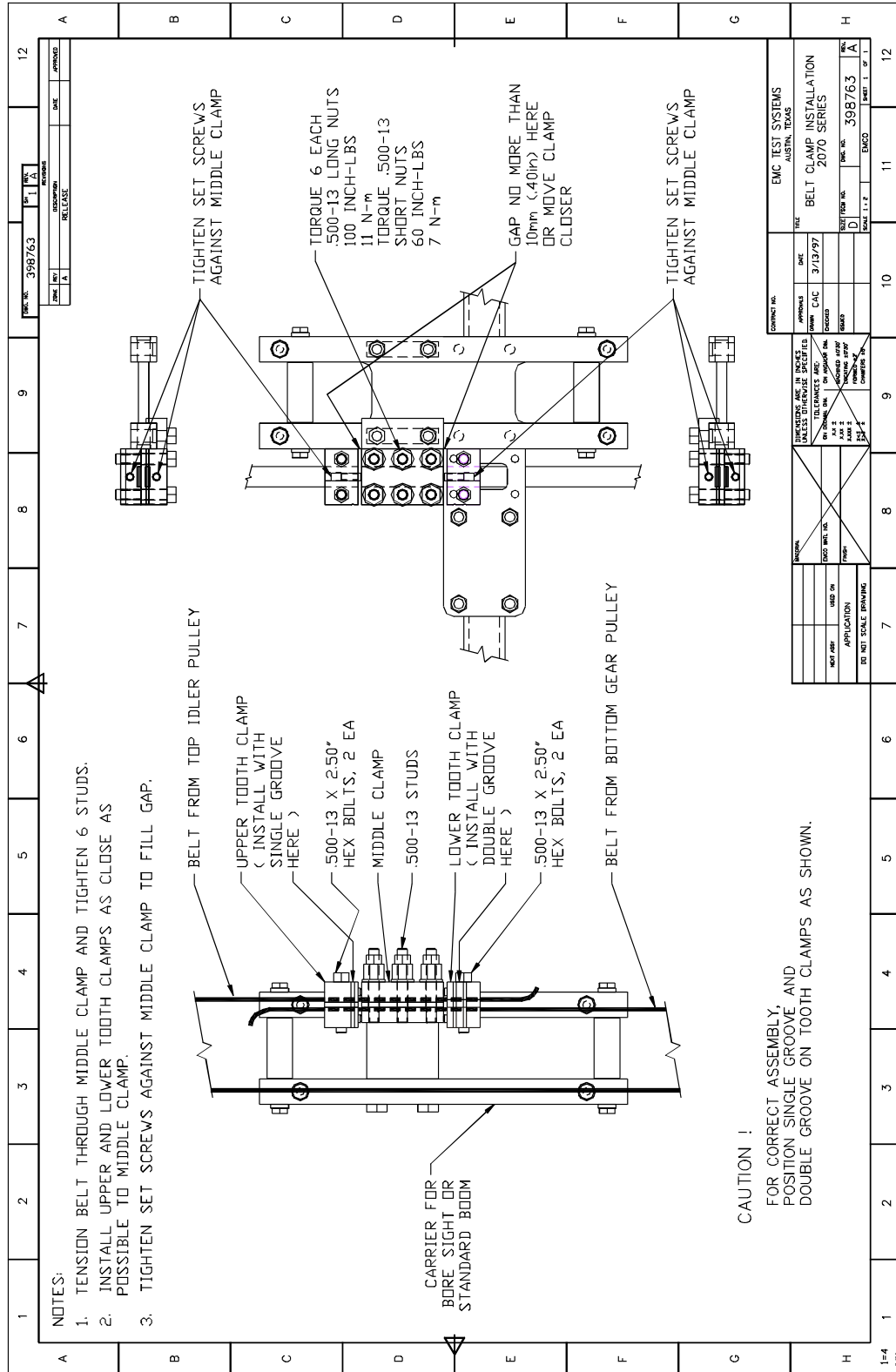
  
James C. Psencik, Engineering Mgr.

23 FEB 96  
**Date of Declaration**

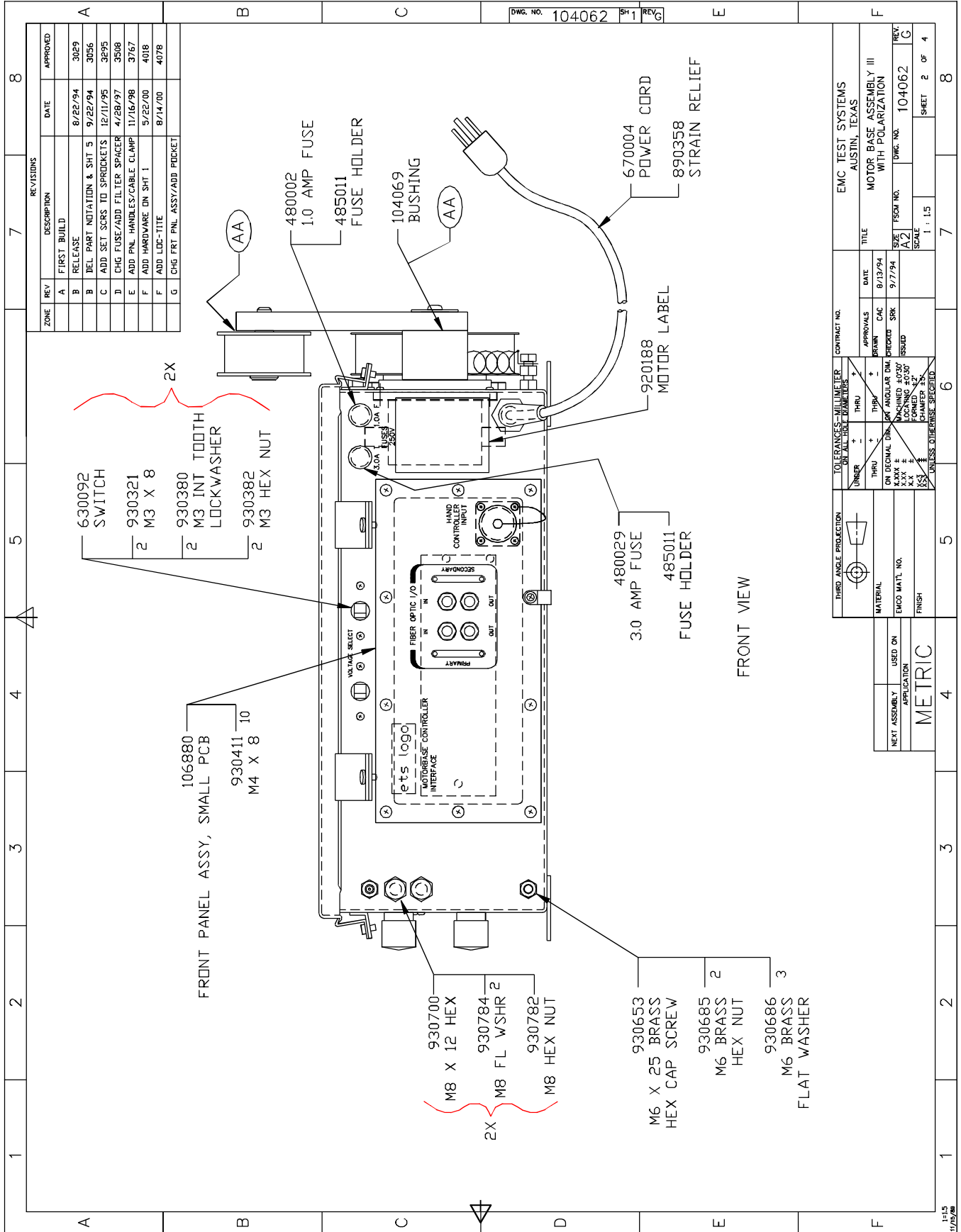
The authorizing signature or the EC Declaration of Conformity document authorizes EMC Test Systems, L.P. to affix the CE mark to the indicated product. CE marks placed on these products will be distinct and visible. Other marks or inscriptions liable to be confused with the CE mark will not be affixed to these products.

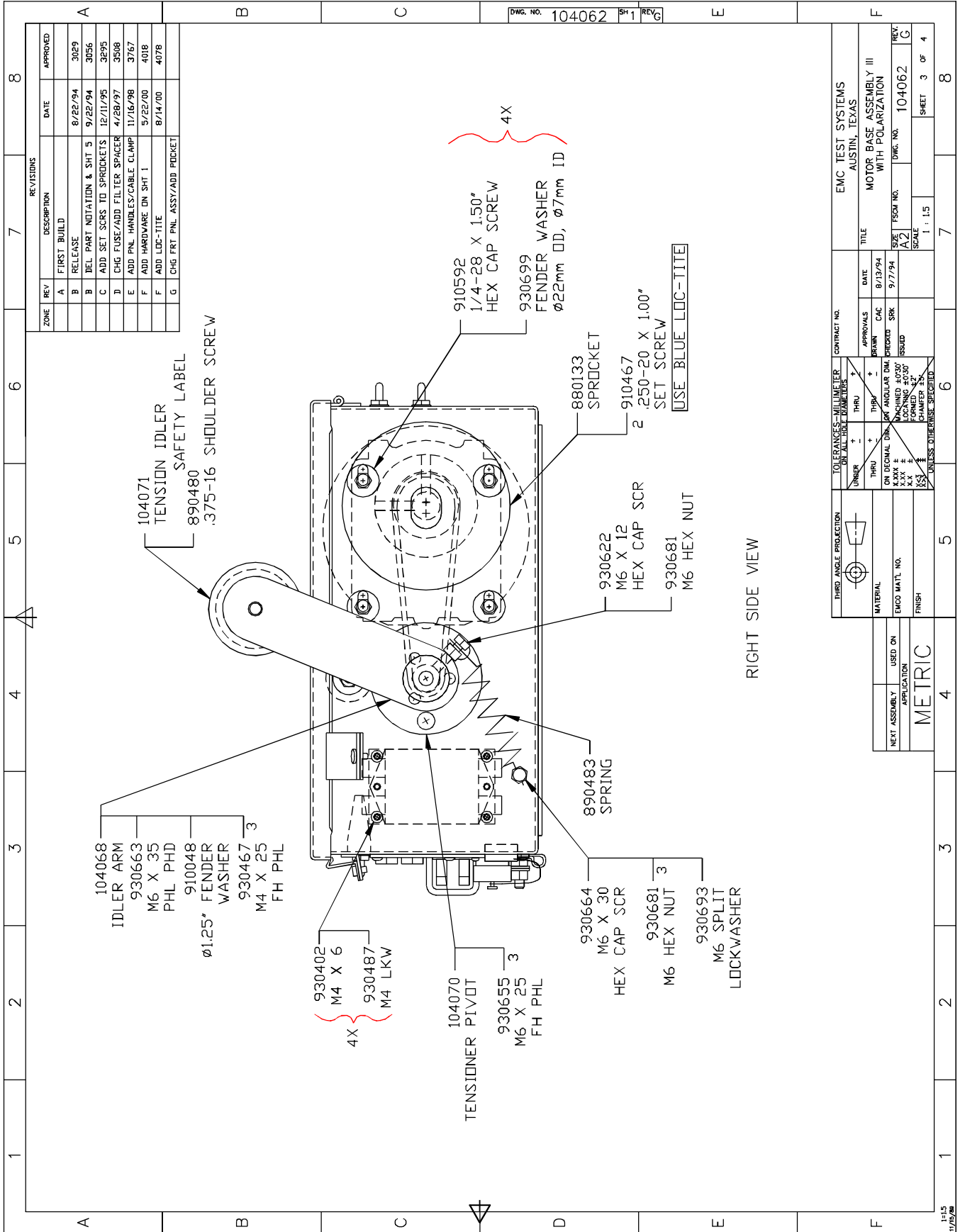
EMC Test Systems, L.P. has ensured that appropriate documentation shall remain available on premises for inspection and validation purposed for a period of no less than 10 years.

# ILLUSTRATIONS



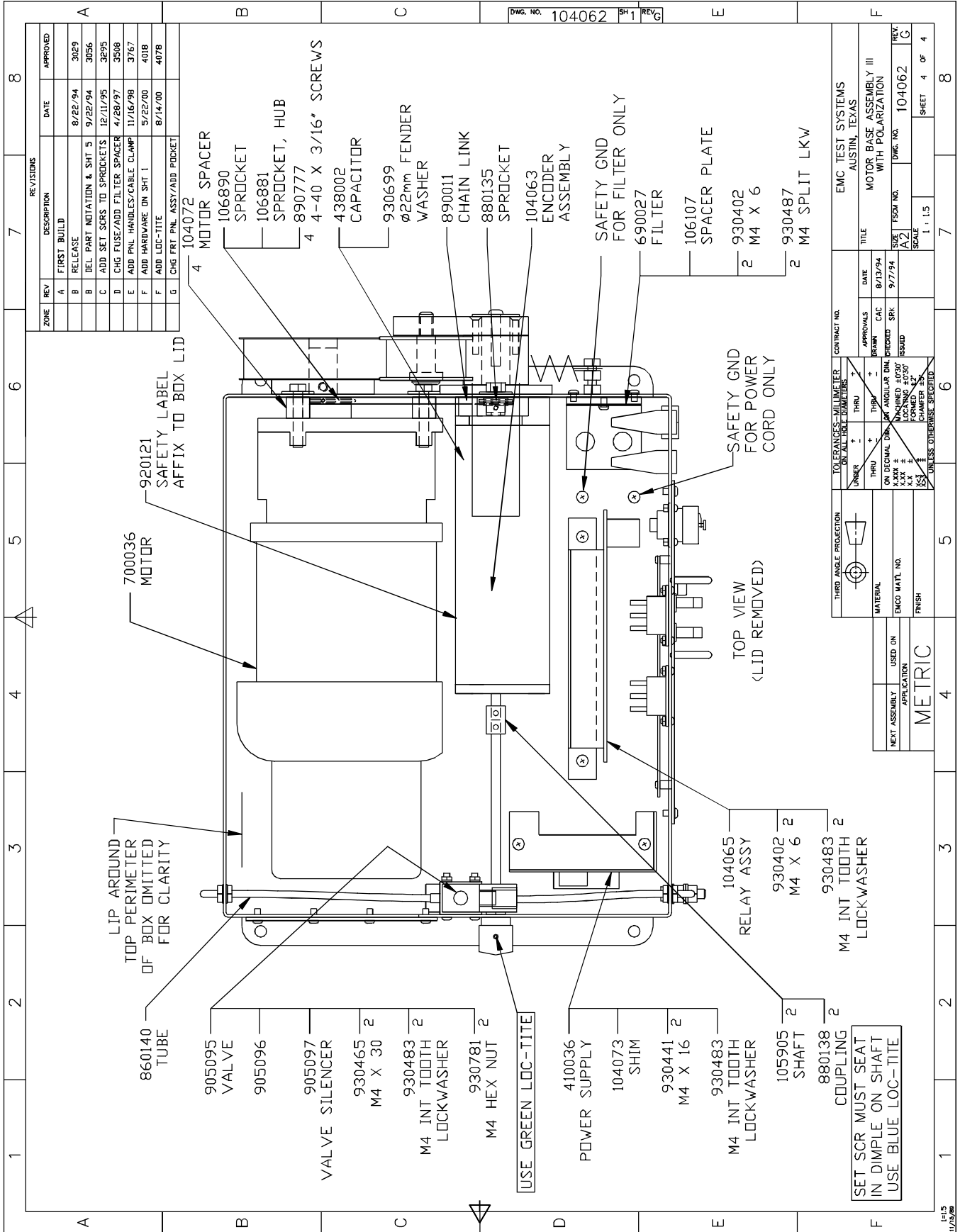


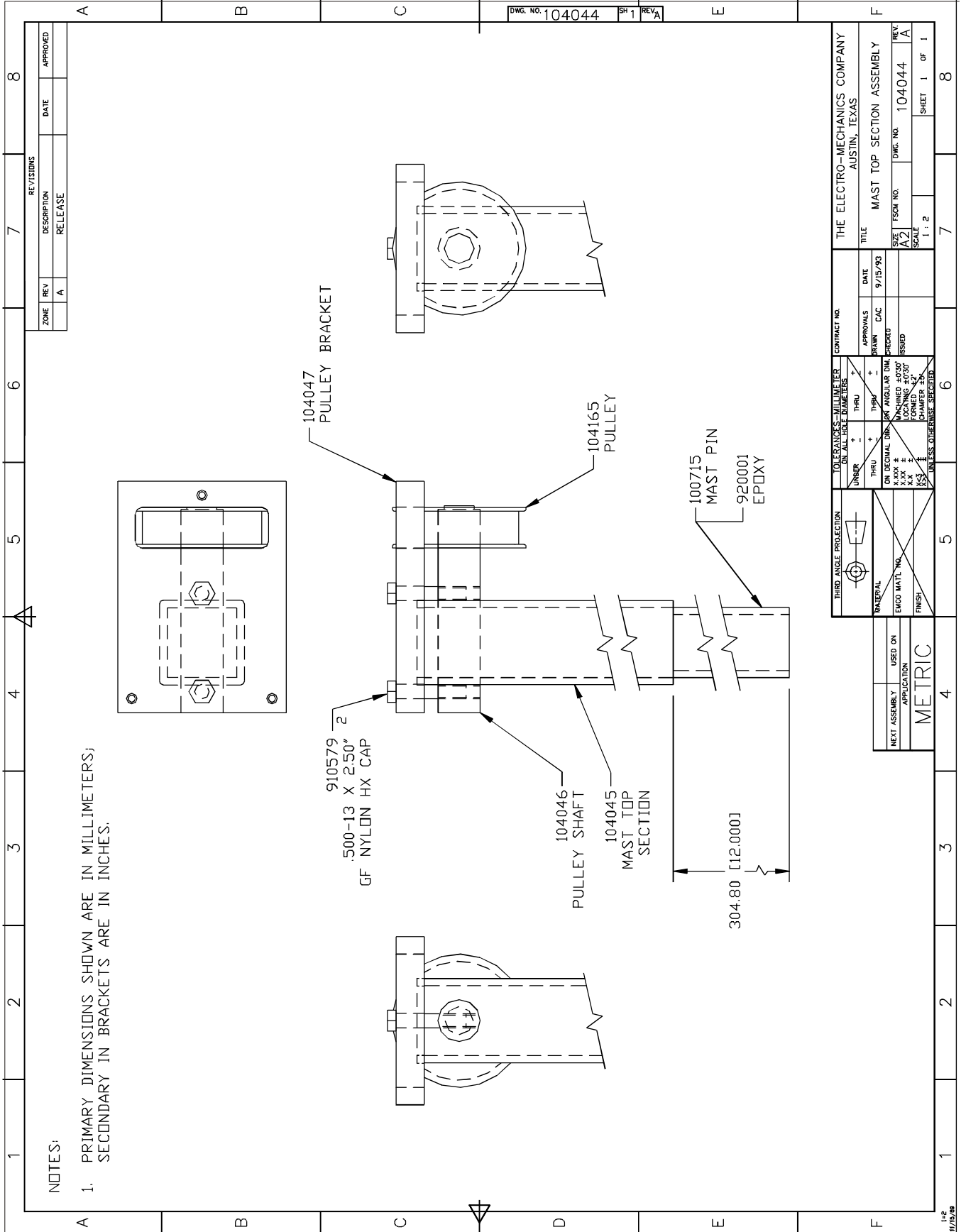




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A	1	FIRST BUILD		
B	2	RELEASE	8/22/94	3029
C	3	BEL PART NOTATION & SHT 5	9/22/94	3056
D	4	ADD SET SCRS TO SPRCKETS	12/11/95	3295
E	5	CHG FUSE/ADD FILTER SPACER	4/28/97	3508
F	6	ADD PNL HANDLES/CABLE CLAMP	11/16/98	3767
G	7	ADD HARDWARE DN SHT 1	5/22/00	4018
H	8	ADD LOC-TITE	8/14/00	4078
I	9	CHG FRT PNL ASSY/ADD POCKET		

TOLERANCES - MILLIMETER		CONTRACT NO.		EMC TEST SYSTEMS	
THRU	+	THRU	+	AUSTIN, TEXAS	
0.000	0.000	0.000	0.000	MOTOR BASE ASSEMBLY III	
0.000	0.000	0.000	0.000	WITH POLARIZATION	
0.000	0.000	0.000	0.000	SIZE	FSOM NO.
0.000	0.000	0.000	0.000	A2	104062
0.000	0.000	0.000	0.000	SCALE	REV.
0.000	0.000	0.000	0.000	1 : 1.5	3 OF 4





NOTES:

- 1. PRIMARY DIMENSIONS SHOWN ARE IN MILLIMETERS;  
SECONDARY IN BRACKETS ARE IN INCHES.

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REV	DESCRIPTION	DATE	APPROVED	REV	DESCRIPTION	DATE	APPROVED
A	RELEASE						

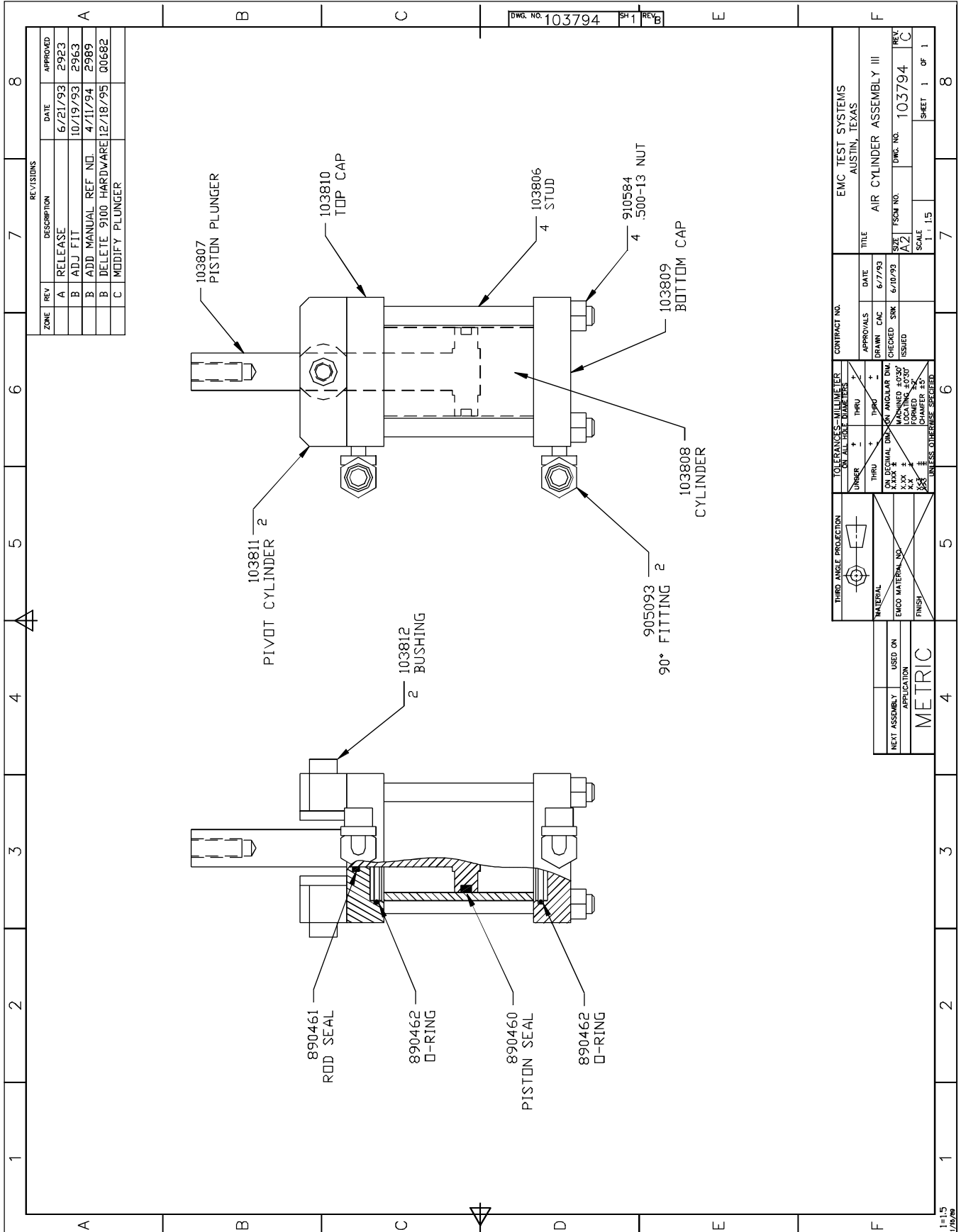
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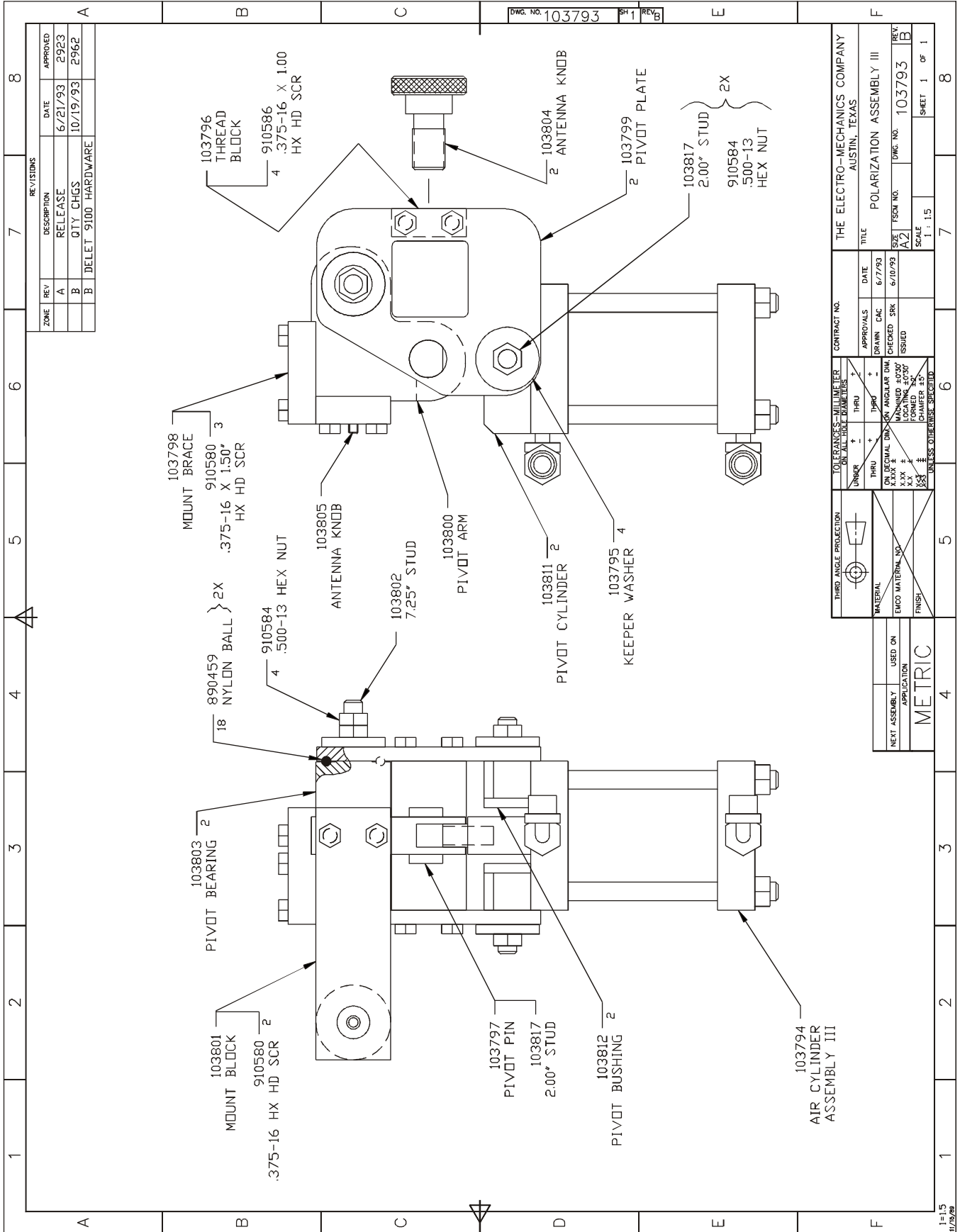
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DIMENSION	THRU	DRAWN	CAC	9/15/93	THE ELECTRO-MECHANICS COMPANY		AUSTIN, TEXAS
ON DECIMAL DIM	±	ISSUED			MAST TOP SECTION ASSEMBLY		
ON ANGULAR DIM	±				SIZE	SECTION NO.	DWG. NO.
ON FINISH	±				A2	104044	104044
ON HOLE LOCATING DIM	±				SCALE		
ON CHAMFER	±				1:2		
UNLESS OTHERWISE SPECIFIED					SHEET	1	OF 1

NEXT ASSEMBLY		USED ON	
APPLICATION			
METRIC			









REVISIONS				
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	B	QTY CHGS	10/19/93	2962
	B	DELET 9100 HARDWARE		

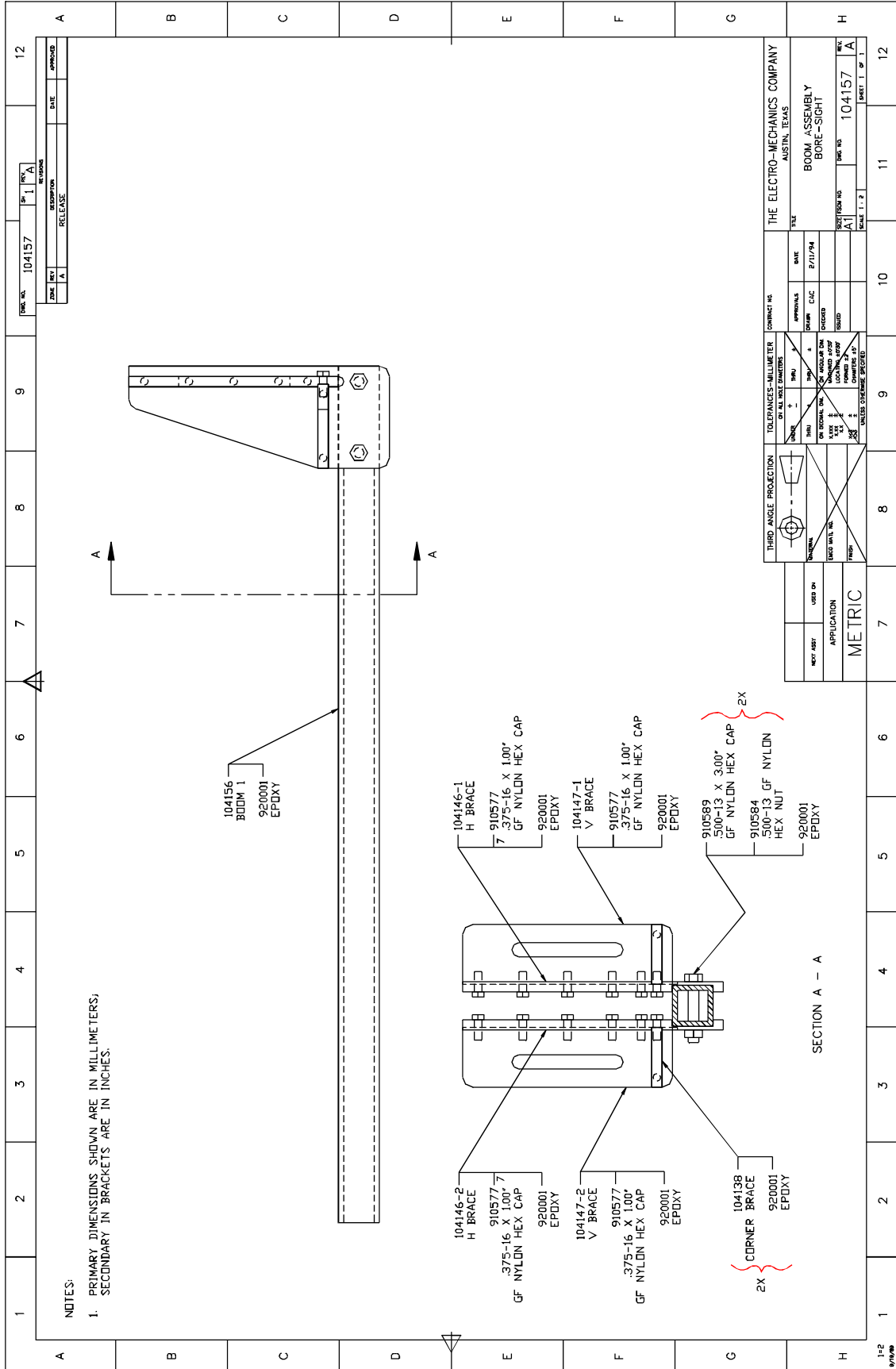
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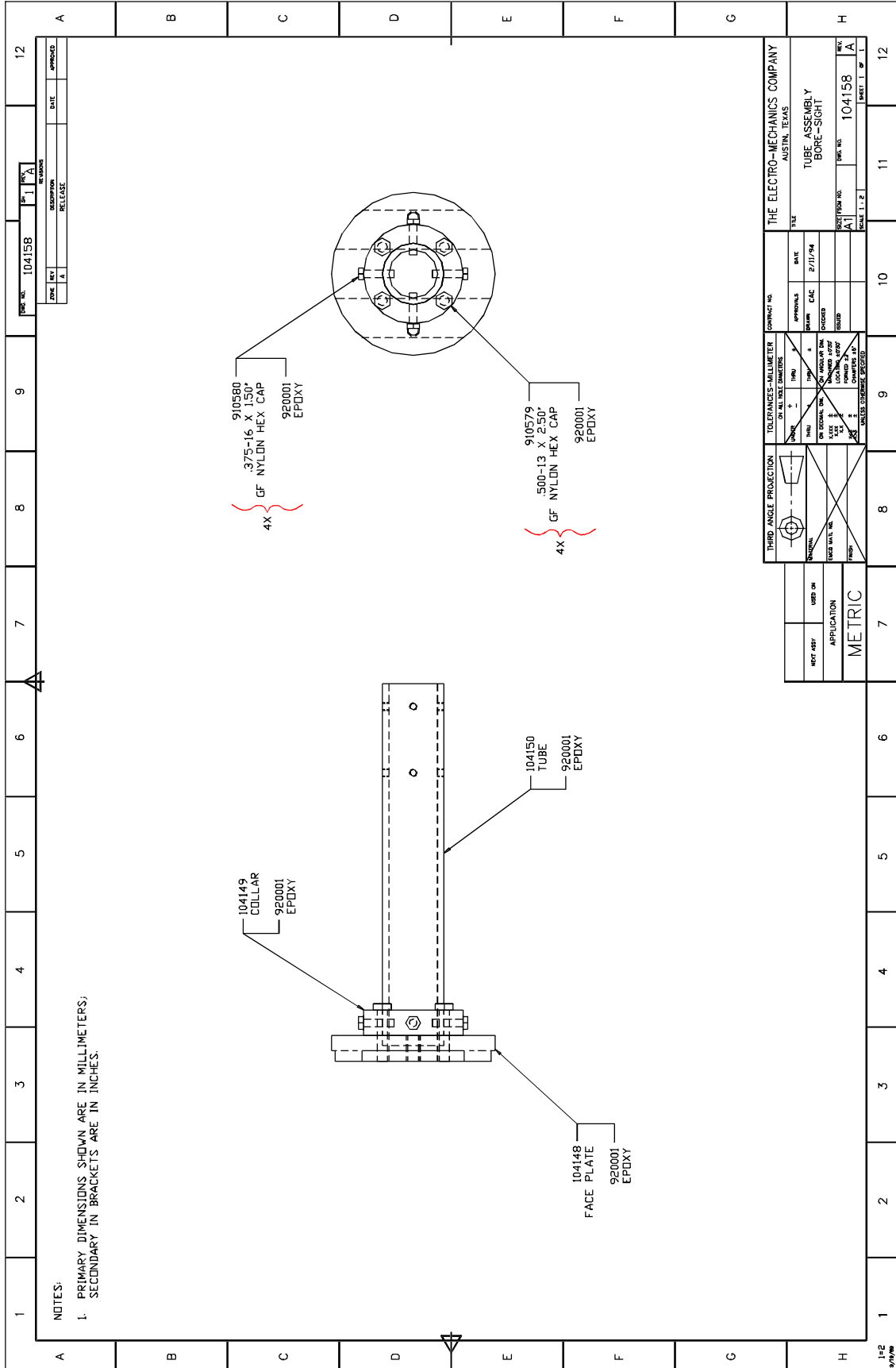
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ON ALL DIMENSIONS			
DIM	± .005	APPROVALS	DATE
THRU	± .010	DRAWN	CAC
ON DECIMAL DIM	± .005	CHECKED	SRK
ON ANGULAR DIM	± .005	ISSUED	
MANUFACTURED ± .005			
LOCATING ± .010			
LOCATED ± .010			
FINISHED ± .005			
UNLESS OTHERWISE SPECIFIED			

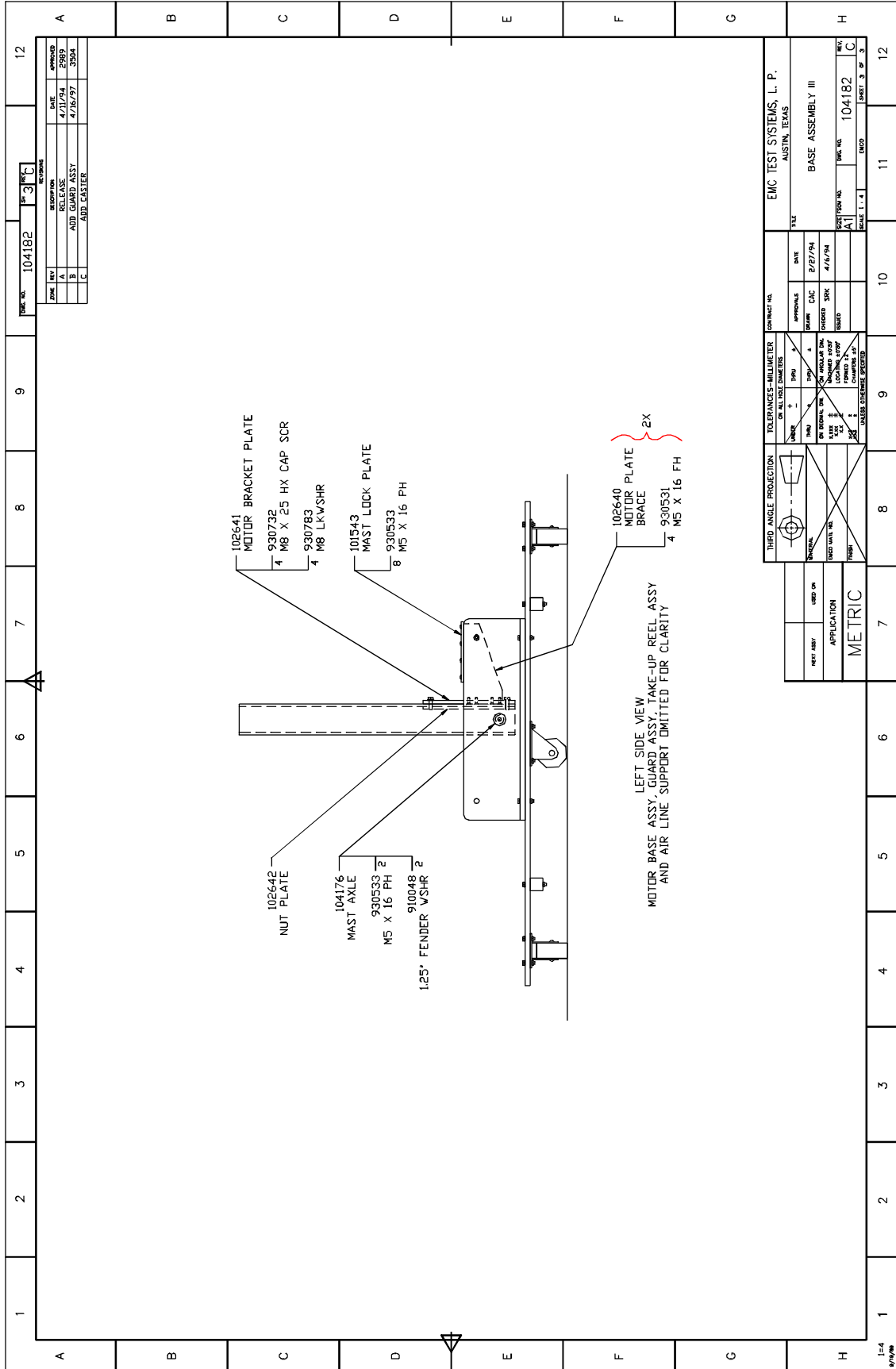
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MATERIAL	EMCO MATERIAL NO.
FINISH	

NEXT ASSEMBLY APPLICATION	
USED ON	
METRIC	

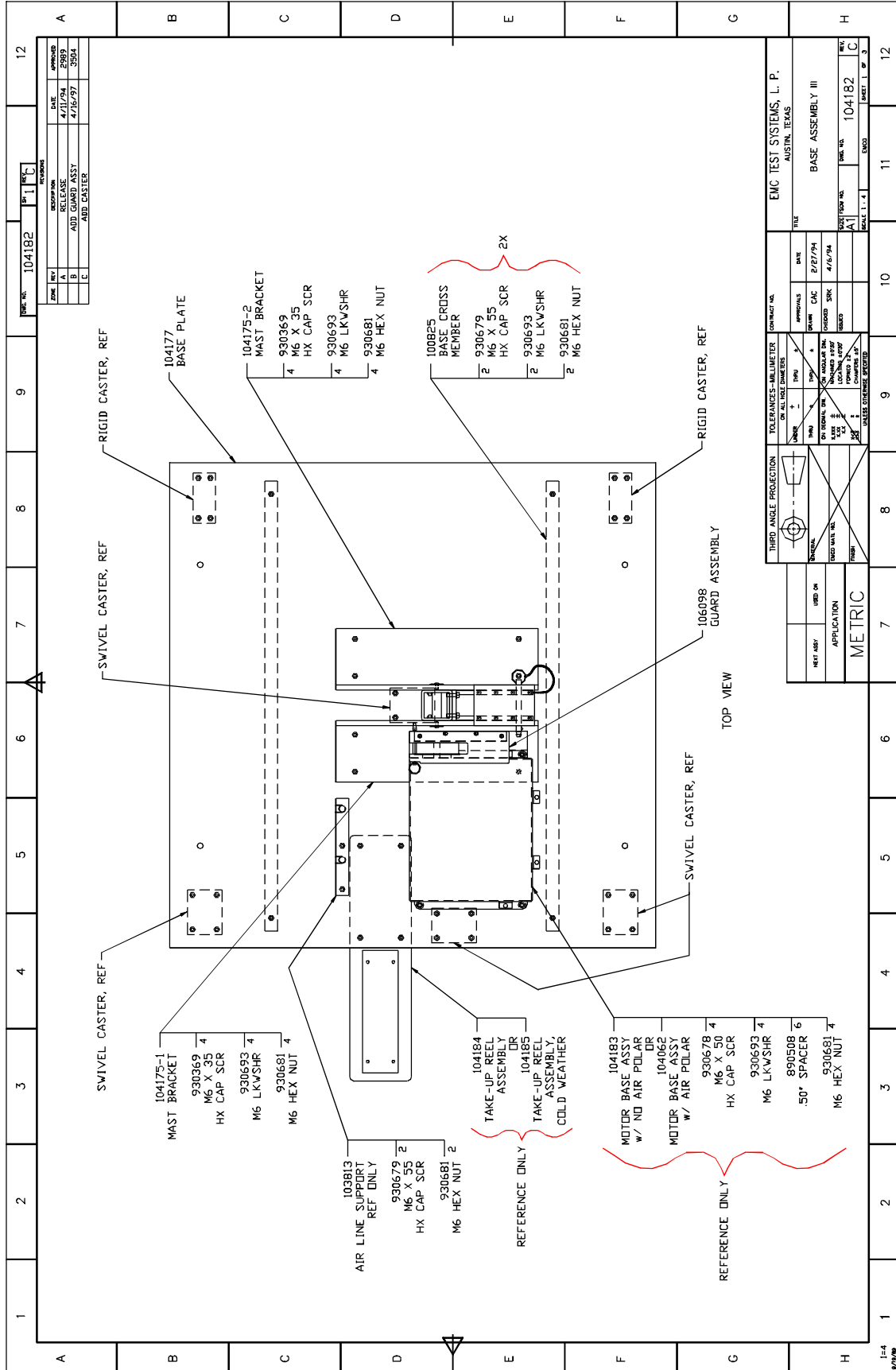
THE ELECTRO-MECHANICS COMPANY	
AUSTIN, TEXAS	
TITLE	POLARIZATION ASSEMBLY III
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ISSUED	6/10/93
DWG. NO.	103793
REV.	B
SHEET	1 OF 1



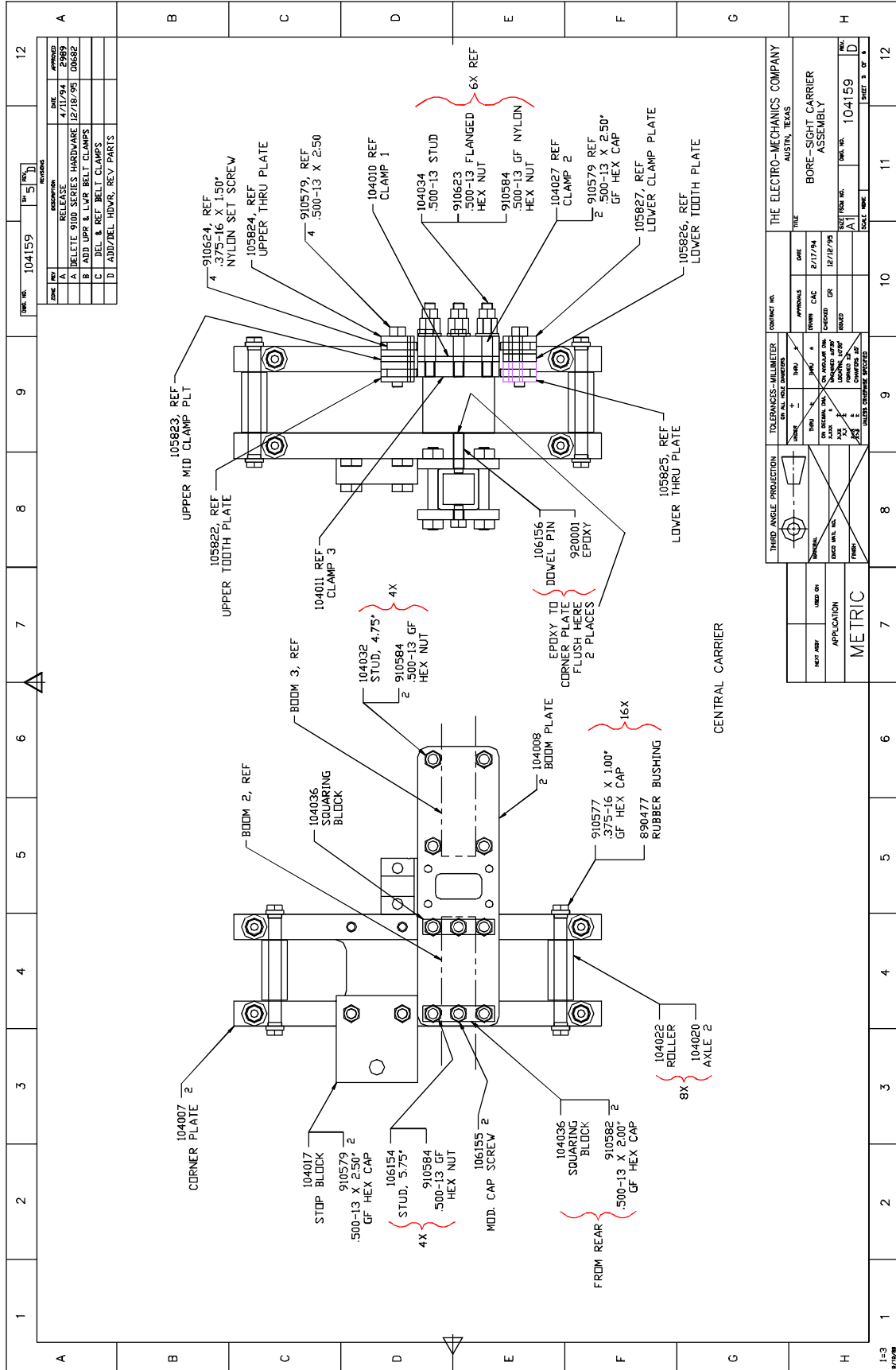


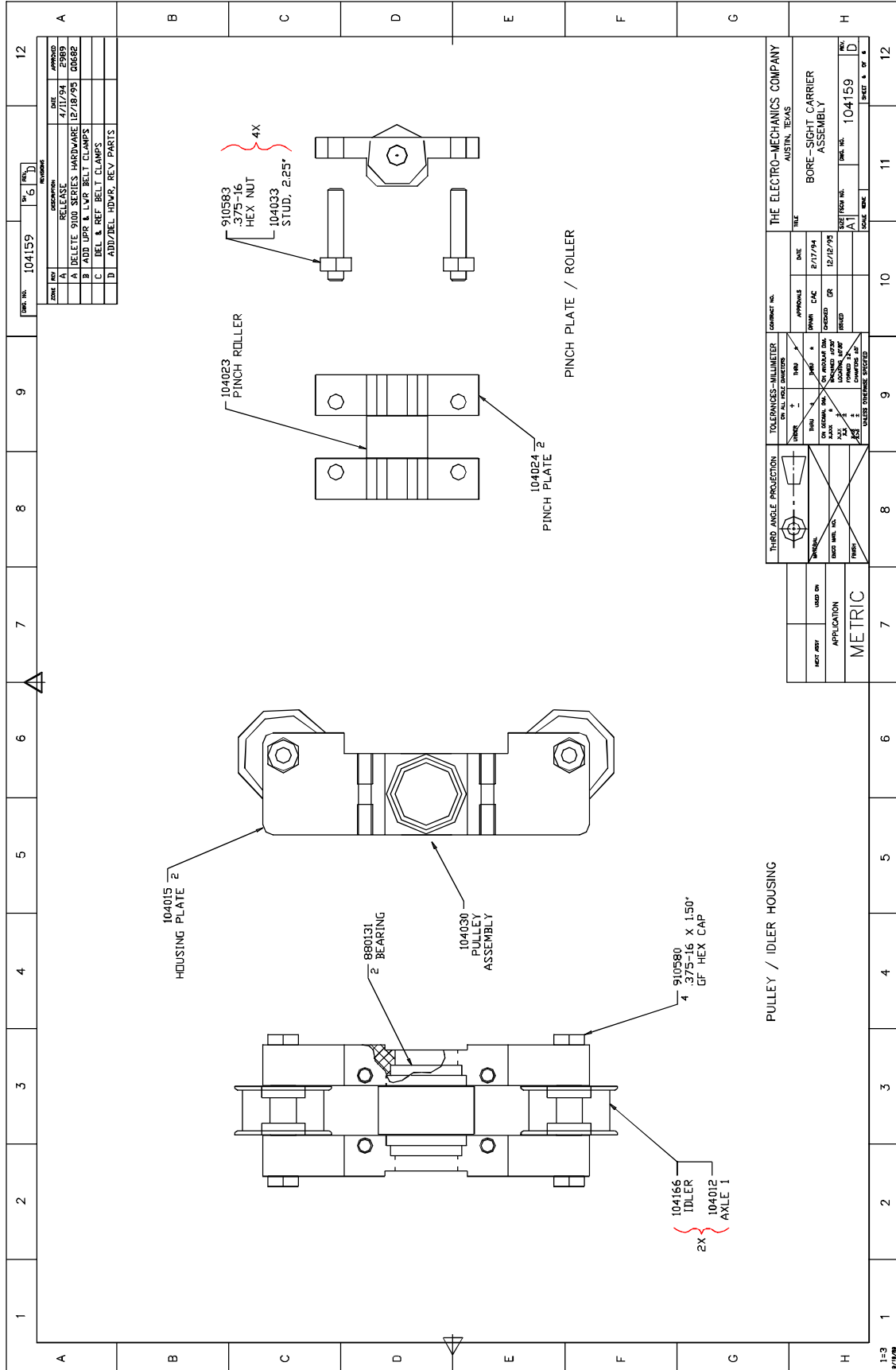


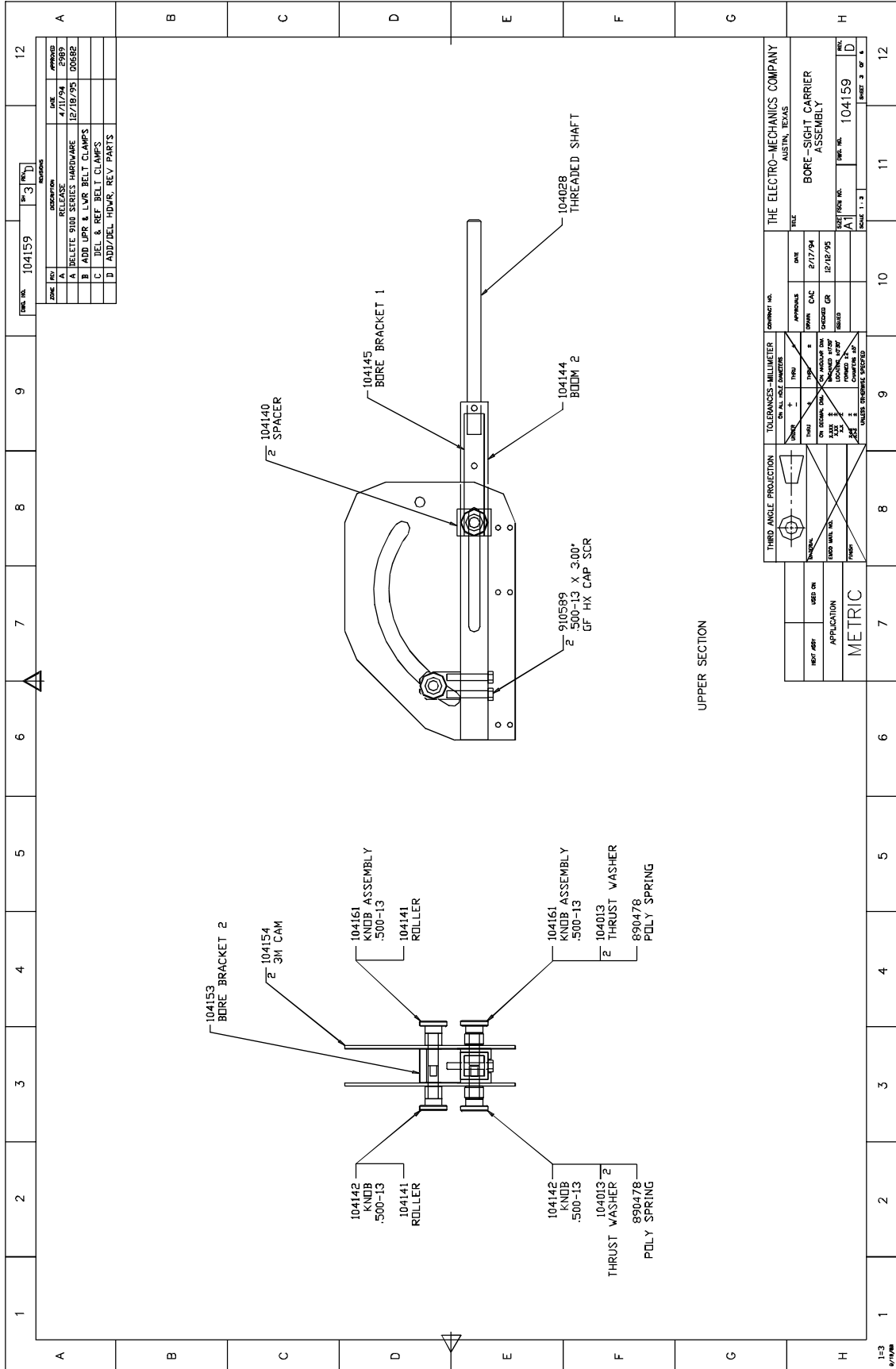


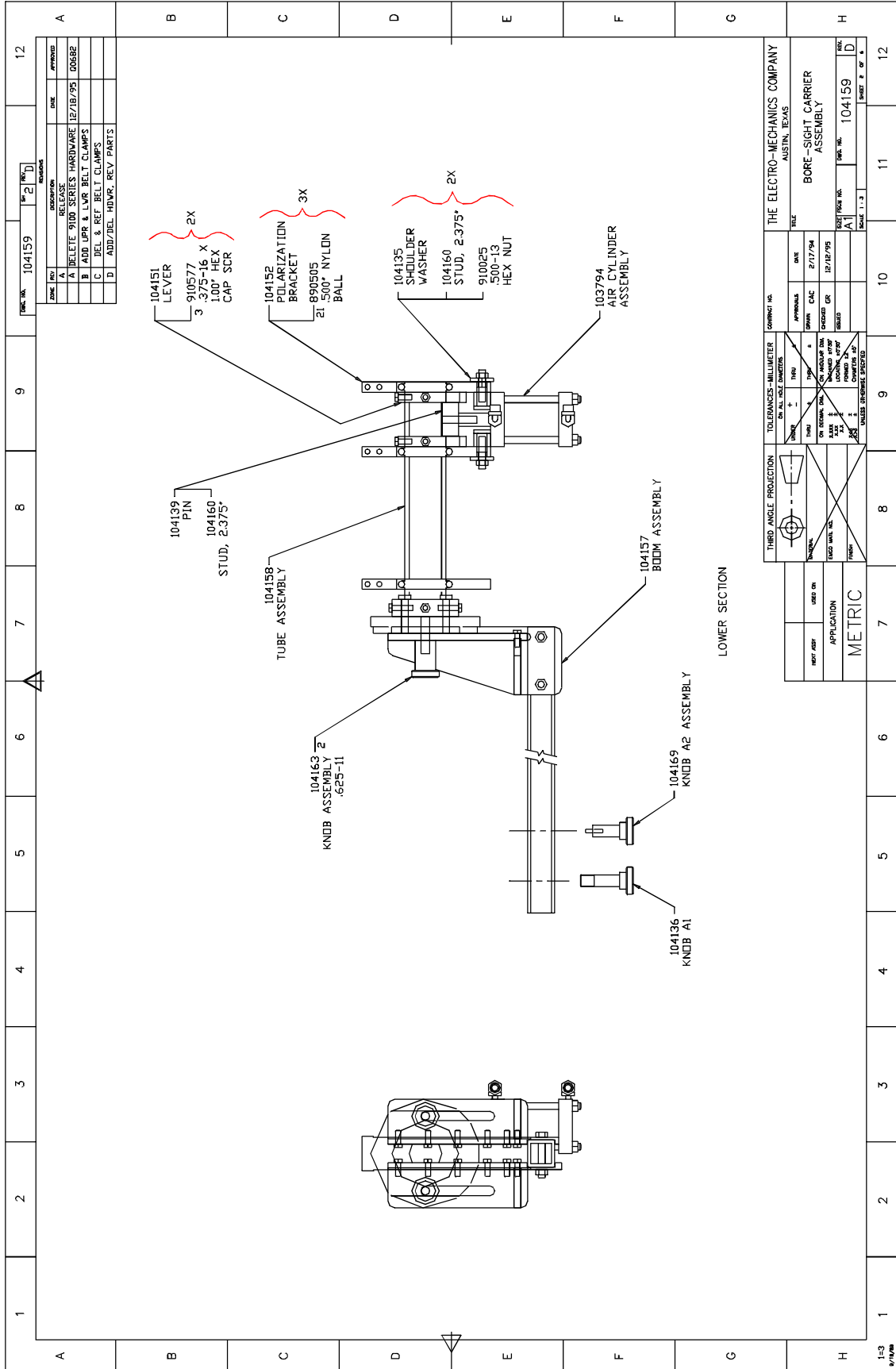






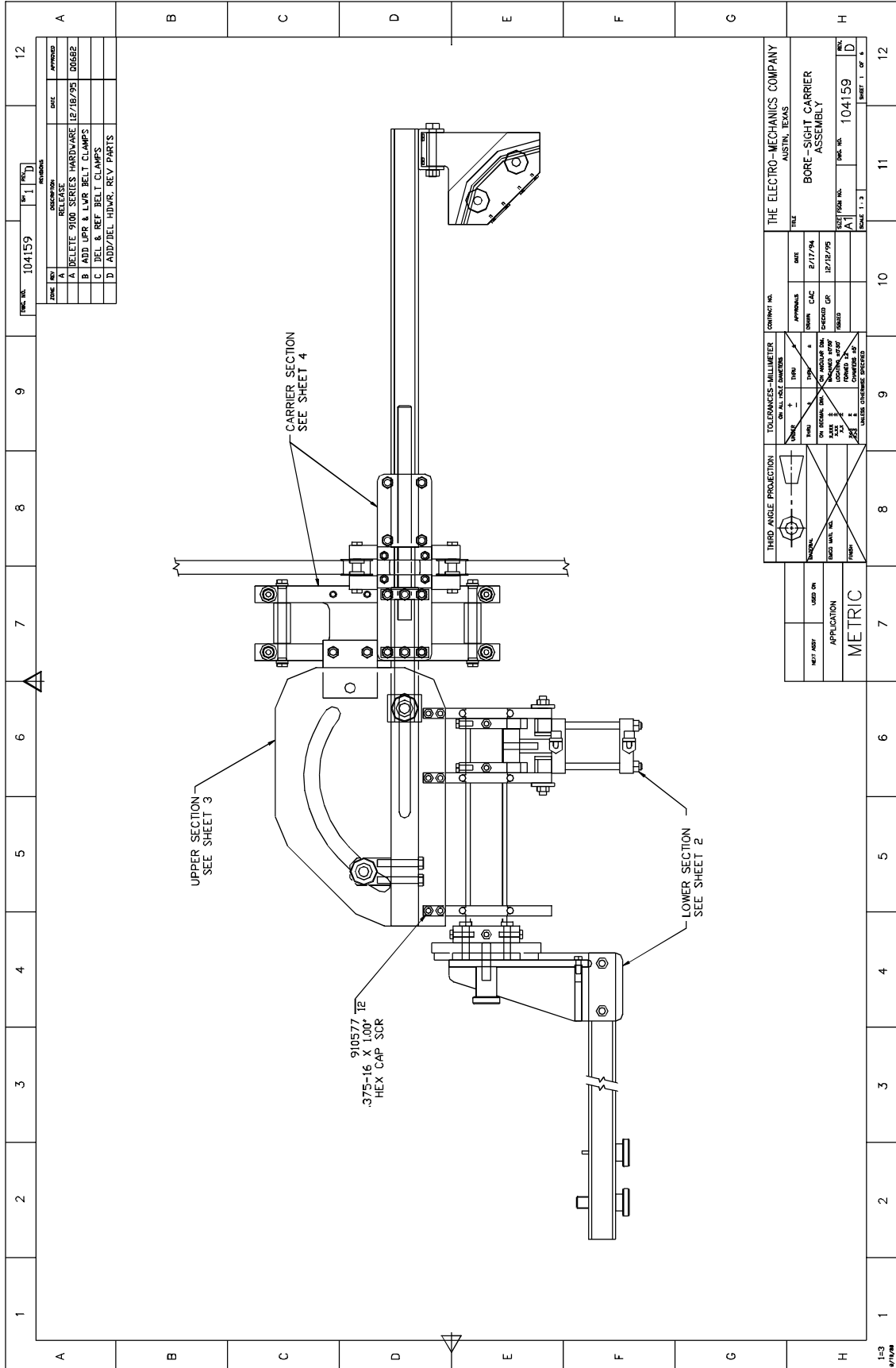






DATE	REV	DESCRIPTION	DATE	APPROVED
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12/18/95	A	DELETE STUD SERIES HARDWARE	12/18/95	00682
	B	ADD UPR & LWR BELT CLAMPS		
	C	DEL & REF BELT CLAMPS		
	D	ADD/DEL HDWR. REV PARTS		

THE ELECTRO-MECHANICS COMPANY AUSTIN, TEXAS	
DATE	2/17/94
APPROVAL	CAC
DESIGNED BY	12/12/95
WORKING DRAWING	
ASSEMBLY	
UNLESS OTHERWISE SPECIFIED	
THIRD ANGLE PROJECTION	
TOLERANCES - ALL DIMETERS	
FRACTIONS	
DECIMALS	
ANGLES	
UNLESS OTHERWISE SPECIFIED	
DATE	12/12/95
APPROVAL	
DESIGNED BY	
WORKING DRAWING	
ASSEMBLY	
UNLESS OTHERWISE SPECIFIED	
THIRD ANGLE PROJECTION	
TOLERANCES - ALL DIMETERS	
FRACTIONS	
DECIMALS	
ANGLES	
UNLESS OTHERWISE SPECIFIED	



REV	DESCRIPTION	DATE	APPROVED
A	RELEASE		
A	DELETE STUD SERIES HARDWARE 12/18/95	12/18/95	00662
B	ADD UPR. & LWR BELT CLAMPS		
C	BELT & REF BELT CLAMPS		
D	ADD/BELT HDR. REV PARTS		

THIRD ANGLE PROJECTION		TOLERANCES - MILLIMETER		CONTRACT NO.		THE ELECTRO-MECHANICS COMPANY	
FRONT	TOP	FRACTIONAL	DECIMAL	APPROVALS <td>DATE <td>FILE <td></td> </td></td>	DATE <td>FILE <td></td> </td>	FILE <td></td>	
VIEW	VIEW	THRU	UNLESS OTHERWISE SPECIFIED	DESIGNED BY	2/17/94	BORE-SIGHT CARRIER ASSEMBLY	
SECTION	SECTION	PERMIT	WORKING SIZE	CHECKED BY	12/12/95		
END VIEW	END VIEW	APPROVED	APPROVED	DRAWN			
THIRD	THIRD	DATE	DATE	SCALE			

NEXT ASST	USED ON
APPLICATION	METRIC

