BTECH **Battery Validation System**

MODEL BVS-S3D
INSTALLATION MANUAL

BATTERY VALIDATION SYSTEM

BVS S3 XXX

INSTALLATION MANUAL

WARNING: BTECH Inc. strongly recommends that only persons trained in the techniques and procedures necessary to assure personal safety when working with high-energy batteries perform installation of its Battery Validation Systems.

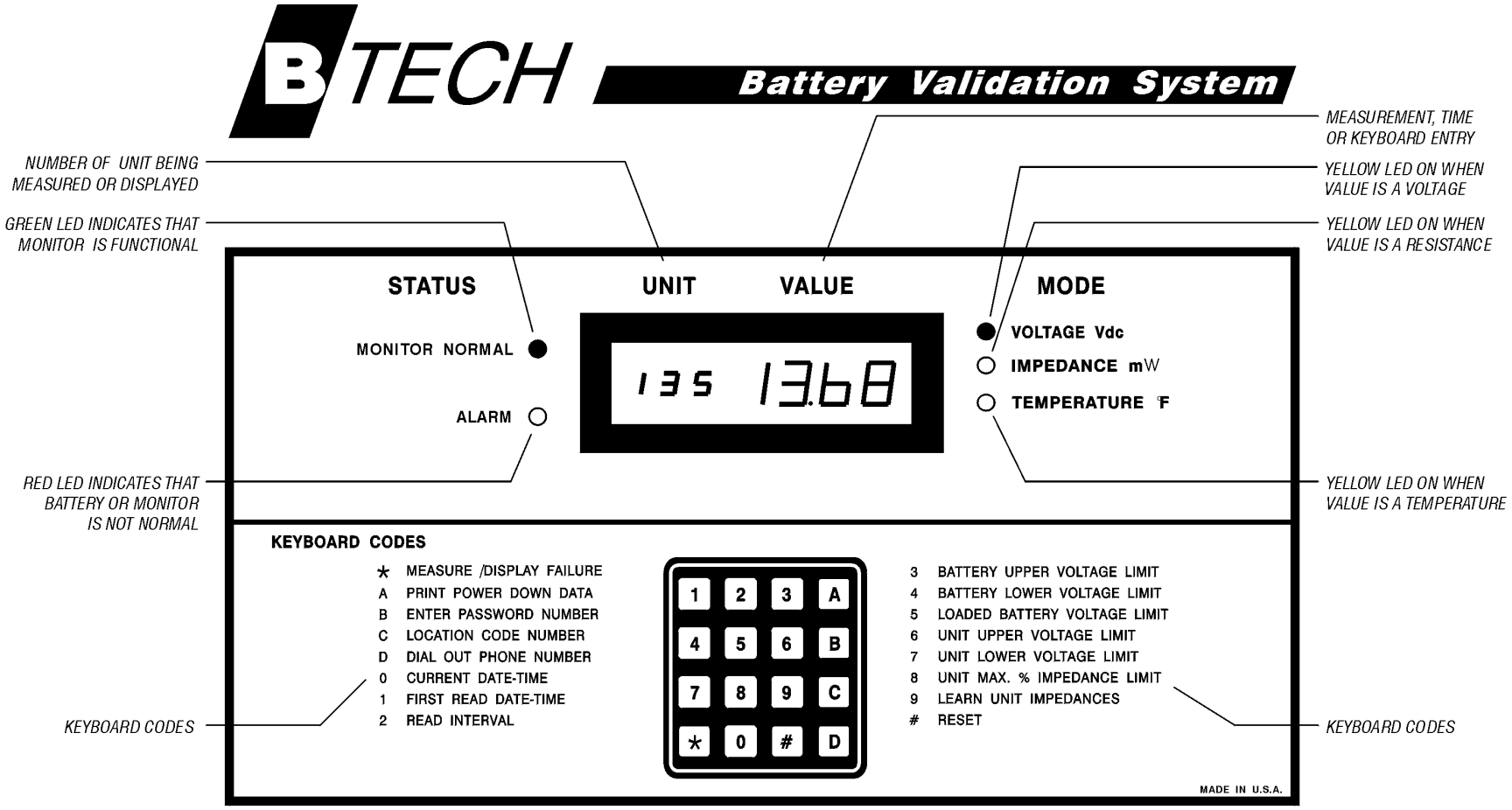
M 7.5-5
4/1/05

WARNING

Battery systems have the potential to inflict serious burns, shocks, and other injuries. Maintenance procedures should be relegated to knowledgeable and experienced personnel. Nothing in this manual is to be construed as **BTECH Inc.** recommending that battery users service their own batteries. Only persons especially trained in the installation, servicing, replacement and hazards of batteries should be allowed access to the battery compartment or room.

ATTENTION

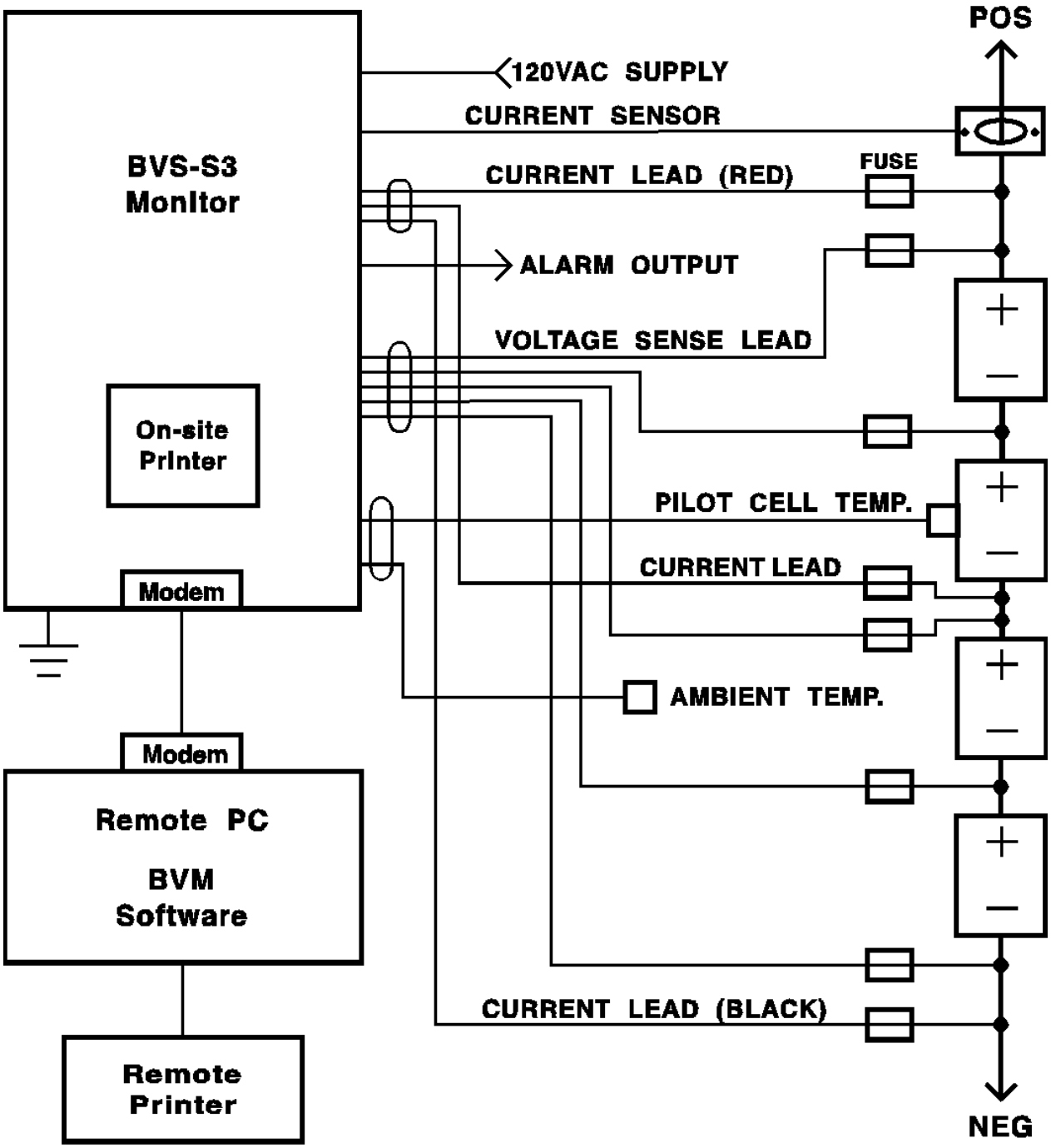
This sensitive electronic equipment can become inoperative and require extensive repairs because of metal chips and filings creating short circuits. If you allow this to happen, the **warranty will be null and void**, and repairs will be made only at the expense of the installer. **BTECH** recommends use of the cabinet knockouts for routing leads from the cabinet. If you must drill or punch additional holes in the cabinet, the chassis **must** be removed. Prior to removing the unit, carefully disconnect the three connectors from the display board in the door. Disconnect the printer cable from the socket in the chassis and remove the cable from the retaining clips. Remove the four nuts in the corners of the cabinet. Remove the chassis and set it in a protected place until all chips are cleaned up. **Do not** rely on covering the equipment while it remains in the enclosure. Metal chips inevitably find their way into connectors and onto circuit boards.



BATTERY VALIDATION SYSTEM MODEL S3

FRONT PANEL INPUTS AND DISPLAYS

frnt_pnl.cdr



BATTERY VALIDATION SYSTEM MODEL S3

SYSTEM DIAGRAM

Assemblies Required/Shipped

Main Control in Enclosure with Display, Input Keyboard, and Printer
Plug-in Low Voltage Isolation Transformer
Thermistor Assembly(s) with Common Connector(s) and adhesive mountings (quantity of thermistors and length of leads depending on order)
Load Current Lead Assembly(s) with Connector(s) and Fuseholders
Voltage Sense Lead Assemblies with Connectors and Fuseholders (quantity and length depending on order)
Discharge Current Sensor w/cable
Options as Ordered:
BVM Software and Instructions
Short Haul or Telephone Modem with Wiring Kit
Communications Switch

Mounting of Major Components

The **BVS** monitor, **S3**, can be mounted on a wall or other vertical surface suitable for supporting 75 pounds. Select a location where access is unobstructed and the display on the door is at eye level. See Fig. 1 for mounting dimensions. All conduit and cabling should enter as shown in Fig. 2.

A source of 120VAC, 60Hz, 0.5Amp is required. A receptacle is already installed within the right side of the enclosure. Run 1/2" EMT to it. A double-insulated transformer is provided to supply approximately 12VAC operating power and to assure that isolation of the battery system from the AC power grid is not compromised. In most cases, it is best to draw power from either the UPS or a generator that operates during a failure of the power grid. In rare cases where the discharge current sensor cannot be used, we may require (and state in the specific installation instructions) that power must be drawn from the grid because the **BVS** will need to sense a power outage by the disappearance of the AC power input. In either case an internal rechargeable battery will provide approximately 2½ hours of operation in the absence of AC power.

Though not required by the **BVS**, running the leads in wiring trays and/or conduit is recommended for physical protection; it may also be required by local code. However, the load current leads must **not** be routed through the same conduit nor bundled with the voltage sense leads or any other cables.

Wiring the System

Be sure that the **NICAD** switch is in the **OFF** position and that the **MODE** switch is in the **STANDBY** position before proceeding with the installation.

Normally, every jar (and sometimes every cell) terminal will be connected to the monitor. Thus, if there are 60 single cell jars, there will be 61 (or more) voltage sense leads. First, attach the approximately 6" leads with fuseholder halves to each of the cell or unit terminals as directed in the **Battery Wiring List**, observing the required polarity. Either U-shaped clamps or ring terminals have been supplied as specified by the purchasing documentation. Please refer to the drawings showing "**TYPICAL ATTACHMENT OF RING TERMINAL**" or "**TYPICAL ATTACHMENT OF STAINLESS STEEL CLAMP**", Figs.3A-C & 4A-B.

If the battery is mounted on a multi-layer steel frame, the routing of the voltage sense leads is especially important. Magnetic flux concentrated in the steel increases noise pickup in the sense leads. Therefore, a steel support must not be present in the "loop" between two sense leads. Please note carefully the examples of sense lead channel placement with respect to the support frame, as shown in the figure entitled "**LOCATING OF WIRING DUCTS**", Figs.5A-C.

Wiring duct is available from several manufacturers. Typical duct and mounting options are shown in Figs.6A-B. Since rack construction and working clearances vary, you will need to decide which option is most suitable for your particular installation.

Correct dressing of the voltage sense leads is also important to minimize pick-up of noise. Please refer to the diagram entitled "**BVS VOLTAGE SENSE LEAD TO CELL CONNECTION EXAMPLES**", Fig.7. The goal of wire routing and dressing should be to keep the sense leads in a tight bundle as far as possible, uniformly bringing out one sense lead at a time at that place where it can be routed most directly to its attachment point.

Now, note that the long voltage sense leads are numbered. By IEEE convention, lead #1 connects to the most positive terminal of the battery. Leads *must* be attached in numerical sequence as shown in the **Battery Wiring List**. Lead assemblies are shipped without fuses in the fuseholders so that the leads may be dressed, stripped, and connected without danger. For your safety, *do not insert the fuses until wiring is complete!*

Connect the first lead to the most positive terminal of the battery. Dress and temporarily tie or restrain it in place all the way to the 17-terminal connector. Cut and strip the wire 1/4 inch from the end, and insert it into the opening marked **1**. Connect

the next lead to the junction between the first and second cells (or jars) of the battery, dress it back to the same connector and fasten it into the next opening. Continue in this manner until all inter-connection points, including the most negative terminal of the battery, have been attached to a 16 or 17-terminal connector. Note that these plugs have been numbered to show the first and last leads to be inserted. Be sure to maintain the same sequence at these connectors as at the cells.

Some batteries are assembled with long interconnects between rows or shelf levels. The resistance of these long interconnects is significant and interferes with the proper evaluation of cell or unit resistance. **BVS** incorporates a feature whereby this extra resistance is ignored. If the system contains long interconnects, a voltage sense lead should be connected to both ends of each of these long interconnects, as called for in the **Battery Wiring List**. Thus, the cell or unit numbers and the numbers on the voltage sense leads will not match after the first long interconnect. During its first measurement cycle, the **BVS** will search for and remember the location of these long interconnects. Thereafter, it will ignore them, so that the display and printout will correctly identify each cell or unit in sequence in the string.

When connecting the voltage sense leads to the long interconnects, the connection should be made preferably either directly to the cable with a tap coupler or to the spreader plate. Attaching at this point will assure that the interface secured by correct torquing of the post bolt will be checked in the resistance measurement. The specific instructions and hardware supplied will indicate where this connection is to be made.

Note that the final 16-terminal connector has two jumpers pre-installed. Be sure to leave them in place as you connect the last voltage sense lead. Note also that a short piece of black wire is attached to a 3-terminal connector next to the only 17-terminal connector (where the #1 lead enters). This black wire is labeled with a hangtag indicating into which opening it is to be inserted. Parallel this black wire with the voltage sense lead already there, to complete the connection to the most negative terminal of the battery.

Plug the 16 and 17-terminal connectors into the connector panel of the chassis (see Fig.8), starting with the most positive connection (lowest cell number) toward the right (as viewed from the open door). Insert the second connector immediately to the left of the first one. Continue in this order with the remaining 16-pin connectors, matching the first lead number in each connector with the number on the chassis. Using cable ties or other restraining means, secure the voltage sense leads at intervals to make a tight, neat bundle. The finished wire dressing and tie wrapping should appear as illustrated in Figs. 4-7. Now you may insert a 1/16-ampere fast blow fuse into each fuseholder.

Insert the load current connector(s) with the red, orange and black (and sometimes additional colors) leads already attached into the mating socket(s) in the left (and if required the right) side of the load plate. Run the red lead toward the most positive terminal of the battery and fasten it securely along its route. If these leads are not in separate metallic conduit, maintain at least a 2-foot separation (the more the better) between the voltage sense leads and these load current leads. Do the same with the black lead toward the most negative terminal. Other leads from this connector will be tagged indicating where to connect them to the battery. Cut the leads to the appropriate length, and fasten the attachment hardware with the in-line fuseholders to the battery. See Fig.9A-B for current lead attachment examples. Be sure to connect the fuseholders so that the load arrow points toward the **BVS**. Remove the load current connector(s) before installing the fast-acting fuses supplied. **Do not re-connect it (them).** This (these) connector(s) must remain out of its (their) socket(s) until the proper point in the start-up procedure is reached.

> ***NOTE*** **: It is imperative that the load current leads not be routed or bundled with the voltage sense leads. If all leads are running in conduit, the load current wires must be in a separate conduit. Do not run parallel to the voltage sense leads unless they can be at least one foot away. Out of conduit, avoid running them parallel to the voltage sense leads unless they can be at least two feet away. At the terminations where they approach the most positive, midpoint and most negative terminals, bring them in to the terminals as nearly at right angles to the voltage sense leads as possible. Careful routing is required to minimize incidental pickup of the load current impulse that otherwise will distort the impedance readings.**

Locate the thermistor probes. With the foil-backed adhesive foam tape supplied, attach the one marked **THM1** to a cell case in the top tier of cells of the first string, as indicated by its hang tag. This thermistor will be used to read the temperature of the battery. If the battery is composed of flooded cells, locate the probe just below the minimum electrolyte level; if the battery is composed of valve-regulated cells, locate the probe in the general vicinity of the negative post, taking due care for the conductive nature of the foil. (Where a sheet of polyethylene foam separates jars, you may prefer to force the probe between the jar wall and the foam.) If there is a second string in the system, attach the one marked **THM2** to a cell case as indicated by its hang tag; likewise **THM3** should be attached to a cell case in the third string. Mount the other thermistor marked **AMB** away from the battery so that it can sense the air temperature. Usually, this can be the underside of the enclosure, using the plastic self-adhesive clips provided.

Route the extension leads along with the voltage sense leads to the connector panel of the chassis. Connect the leads from the ambient temperature sensor to terminals **1** & **2** of the 6-terminal connector. Connect the leads of the thermistor **THM1** into terminals **2** & **3** of the same connector. If there is a second string, connect the leads of the thermistor **THM2** into terminals **4** & **5**. If there is a third string, connect the leads of the thermistor **THM3** into terminals **5** & **6**.

Locate the current transducer, which is used to sense discharge current when the battery is under load. Separate the halves by releasing the two latches. Re-assemble around any convenient battery current cable with both red dots facing toward the positive terminal of the UPS or other load (not necessarily the positive terminal of the battery). The **Battery Wiring List** will indicate the recommended location. Route the connection cable along with the voltage sense leads back to the enclosure and plug into the socket marked **CURNT SENSR**.

Provide a low impedance ground between the **BVS** chassis grounding lug and the battery rack by means of a #10 or larger *stranded* lead. This connection will reduce noise pickup and bleed off any electrostatic charge that could cause malfunction of the electronics. The location of the grounding lug is shown in Fig.8.

Use of the 3-terminal alarm plug is optional. If there is an existing facility alarm system, use this plug to connect to it. Between terminals **1** & **3** is a normally closed relay switch; between **2** & **3** is a normally open switch. The status of these switches changes when an alarm condition is detected. Contact rating is 32 volts, 60 watts DC, 125 VA AC.

If the **Battery Validation System** has been ordered with a telephone modem, plug the **DB-25** serial cable into the socket marked **MODEM** in the connector panel of the **BVS.** Plug the other end into the back of the modem. Plug the smaller AC adapter into the upper AC receptacle with the wire facing upward. Insert the cord connector into the modem's power input jack. Plug the phone line into the **LINE** jack of the modem and slide the modem into the space at the bottom of the enclosure.

If ordered for use with a local computer, please see the figure entitled "**WIRING DIAGRAM - SHORT HAUL COMMUNICATIONS LINK**", Fig.10. All material has been supplied <u>except the 2 twisted pair cable</u> which must be run through the building. Plug one of the short haul modems into the **DB-25** connector and secure it with the two screws. Insert one end of the black twisted pair cable into the RJ-11 jack in the short haul modem and run to a surface-mounted modular connector block. Use the other modular connector block and cable at the computer end. Plug the other short haul modem into a serial port on the host computer and secure it with the two screws. These modems will provide communications using EIA-232C protocol and will prevent unintentional grounds or ground loops between the **BVS** and host computer. Be sure

to observe the correct connections between modular connector blocks, whether or not the indicated color codes match throughout the building.

When more than one **BVS** is at the same location, a communications switch may have been specified to reduce communications wiring or telephone lines. Specific installation instructions were supplied with the equipment.

Pre-Commissioning Wire Testing

When all wiring is complete and fastened in place, the system is ready to be powered. First, double-check that the load current connector(s) is (are) out of its (their) socket(s), the **NICAD** switch is **OFF**, and the **RUN/STANDBY** switch is in the **STANDBY** position. Then plug the isolation transformer into the 120-volt, 60 Hz outlet and insert the power connector into the receptacle on the connector panel. The system should respond with an immediate beep. If it does not, unplug the AC and reconnect it within 2 seconds; the boot process should now complete itself promptly and show the time within about 30 seconds.[1] The **NICAD** switch disables the internal battery only. Since the system will revert automatically to its own back-up battery when the AC power fails, this switch prevents operation from the battery during shipping and servicing. Turn the **NICAD** switch to **ON.** Also place the **RUN/STANDBY** switch in the **RUN** position. The printer power indicator should be on.

> **IMPORTANT:** The function of the **RUN/STANDBY** switch is to prevent the closure of all of the relays that connect the battery to the **BVS.** Place this switch in the **STANDBY** position whenever the battery is being serviced to protect personnel and equipment.

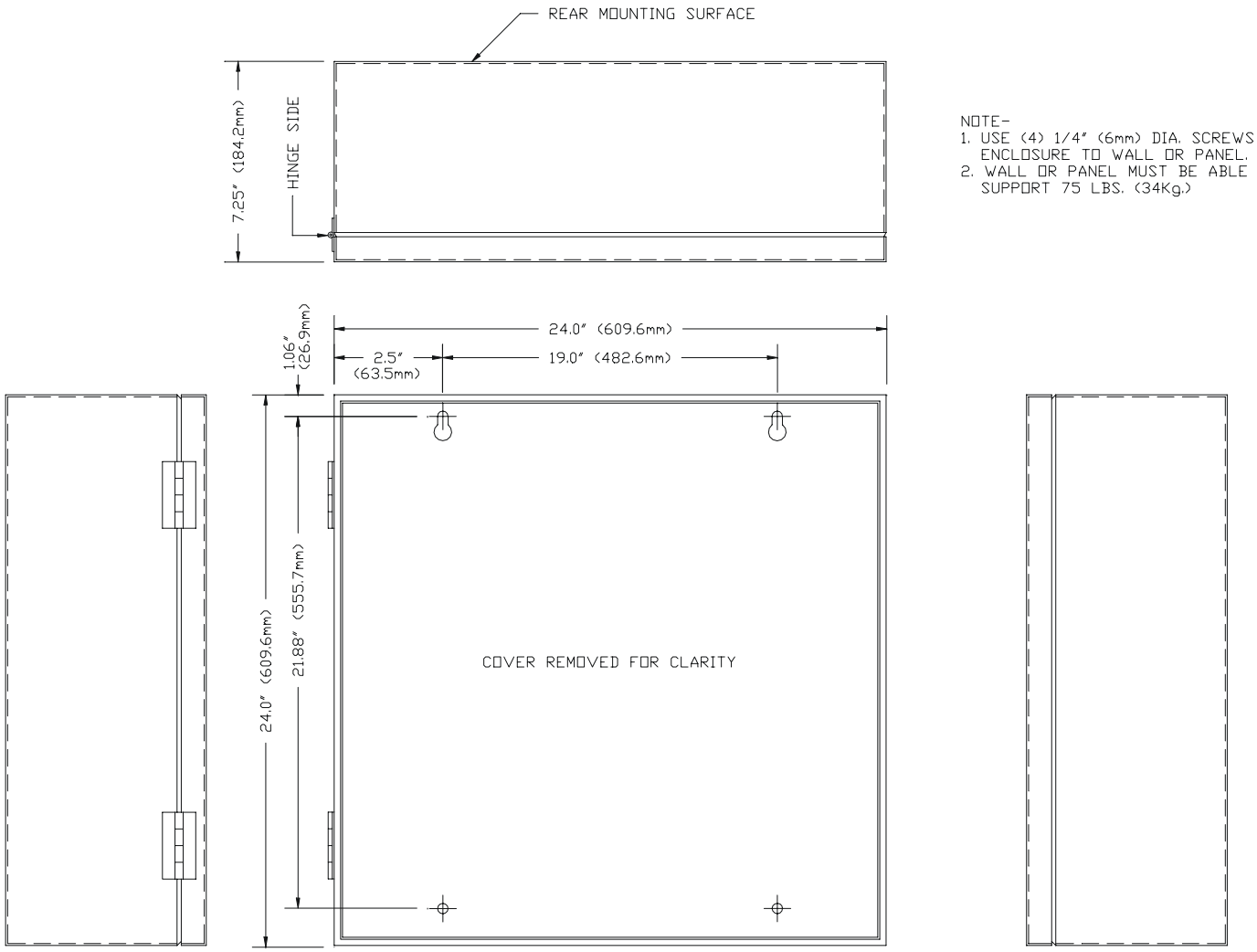
The **BVS** was programmed at the factory to perform a wire-to-wire voltage test and print the results. Press the ***** key momentarily and listen for the acknowledging "beep". The printer tape will show the wire numbers and the respective voltage readings between the pairs of wires. When the **BVS** finds two “0” readings in a row, it will stop. If the display shows the number of units in the battery and the battery voltage, examine the voltage readings for the correct values. If the display shows the time again look at the tape for the wire numbers related to the last pair of 0.00 Volt measurements, there is a wiring error. The lead common to these two “0” readings is open - bad fuse or fuse contact, broken lead, terminal crimped on the wire insulation, are possible causes. You may physically check a fuseholder to make sure it contains a good 1/16th ampere fuse (very difficult visually, better to measure resistance, $\approx 30\Omega$). Start with the numbered fuseholder where you see the pair of 0.00 V

[1] If the Ram backup battery has become completely discharged, a time format (xx:xx) may appear but some of the 7-segment characters may not be recognizeable as any of the ten Arabic numerals. Simply enter the correct date and time as described on the Help-card on the inside of the door.

readings. Or you may measure the voltage between pairs of screw terminals on the 16 and 17-pin connectors. Except where there are long interconnects (which read 0.00 V), all readings should be nearly the same, i.e. »2.25Vdc, or »4.5Vdc, or »6.75Vdc or »13.5Vdc. If some voltages are double what they should be, the respective leads are probably out of sequence. After attempting a fix, press the ***** key again. If the printout is still incorrect, follow the above procedures to solve all of the wiring problems. When the printout exactly matches the battery configuration, fax a copy to **BTECH Inc**. with the **CUSTOMER'S PRE-COMMISSIONING WORKSHEET** mentioned below.

Occasionally, a **BVS** must be wired in a way that ½ the usual unit voltage appears between sense leads. This situation is normal for these special systems, where such lead pairs are treated by the **BVS** as long interconnects.

When all of the above installation has been completed and the communication wiring is in place and active, the **BVS** is ready for commissioning. Please refer to the **CUSTOMER'S PRE-COMMISSIONING INSTRUCTION BOOKLET/WORKSHEET** (packed in the **BVS** enclosure), to assist you in completing the pre-commissioning procedures. If you have any questions regarding these procedures contact **BTECH Inc**. **Technical Support** at (973) 983-1120.



NOTE-
1. USE (4) 1/4" (6mm) DIA. SCREWS TO MOUNT ENCLOSURE TO WALL OR PANEL.
2. WALL OR PANEL MUST BE ABLE TO SUPPORT 75 LBS. (34Kg.)

BVS-S3 NEMA 1 ENCLOSURE: Standard Mounting Hole Locations

FIG. 1

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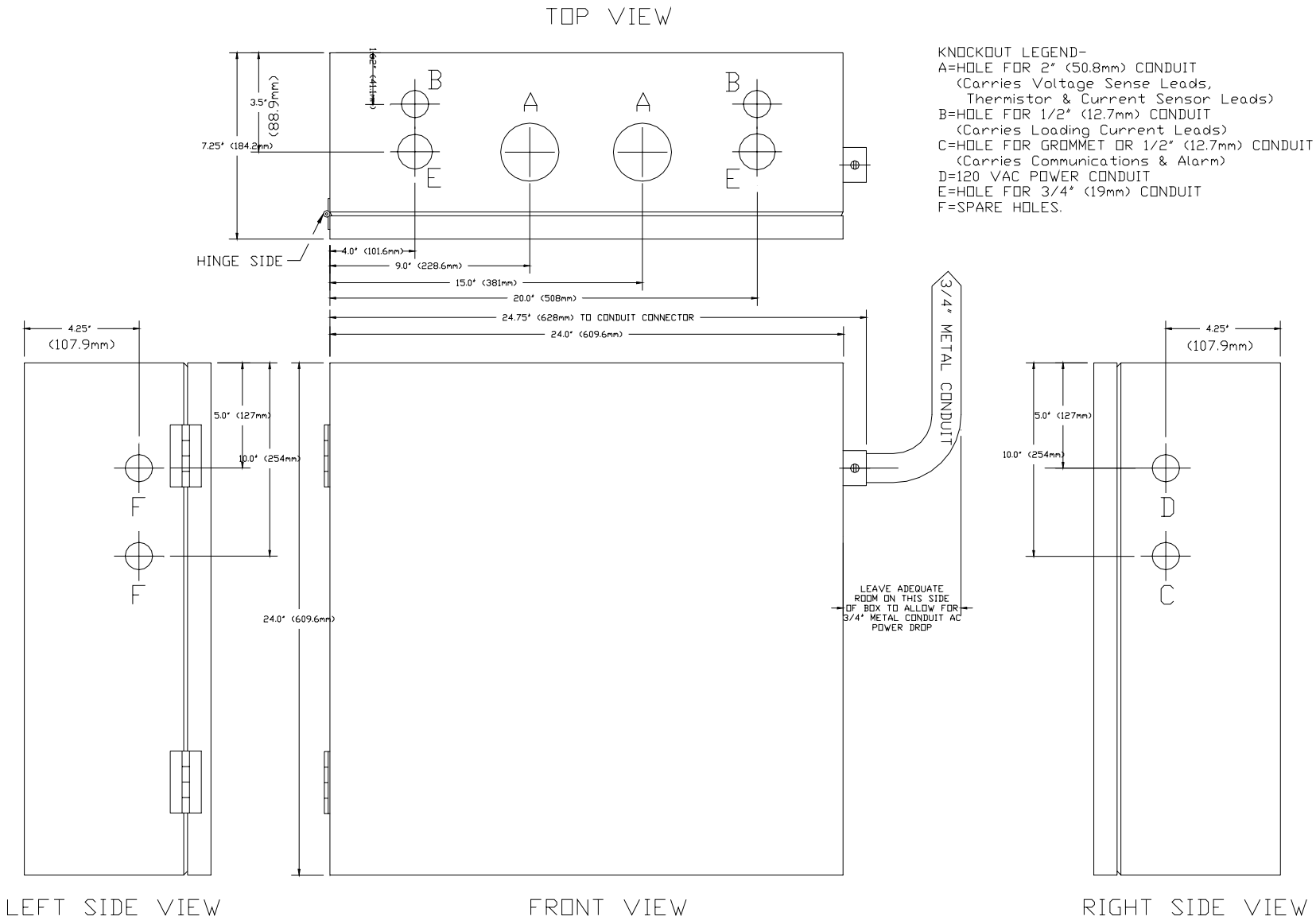
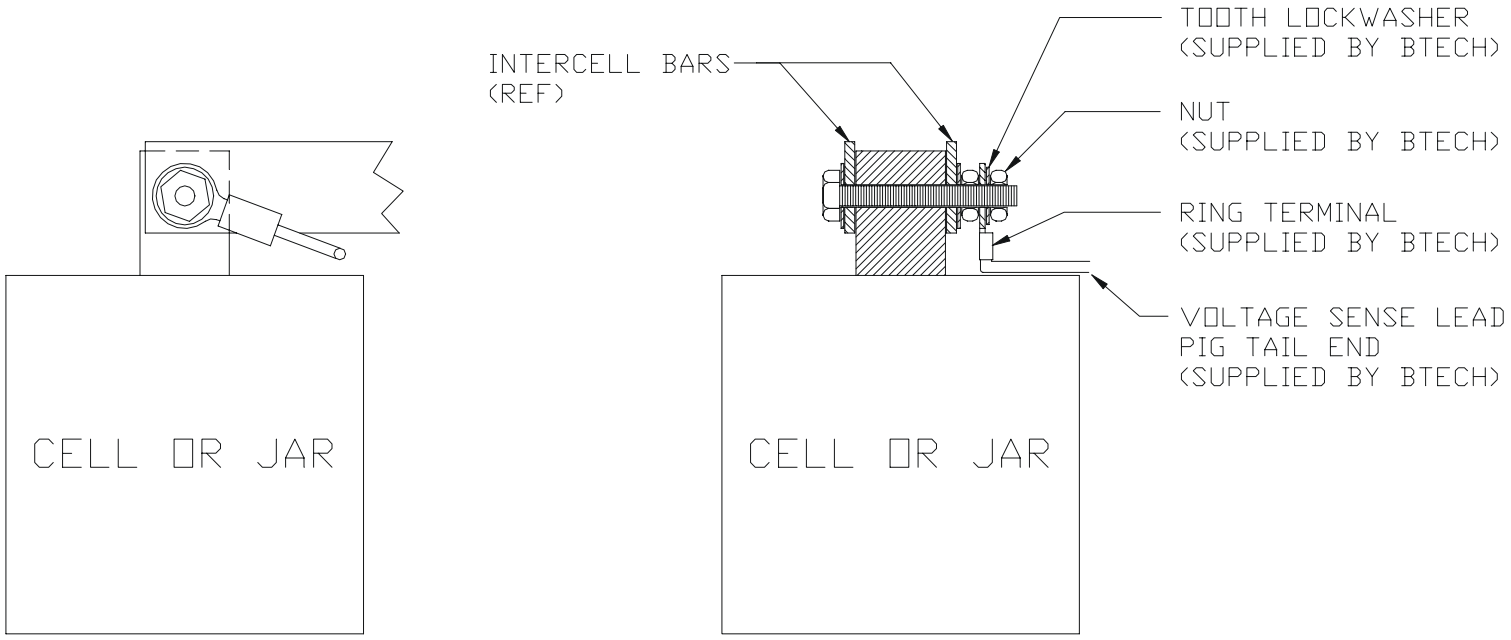


Location of Holes & Knockouts BVS-S3 Enclosure

FIG. 2



TYPICAL ATTACHMENT OF RING TERMINAL WITH DOUBLE NUT CONNECTION
FIG. 3A

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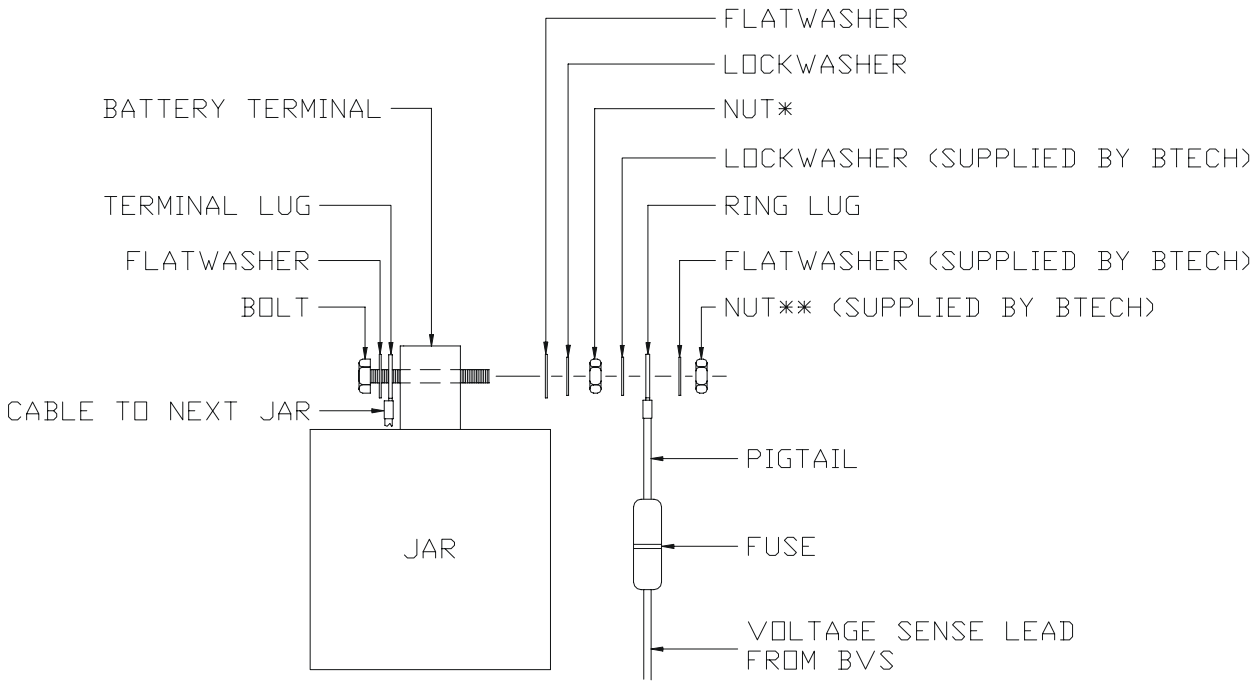

TYPICAL ATTACHMENT OF RING TERMINAL WITH DOUBLE NUT CONNECTION
FIG. 3B

* TORQUE TO BATTERY MANUFACTURER'S SPECIFICATIONS.
** TORQUE TO 5 IN.-LBS.

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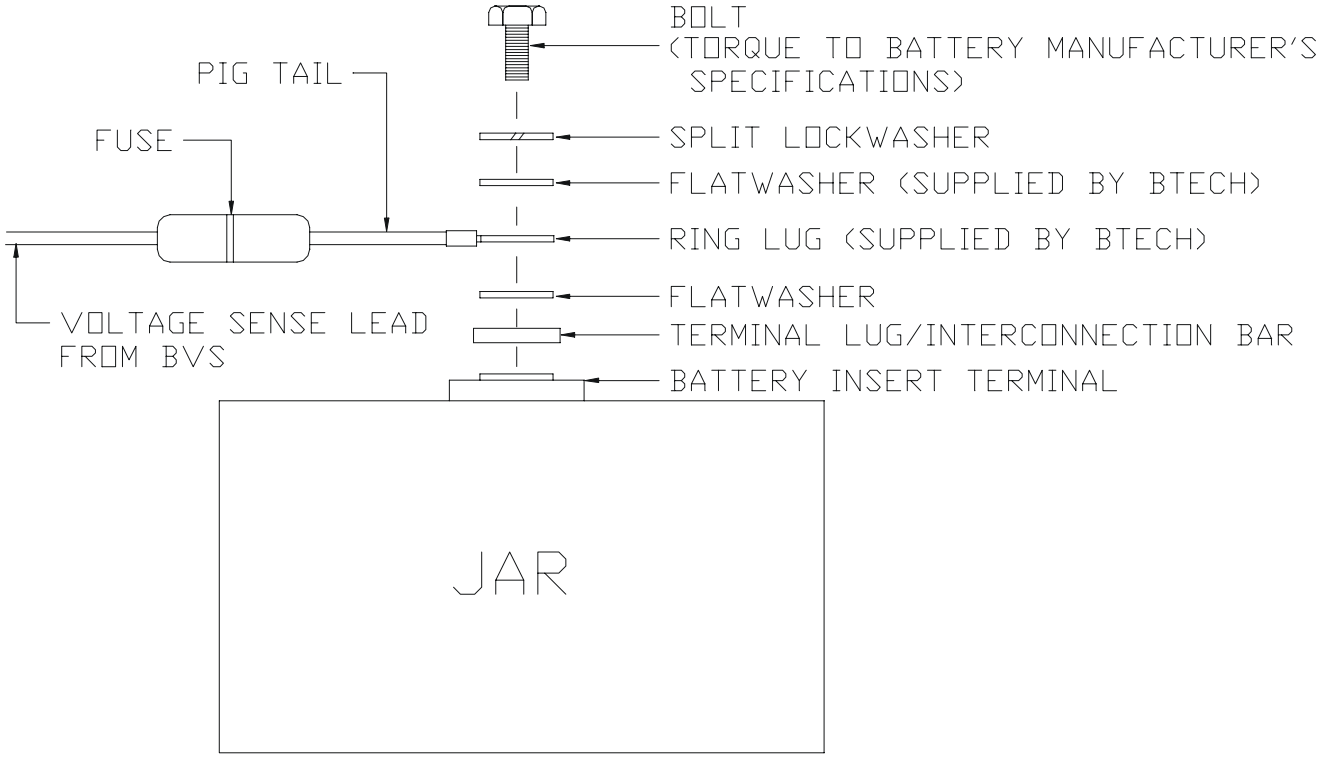

APPLY ANTI-CORROSIVE GREASE TO ALL SURFACE PARTS.

TYPICAL ATTACHMENT OF RING TERMINAL WITH THREADED INSERT TERMINATION FIG. 3C

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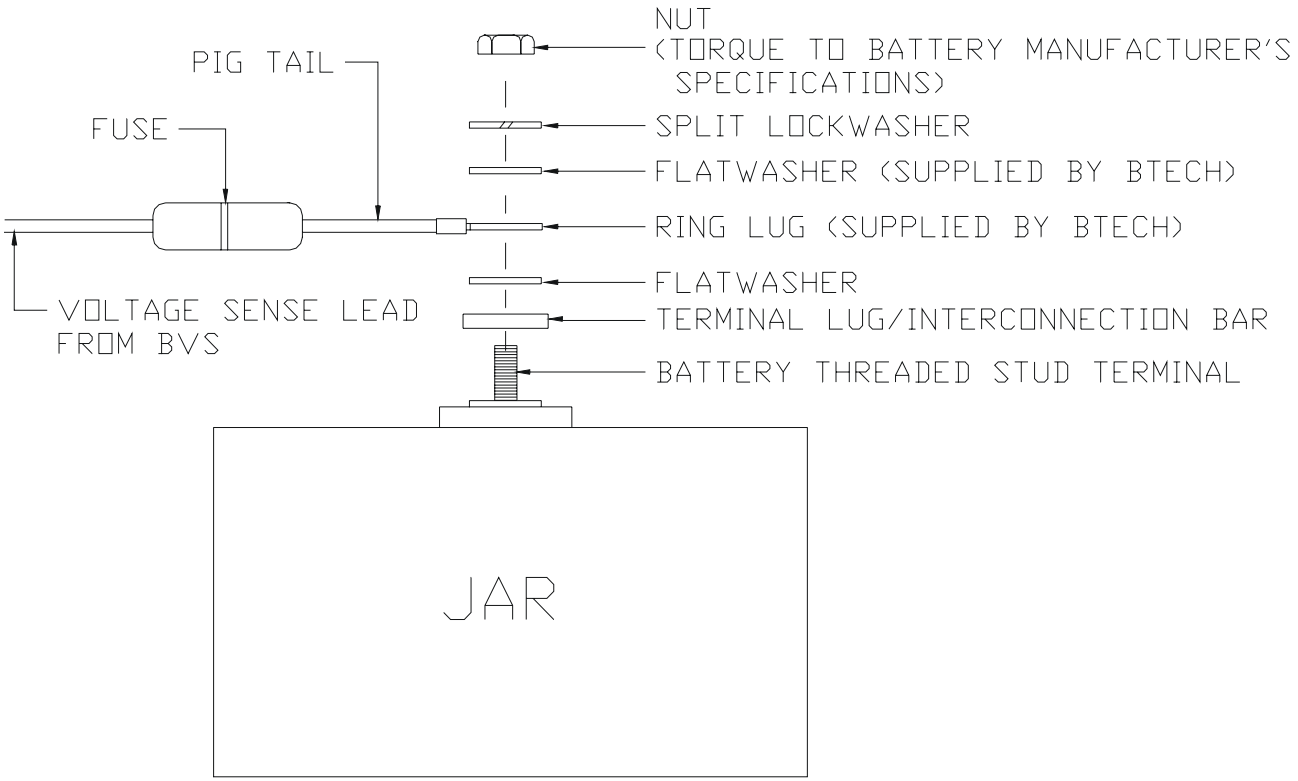
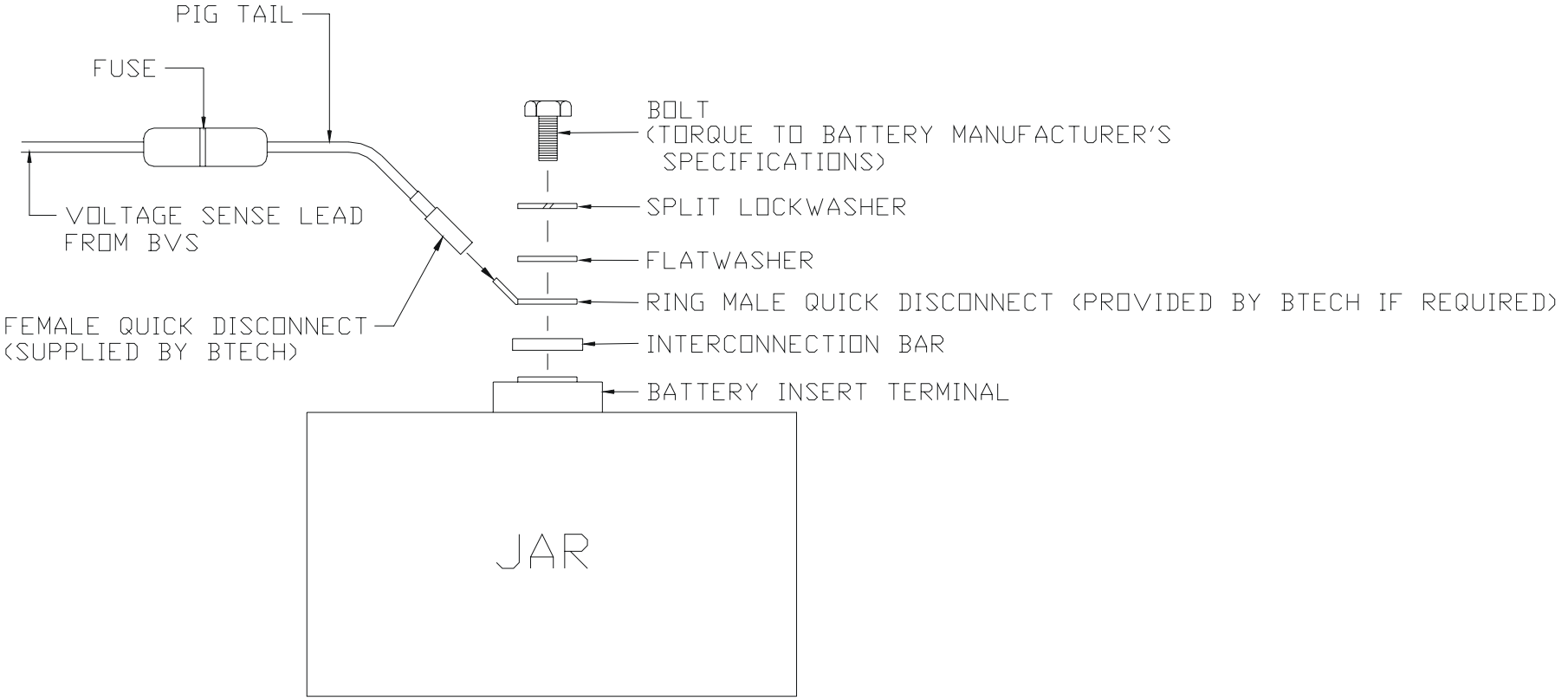


APPLY ANTI-CORROSIVE GREASE
TO ALL SURFACE PARTS.

TYPICAL ATTACHMENT OF RING TERMINAL WITH THREADED STUD TERMINATION
FIG. 3D



APPLY ANTI-CORROSIVE GREASE
TO ALL SURFACE PARTS.

TYPICAL ATTACHMENT OF QUICK DISCONNECT TERMINAL WITH THREADED INSERT TERMINATION AND BAR INTERCONNECTION
FIG. 3E

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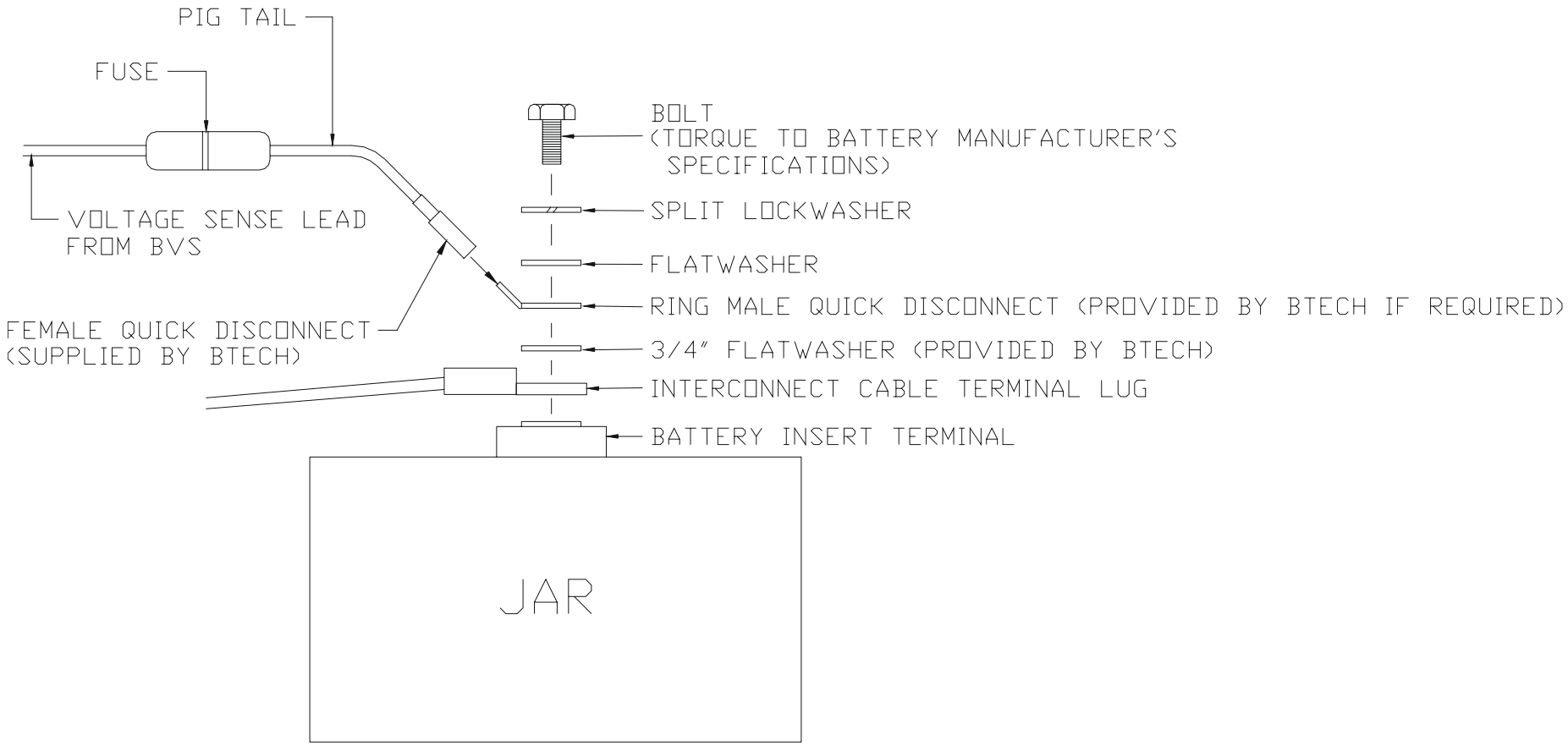

APPLY ANTI-CORROSIVE GREASE
TO ALL SURFACE PARTS.

TYPICAL ATTACHMENT OF QUICK DISCONNECT TERMINAL WITH THREADED INSERT TERMINATION AND INTERCONNECT CABLE WITH TERMINAL LUG
FIG. 3F

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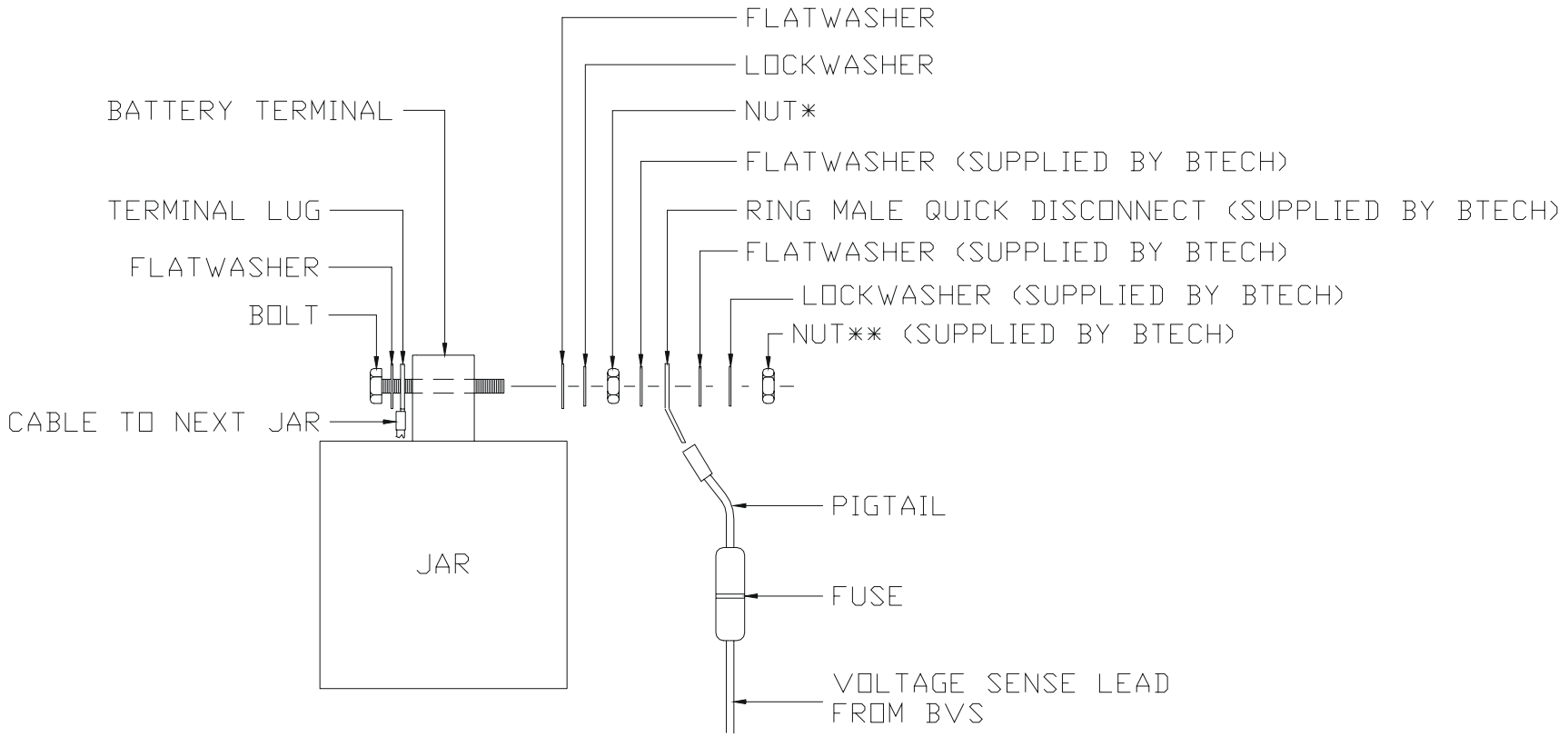
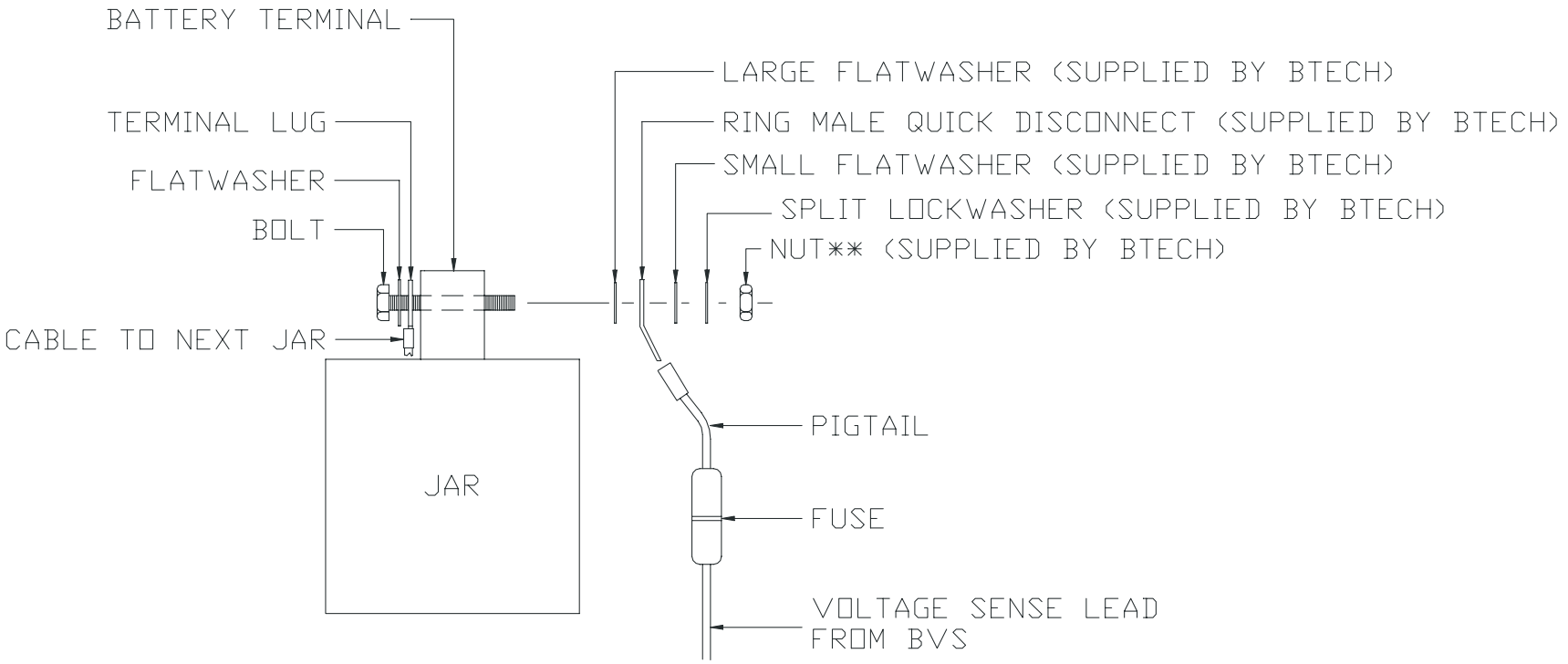


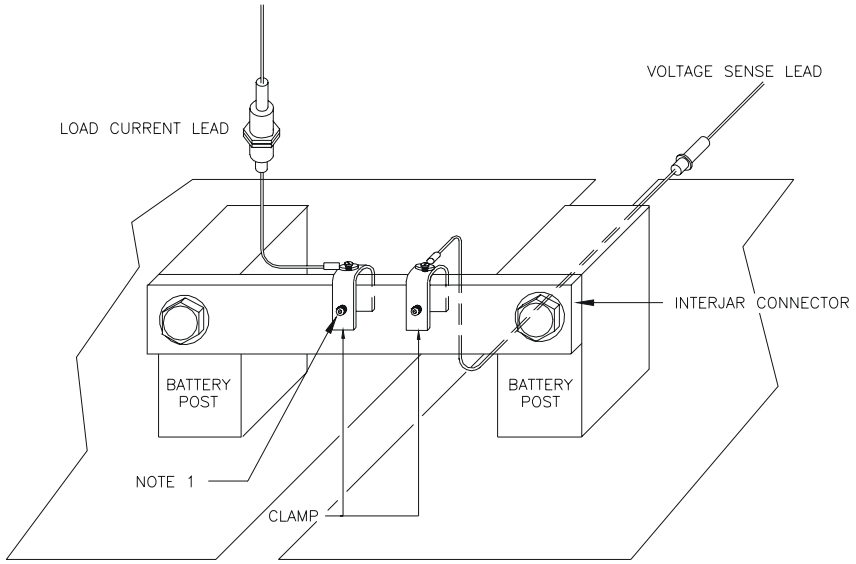
TYPICAL ATTACHMENT OF QUICK DISCONNECT WITH DOUBLE NUT CONNECTION
FIG. 3G

* TORQUE TO BATTERY MANUFACTURER'S SPECIFICATIONS.
** TORQUE TO 5 IN.-LBS.



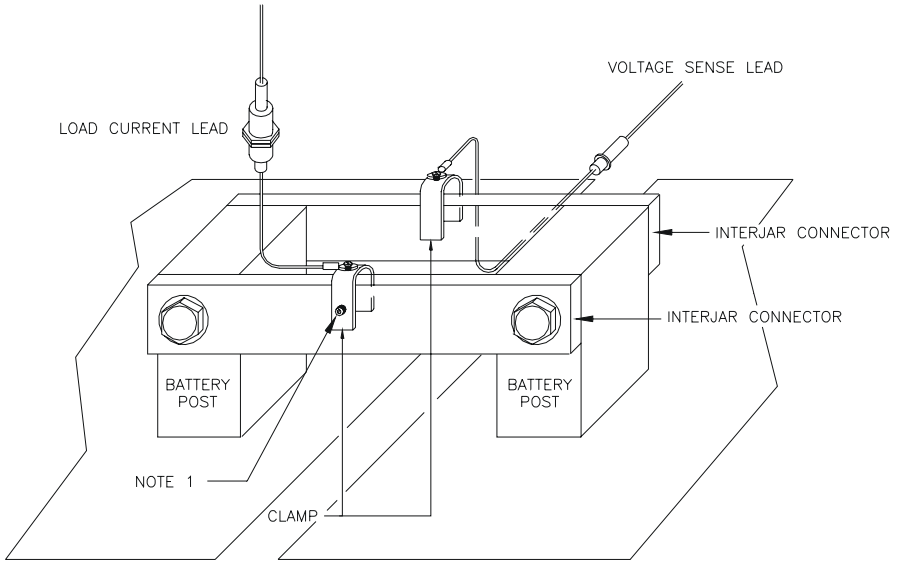
TYPICAL ATTACHMENT OF QUICK DISCONNECT ON "L" POST TERMINAL
FIG. 3H

* TORQUE TO BATTERY MANUFACTURER'S SPECIFICATIONS.
** TORQUE TO 5 IN.-LBS.



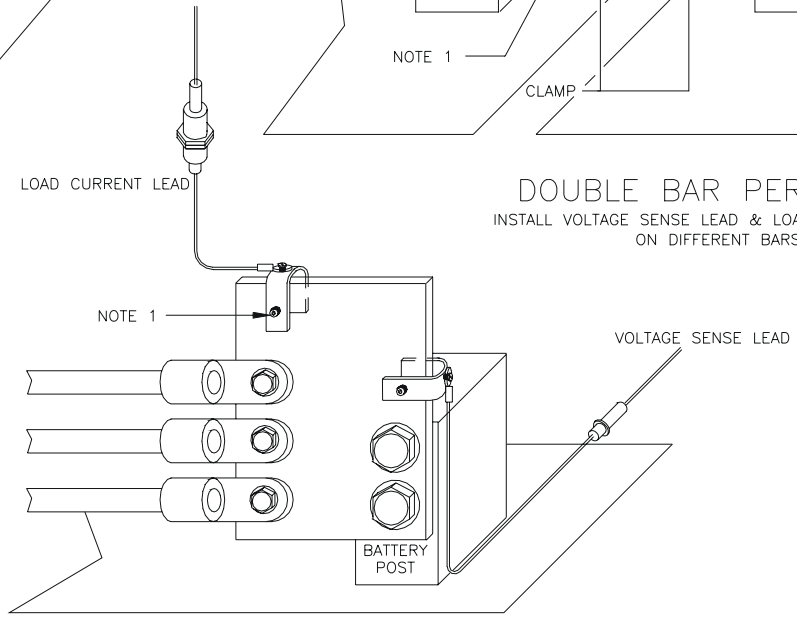
SINGLE BAR PER POST

VOLTAGE SENSE LEAD & LOAD CURRENT LEAD CLAMPS MUST NOT TOUCH



DOUBLE BAR PER POST

INSTALL VOLTAGE SENSE LEAD & LOAD CURRENT LEAD ON DIFFERENT BARS



SPREADER PLATE

VOLTAGE SENSE LEAD & LOAD CURRENT LEAD CLAMPS MUST NOT TOUCH

ATTACHMENT OF STAINLESS STEEL CLAMPS
FIG. 4A

NOTES:
1. TIGHTEN SET SCREW ON ALL CLAMPS TO 7 IN.– LBS.
2. APPLY ANTI–CORROSIVE GREASE TO ALL CONNECTION SURFACES.

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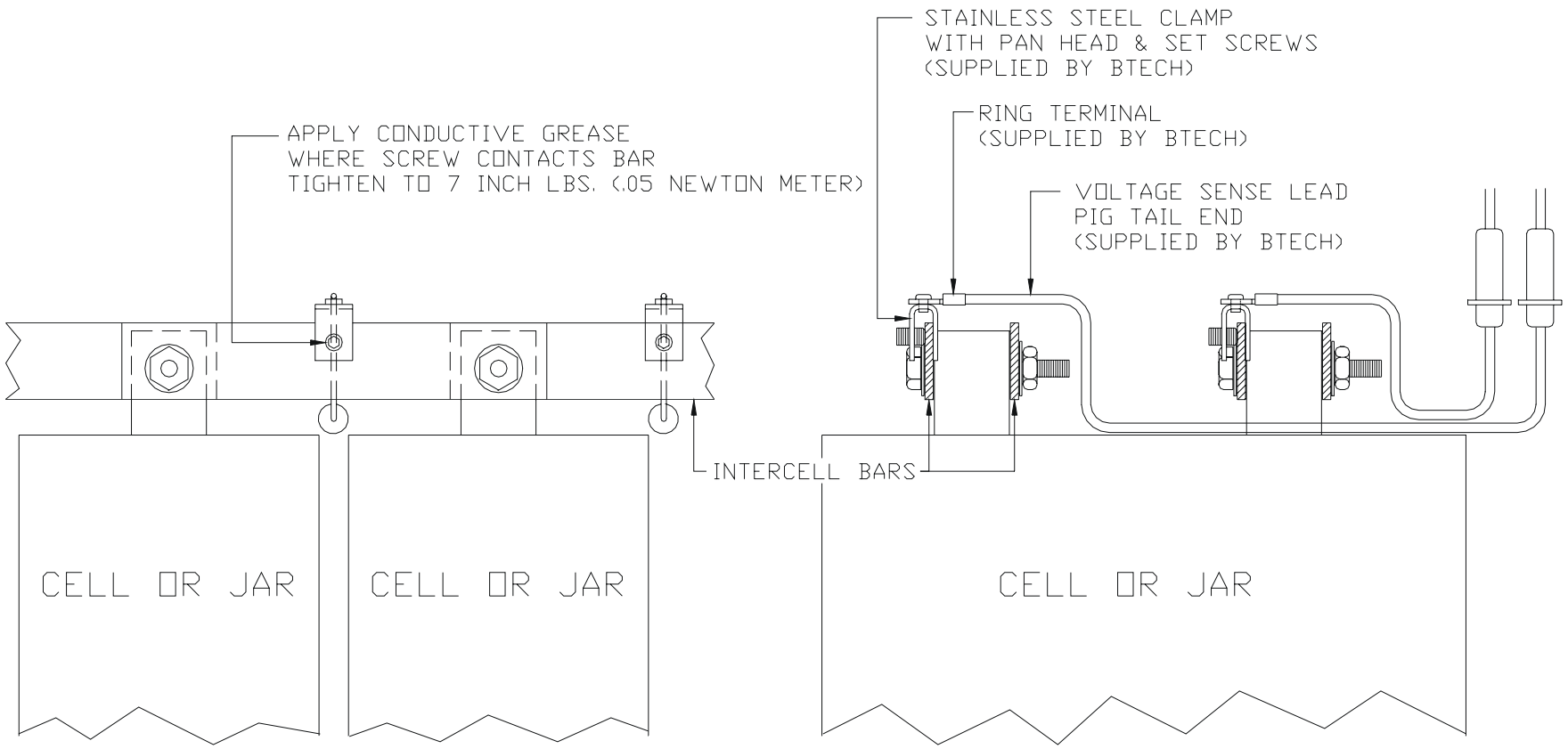

TYP. ATTACHMENT OF STAINLESS STEEL CLAMP
FIG. 4B

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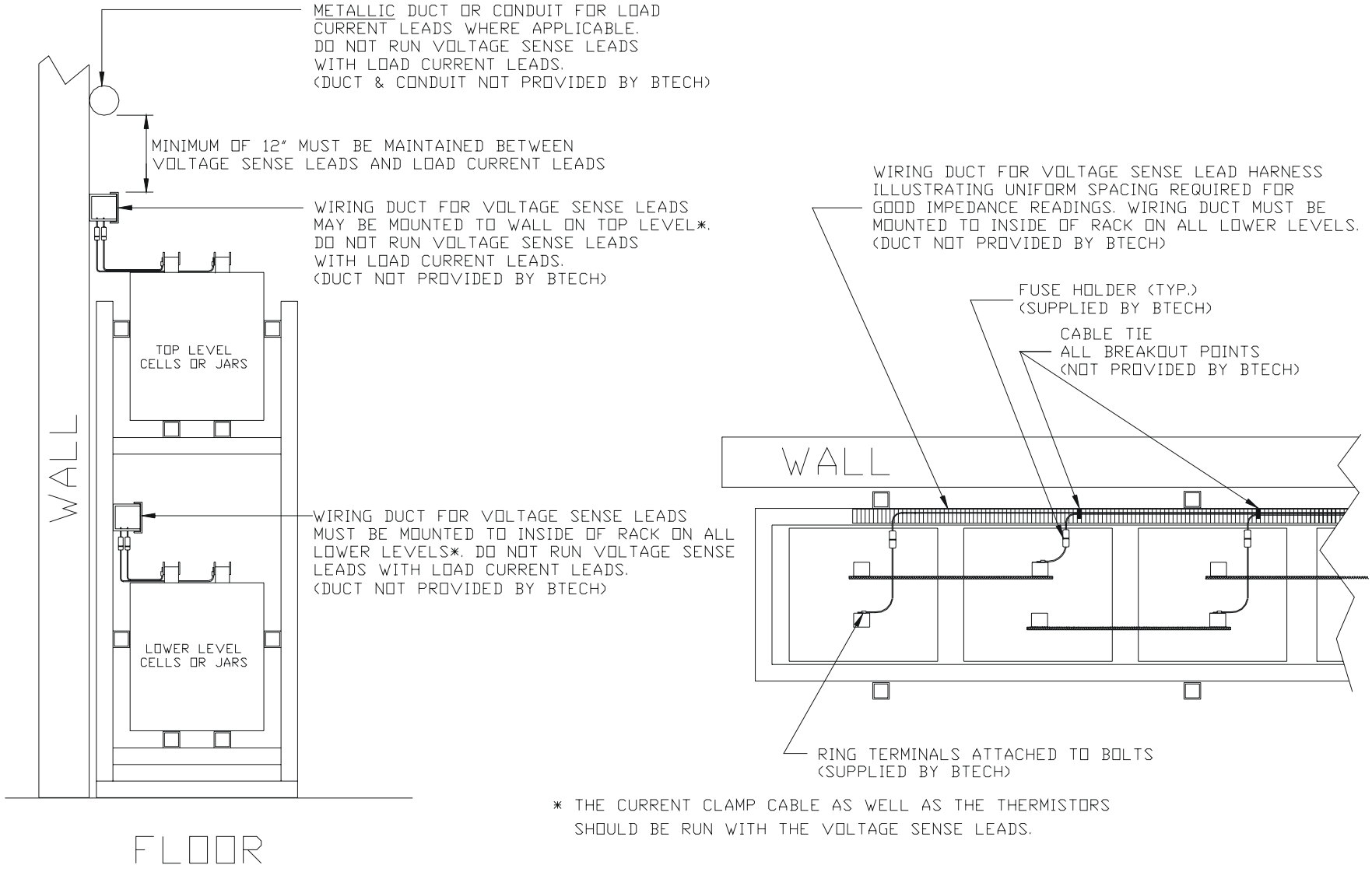
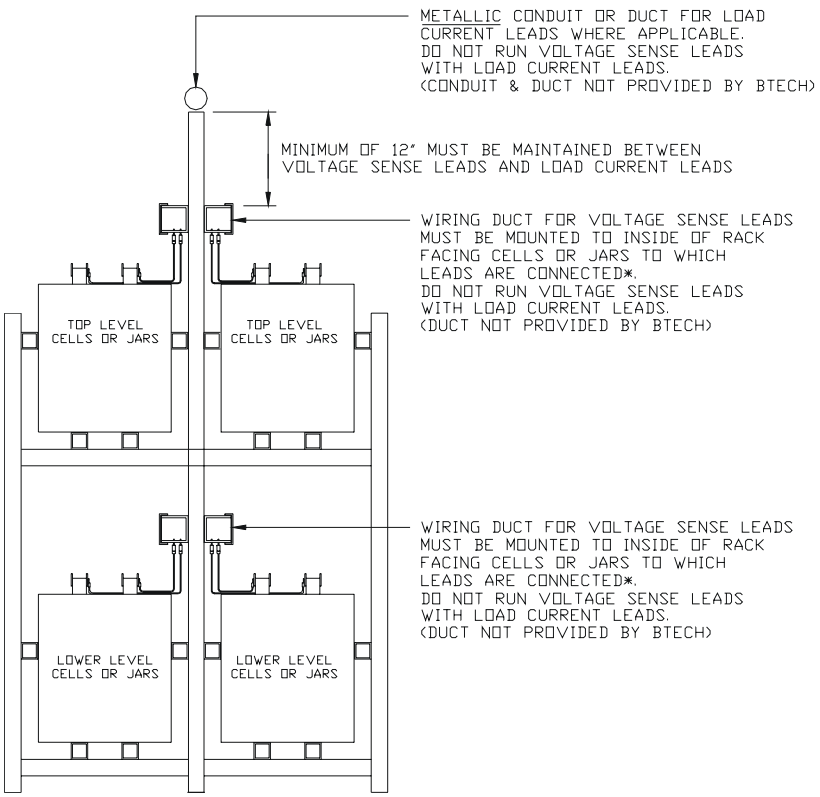
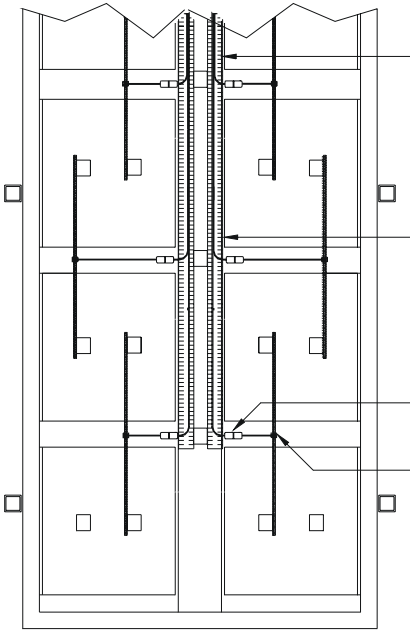


* THE CURRENT CLAMP CABLE AS WELL AS THE THERMISTORS SHOULD BE RUN WITH THE VOLTAGE SENSE LEADS.

LOCATING OF WIRING DUCTS
FIG. 5A

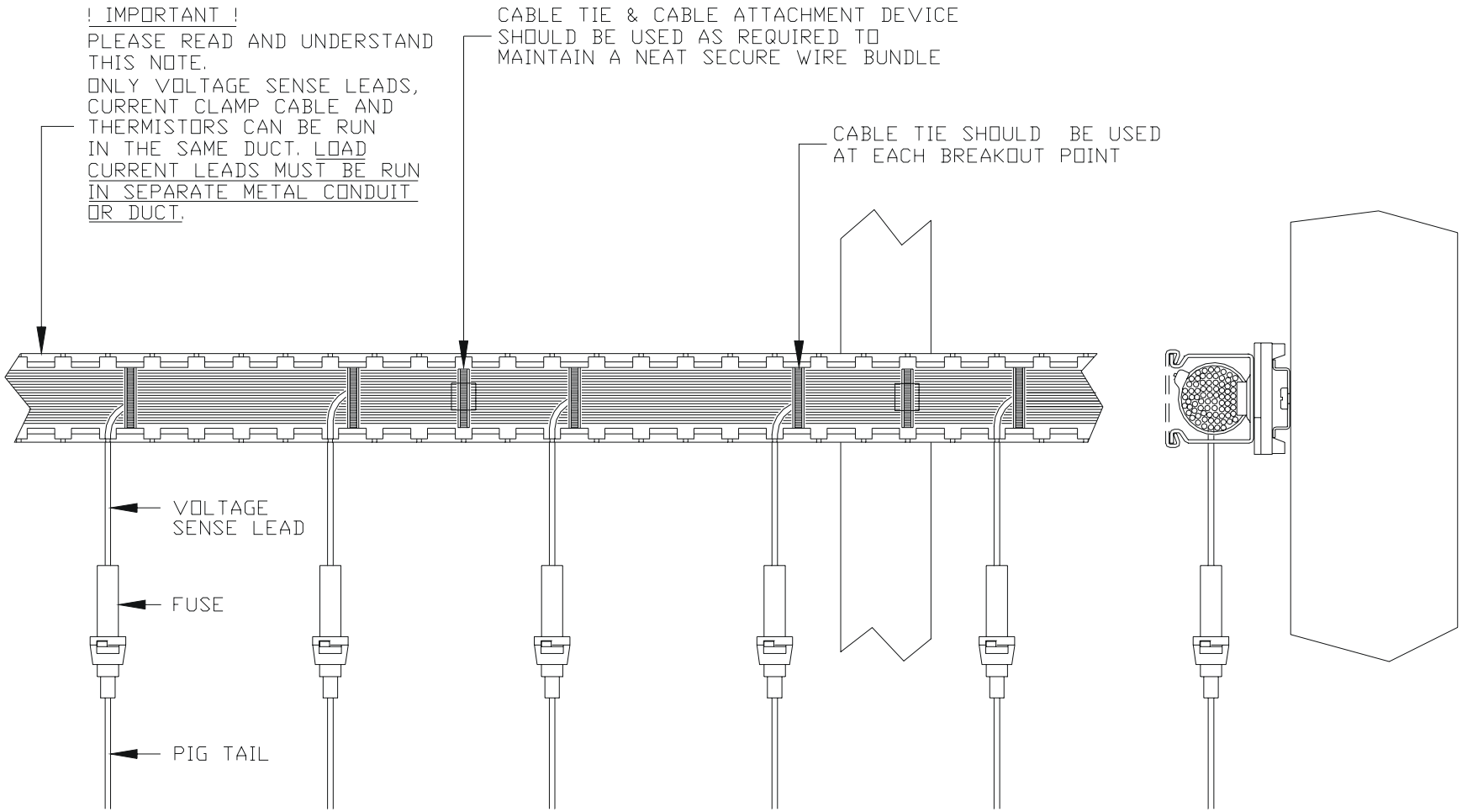




* THE CURRENT CLAMP CABLE AS WELL AS THE THERMISTORS SHOULD BE RUN WITH THE VOLTAGE SENSE LEADS.

LOCATING OF WIRING DUCTS
FIG. 5B

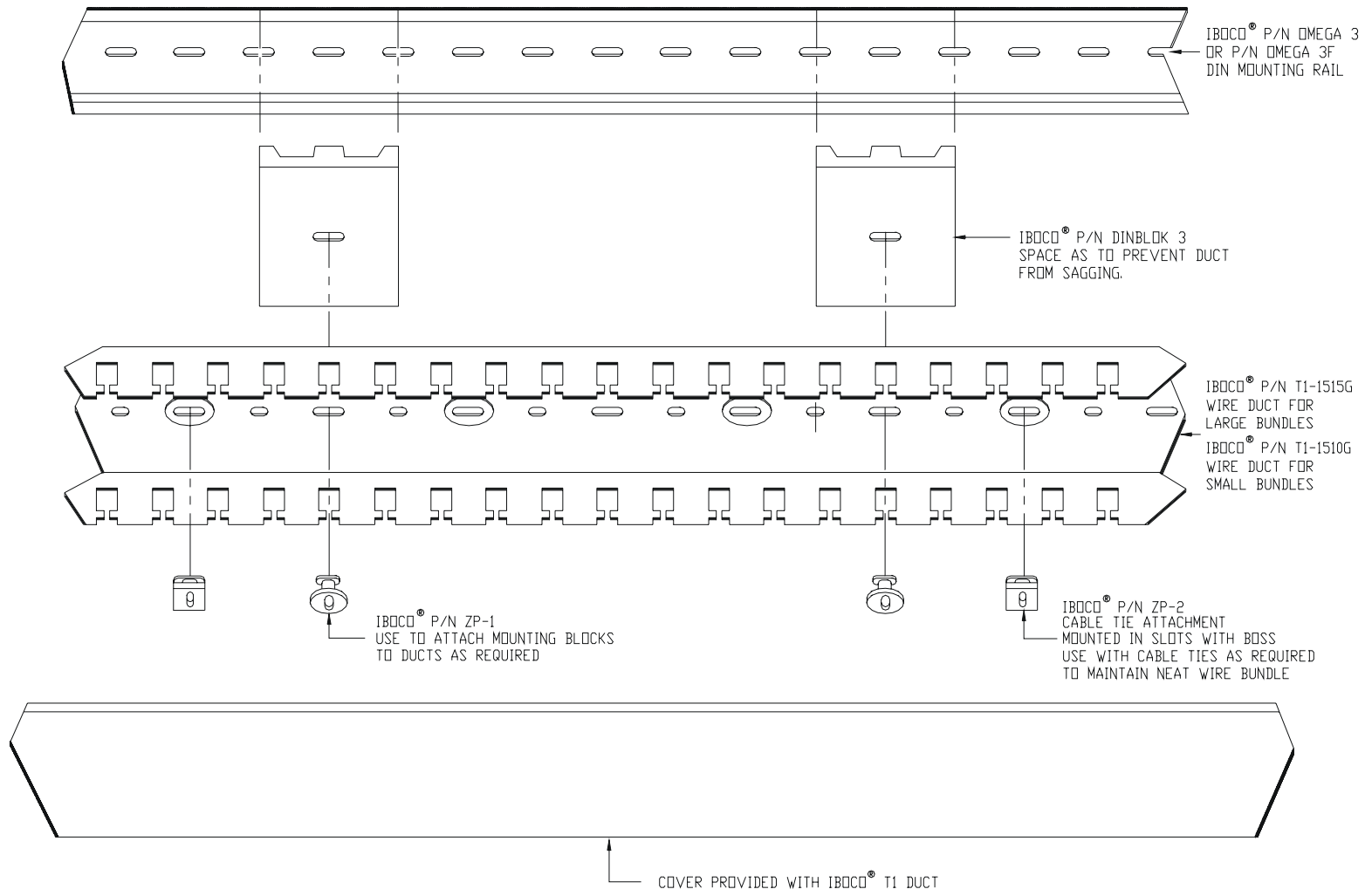
REV. 1 10/25/96



RECOMMENDED CABLE TIE POINTS
FIG. 5C

REV. 1 10/25/96

IBOCO® CORP.
10 ALVIN COURT, SUITE 100
EAST BRUNSWICK, NEW JERSEY 08816
PHONE (908) 238-0200 * FAX (908) 238-0304



WIRE DUCT FOR VOLTAGE SENSE LEADS
FIG. 6A

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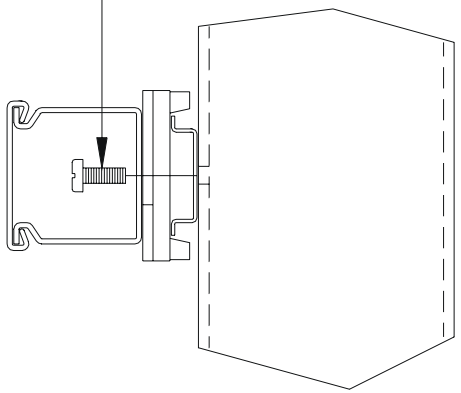
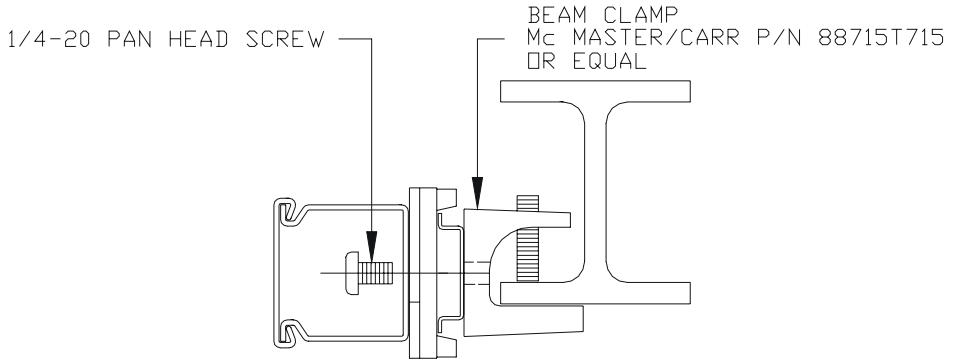
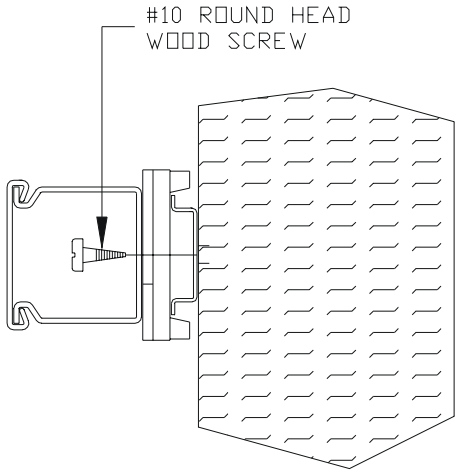


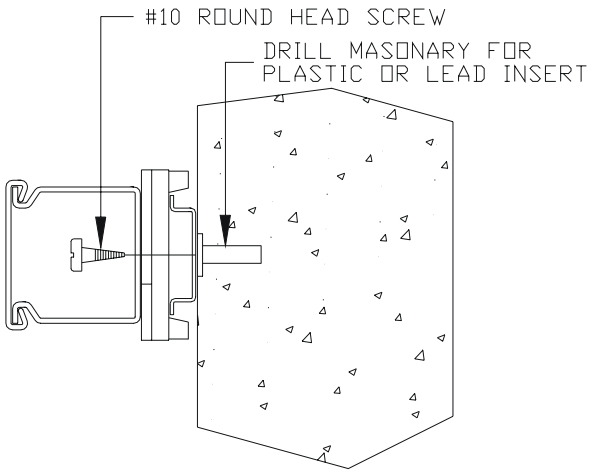
SQUARE METAL POST MOUNTING



METAL ANGLE, CHANNEL OR I BEAM MOUNTING



WOOD STUD OR POST MOUNTING



MASONARY OR BRICK MOUNTING

NOTE-
WHATEVER METHOD IS USED, SPACE FASTENERS
IN SUCH A WAY AS TO ASSURE A SECURE INSTALLATION

IBOCO® T1-XXXXG RAIL ATTACHMENT

IBOCO® IS A REGITERED TRADE MARK OF THE IBOCO® CORP. FIG. 6B

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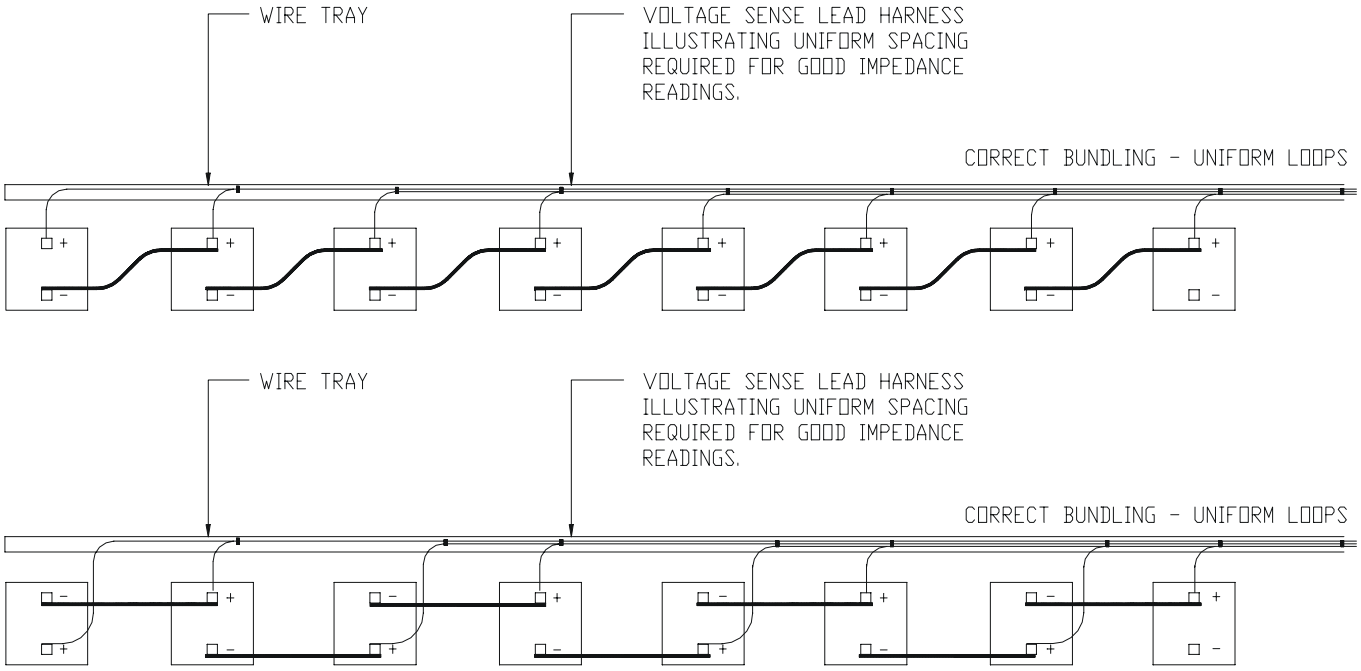
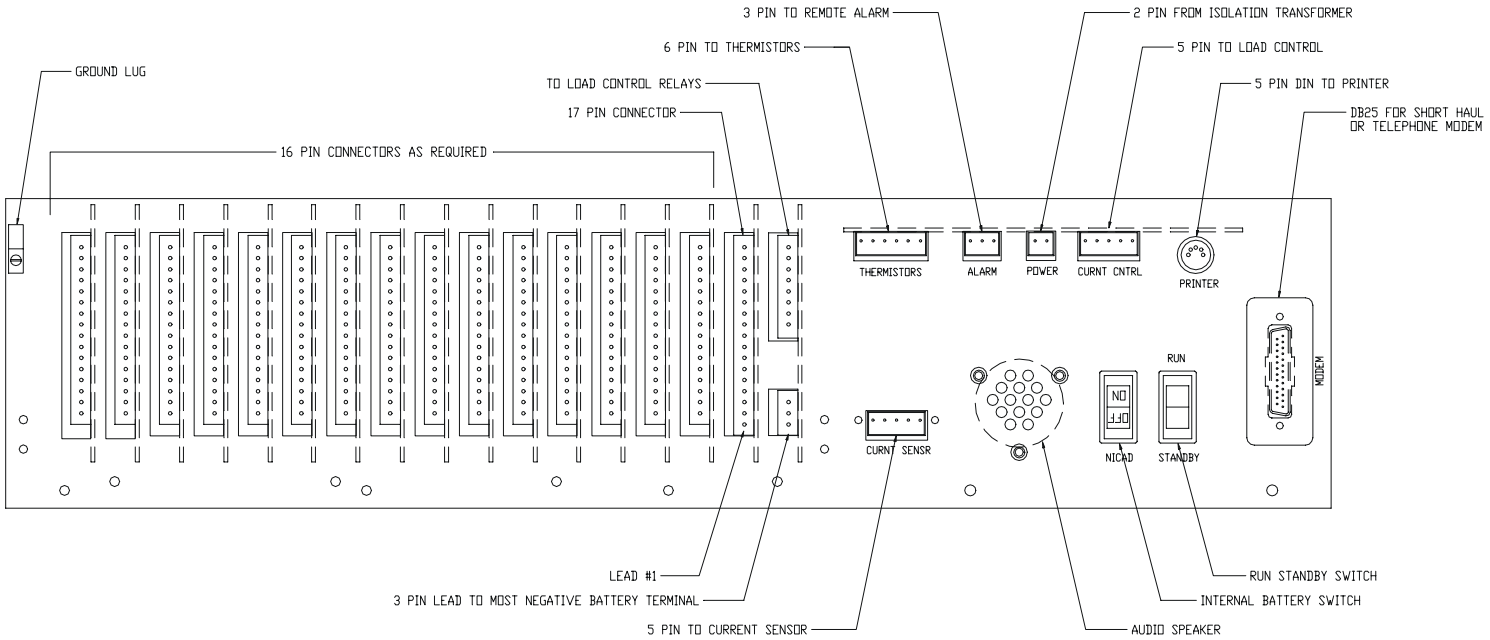


BVS VOLTAGE SENSE LEADS TO CELL CONNECTION EXAMPLES
FIG. 7



INTERNAL CONNECTOR LOCATIONS
FIG. 8

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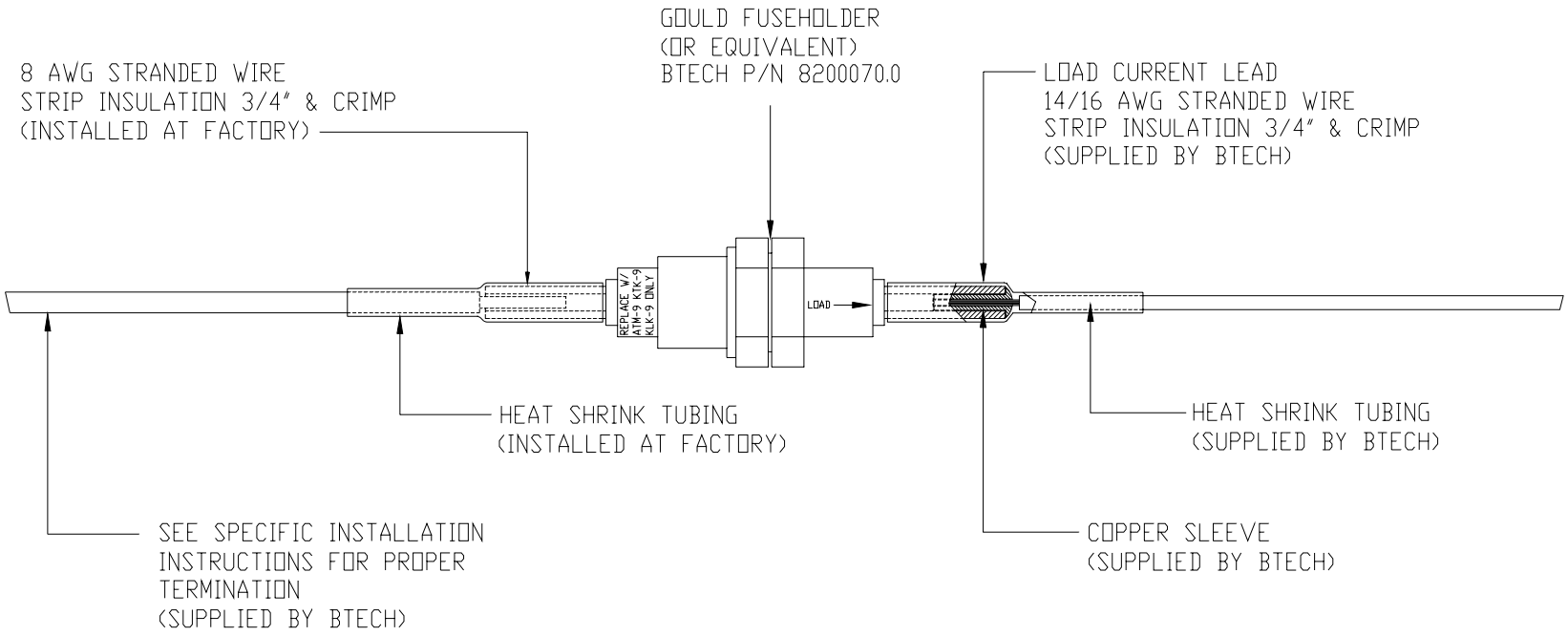

CURRENT LEAD
FUSEHOLDER CONNECTION
FIG. 9A

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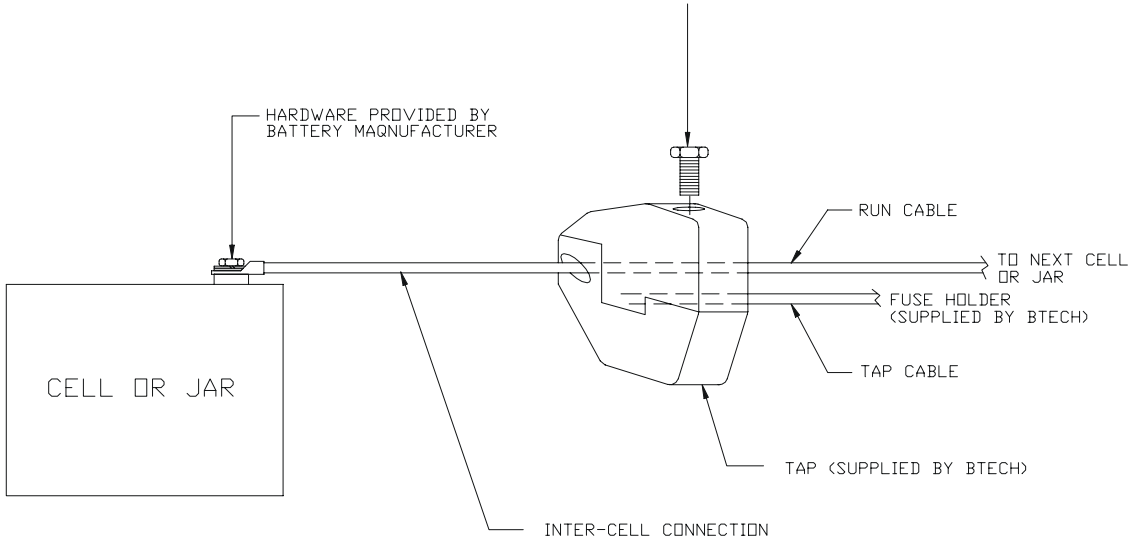
BOLT
FOR TAP IPC-4/0-6 TIGHTEN TO 156 INCH-POUNDS OF TORQUE FOR RUN CABLE LESS THAN 0.650" O.D.
FOR TAP IPC-350-4/0 TIGHTEN TO 300 INCH-POUNDS OF TORQUE FOR RUN CABLE GREATER THAN 0.650" O.D. BUT LESS THAN 0.815" O.D.



TYPICAL ATTACHMENT OF TAP
FIG. 9B

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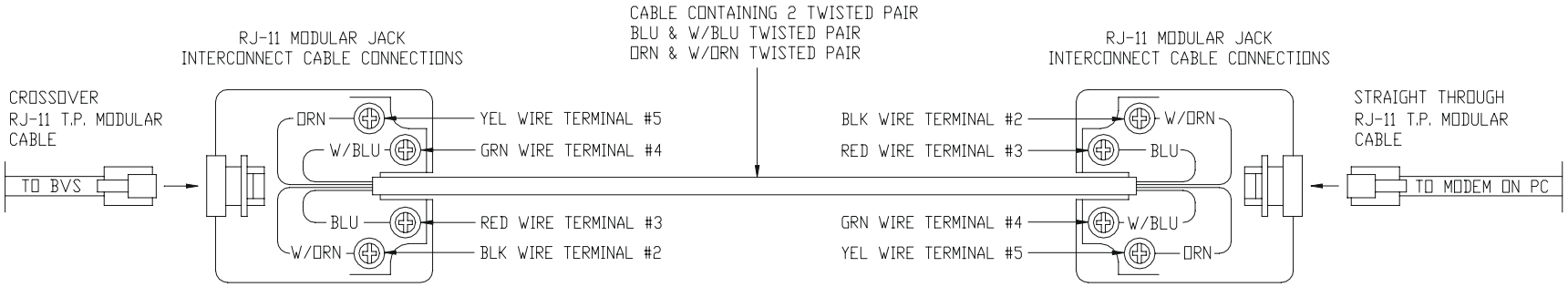

WIRING DIAGRAM
SHORT HAUL COMMUNICATIONS LINK
BVS TO PC

FIG. 10