

Installation Engineering Handbook 18
Western Electric Company, Incorporated
Kearny Works

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CONNECTING

PRESSURE TYPE (MECHANICAL) LUGS, CONNECTORS, SPLICES AND CONNECTIONS

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2. GENERAL2.1 Scope

2.11 This section contains connector information and methods for making solderless connections of wire ends to connecting devices (connectors, lugs, etc.). Connection of small gauge wire ends directly to screw heads is a form of a solderless connection and is also contained herein.

2.12 Securing these devices to bus bars, bus bar details, stud connectors, studs, etc., is covered in Section 7E, with the exception of KS-5537 List 300 series. The fastening of this connector to the bus bar is covered herein since the screws used for this purpose, and the screws used for clamping the wire in the connector are the same.

2.13 These generally used solderless connector devices are considered "pressure-type wire connectors" in the National Electrical Code.

2.14 Use this section with the other sections in the 7 series.

2.2 Storing and Ordering

2.21 Keeping the parallel connectors and lugs in the cartons and stored by list numbers until ready for use will facilitate selection of item numbers called for on job drawings.

2.22 On job requisitions for connectors specify the KS and list number if available, otherwise specify the type of connector and the wire sizes to be joined as well as indicating whether the wire is stranded or solid.

2.3 Cautions

2.31 The main difficulty in obtaining a reliable connection when installing solderless connectors is poor workmanship. The instructions in the following paragraphs regarding tightening and the precautions against overtightening must be carefully observed.

2.32 When using Allen type wrenches to set up connectors or terminal lugs as covered in this section, no additional leverage should be applied to the wrench by means of pipes or bars. The "feel" of the Allen wrench, due to its length and "sharpness" on the hand, tends to limit the tightening to the proper value. Therefore, the wrench should not be protected unless hazards of making hot connections are involved. When protection is required apply friction tape. Spaghetti tubing or sleeving may be placed on the wrench before taping as an aid in removing the tape. When taped for this reason, guard against this padded feel lending itself to overtightening.

2.33 Under no circumstances shall a connector be used on a wire for which it is not intended. Never cut or fold strands.

2.331 Markings on the connectors usually show the wire sizes, otherwise a code will be used which can be referred to information in the handbook for the corresponding wire size. KS-5482-01 power wire is marked on the outer covering, however, if it is not possible to read this, the bare diameter may be referred to Section 6A for its corresponding size.

2.4 Planning

2.41 Due to both installation verification and subsequent operating company maintenance procedure, consideration shall be given to the location of solderless connectors when planning and running power wire. The area allocated on cable racks, details, etc., for solderless connectors should be selected on the basis that the connectors so placed, will least likely be covered on present or future cabling jobs.

2.42 Solderless terminals, lugs, connectors and splices must be located so they can be felt with the hand, as a check for heating, without disturbing other wires. They must also be accessible for tightening by opening doors, removing covers, wedging up or moving other cables as necessary, but without interrupting service. These connections, when on cable racks or other supporting frameworks, must therefore be placed on the bottom and kept accessible from below or on top or outside of other wires and cables.

2.5 Tightening

2.51 The tightening of a solderless connector is not quite like the tightening of a bolt. The materials are softer and yield more easily under pressures. Each connector and the correct wrench supplied for it have been designed

so that a mechanically and electrically secure connection results when the screw or nut is tightened until the wrench presses firmly into the hand. A slight additional tightening does no harm. It is considered good practice to bear down until the wrench almost hurts the hand. Further tightening (and it may be possible to take up a quarter turn more without using padding or an extension on the wrench) approaches the danger point where either the wire or the connector may be injured.

2.52 All connectors in common use in the field have a wide margin between just securely tight and overtight. They will cause no trouble if installed in a workmanlike manner. A few will loosen slightly, apparently due to repeated cycles of heating and cooling, and must be re-tightened. Hence the need for rechecking most connectors before turnover and the need for locating them so the telephone company can check them. Verification must be done according to instructions. Excessive twisting or pulling will loosen small connectors.

3. INSTALLING EQUIPMENT

3.1 The required tools and supplies are shown in Section 7A.

4. CONNECTORS - SMALL WIRE SPLICING (WIRE NUTS)

4.1 Description & Application

4.11 Table "A" shows the various numbers of stranded or solid wires and combinations that can be connected by the Bryant or Ideal R-3045 and R-3046 wire connectors. These connectors can be recognized by their hard bakelite body. See Figure 1(B).

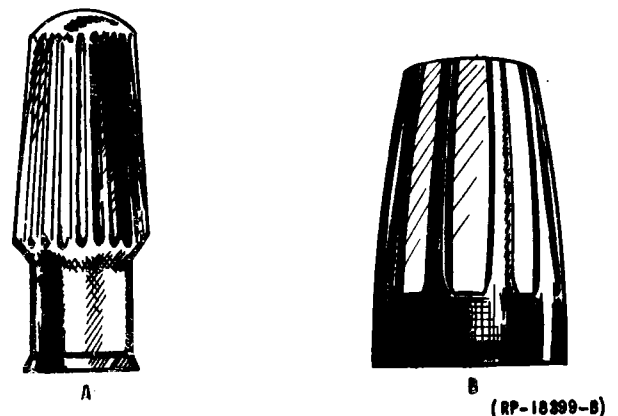


FIG. 1 SMALL WIRE CONNECTORS (WIRE NUTS)
(PARS. 4.11, 4.12)

4.12 Table "B" indicates all combinations of wire sizes that can be joined with the 3M R-3045 wire connector. This connector may be identified by a soft PVC outer covering. See Figure 1(A).

4.121 Orders for either R-3045 or R-3046 wire connector may be supplied by the R-3045 wire connector manufactured by the Minnesota Mining and Manufacturing Company designated 3M. This connector will join nearly the same range of wire sizes as both the R-3045 and R-3046 by Bryant or Ideal. See Table B. The 3M connector contains a "live" spring and since it may take a degree of set when placed on the wires it is not recommended for reuse.

TABLE A - NUMBER AND COMBINATIONS OF VARIOUS STRANDED AND SOLID WIRES JOINED WITH BRYANT OR IDEAL R-3045 AND R-3046 WIRE CONNECTOR (PARS. 4.11, 4.43)

	No. 14	No. 12	No. 10
R-3045	2, 3, 4	2	-
R-3046	4, 5, 6	2, 3, 4	2, 3
<u>Combination of Different Size Wires</u>			
R-3045	1 No. 12 and 2 No. 14		
	1 No. 10 and 1 No. 16 or 18		
R-3046	1 No. 12 and 2, 3, 4 or 5 No. 14		
	2 No. 12 and 1, 2 or 3 No. 14		
	3 or 4 No. 12 and 1 or 2 No. 14		
	1 No. 10 and 1, 2 or 3 No. 14 or 12		
	2 No. 10 and 1 No. 12		
	2 No. 10 and 2 No. 14		
	2 No. 10 and 1 No. 16 or 18		

TABLE B - NUMBER AND COMBINATIONS OF VARIOUS STRANDED AND SOLID WIRES JOINED WITH 3M R-3045 WIRE CONNECTOR (PARS. 4.12, 4.43)

		SCOTCHLOK TYPE R											
WIRE SIZE	NO. OF WIRES	1	2	3	4	5	6	7	8	9	10	NO. OF WIRES	WIRE SIZE
16S	2	•	•	•	•	•	•	•	•	•	•	2	16S
	3	•	•	•	•	•	•	•	•	•	•	3	16S
16	2	•	•	•	•	•	•	•	•	•	•	2	16
	3	•	•	•	•	•	•	•	•	•	•	3	16
14S	2	•	•	•	•	•	•	•	•	•	•	2	14S
	3	•	•	•	•	•	•	•	•	•	•	3	14S
14	2	•	•	•	•	•	•	•	•	•	•	2	14
	3	•	•	•	•	•	•	•	•	•	•	3	14
12S	2	•	•	•	•	•	•	•	•	•	•	2	12S
	3	•	•	•	•	•	•	•	•	•	•	3	12S
12	2	•	•	•	•	•	•	•	•	•	•	2	12
	3	•	•	•	•	•	•	•	•	•	•	3	12
10S	2	•	•	•	•	•	•	•	•	•	•	2	10S
	3	•	•	•	•	•	•	•	•	•	•	3	10S
10	2	•	•	•	•	•	•	•	•	•	•	2	10
	3	•	•	•	•	•	•	•	•	•	•	3	10

ALL WIRE SIZES FOLLOWED BY THE LETTER "S" DENOTE STRANDED WIRE.

4.2 Battery Distribution Leads

4.21 Splices and connections of No. 10, 12 and 14 A.W.G. leads shall be made with R-3045 and R-3046 wire connectors. These connections shall be left accessible and shall be made only at protected locations as discussed in Section 7A.

4.22 After assembly as covered in Paragraph 4.4 place a tie around all wires in each wire connector 2-1/2 inches to 3 inches from the connection. Using sewing twine, secure with a "clove hitch" and a "single tie" forming a square knot." See Figure 2. After completion, fold the splice parallel with form and include under stitches if sewed or banded. Always leave the wire connectors on the outer surface of forms.

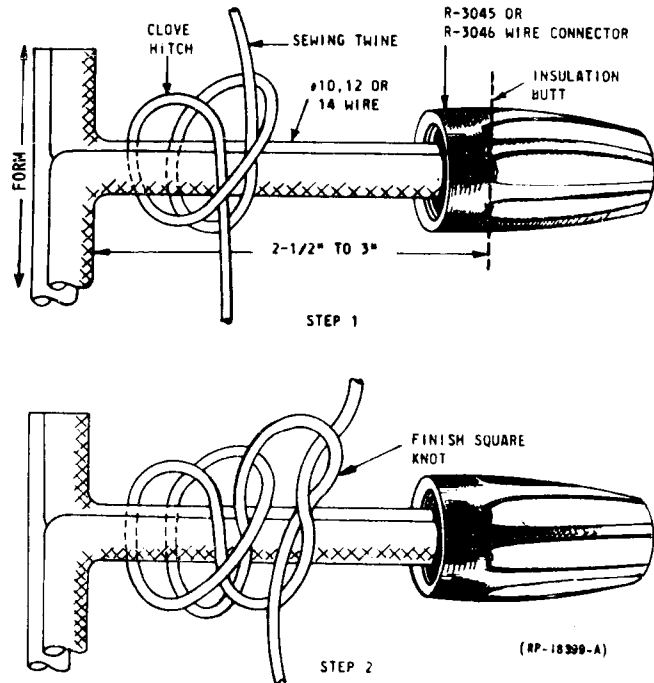


FIG. 2 METHOD OF TYING SPLICE ON SMALL BATTERY DISTRIBUTING LEADS (PAR. 4.22)

4.3 Power Service Circuits

4.31 No. 10, 12, and 14 AWG used in power service circuits are spliced in approved boxes, fittings, wireways, gutters, enclosures, etc., with R-3045 and R-3046 wire connectors. See Figure 3.

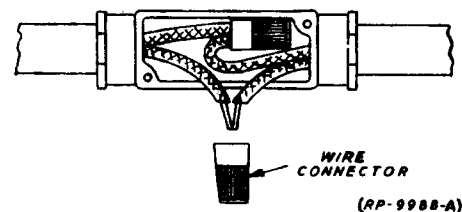


FIG. 3 SPLICING WITH SMALL WIRE CONNECTOR (PAR. 4.31, 4.41)

4.4 Assembly

4.41 Figure 2 shows the simplest splice when joining two wires together with these wire connectors.

4.42 Wire connectors shall be located so as to be accessible for maintenance and inspection.

4.43 Where combinations of wires as shown in Tables A and B are to be connected proceed as follows:

4.431 When connecting in a box or fitting arrange the group of leads so that the completed connections may be fitted into the box without having to be forced by the cover. This may be done by staggering the connector locations, that is, do not make individual connections in the same location in the box.

4.432 Remove the insulation from the end of the wires for a distance of 1/2" for solid wires and 5/8" for stranded.

4.433 See that the exposed ends of the wires are clean. Scrape with R-2761 skinning knife or clean with fine abrasive paper as necessary.

4.44 Hold wire ends together close to the insulation butt, making sure ends are even. Allow stranded wire to extend beyond solid wires when joining the combination. Place the connector over the wire ends without attempting to twist them together and screw on the connector in a clockwise direction similar to screwing a nut on a bolt.

4.45 Tighten connector securely. It is imperative the connector be tightened completely when initially installed as no further verification is required during the time of the installation interval.

4.46 The wire insulation shall extend into the skirt of the connector.

4.47 When it is necessary to add a wire to an existing joint, unscrew the connector, place the wire to be added alongside the joined wires, and screw a proper size connector on again.

4.471 If turning the 3M connector counterclockwise does not remove it, slightly flatten the closed end of the connector with a pair of pliers. Once removed, discard the connector.

4.48 Use the R-3253 small wire connector (wire nut) wrench when installing a number of the wire connectors of either size. This hand tool will relieve finger fatigue frequently experienced when many connections are made in a short period of time. See Figure 4.

5. CONNECTORS - PARALLEL TYPE (KS-5537)

5.01 KS-5537 connectors covered herein do not include the list 300 series. These are listed under a separate paragraph

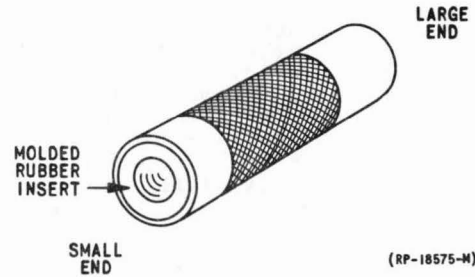


FIG. 4 SMALL WIRE CONNECTOR (WIRE NUT) WRENCH R-3253 (PAR. 4.48)

heading elsewhere in this section. The parallel connectors covered in this paragraph are also known as "gutter taps". Various stages of connector assembly are shown in Figure 5.

5.02 Locate connectors to insure they will not be under strain, liable to damage and insofar as drawing requirements permit, accessible for verification. Allow room for the assembly of covers.

5.03 Do not locate connectors on cable rack cross straps.

5.04 Each wire shall extend, without a break, the full length of the connector groove.

5.05 Select the correct connector as listed in Table C and check the size of the wire stamped on the connector. Use the connector body as a guide, and mark the tap lead and feeder wire at the connecting points allowing up to 1/16" overhang on the tap lead (lead that terminates). Remove the insulation with the R-2761 skinning knife or the R-2884 power wire stripper as described in Section 7A. Exercise care so as not to remove more insulation than is required and not to nick the strands.

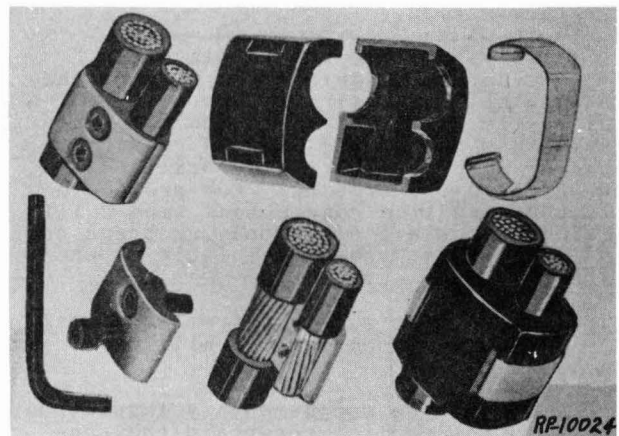


FIG. 5 KS-5537 PARALLEL CONNECTORS AND WRENCH (PARS. 5.01, 5.10)

5.06 Contact surfaces which show any signs of corrosion or oxidation shall be cleaned. Use fine abrasive paper for connectors and remove dust with a dry cloth. Removed insulation usually exposes a clean wire end, however, should the rubber adhere to the strands, scrape clean with the skinning knife. Coat the contact surfaces of the connector and the wire with NO-OX-ID "A" "Special" or NO-OX-ID "A" compound taking care so as not to get any of the compound on the wire insulation. Apply to cleaned surfaces as soon as cleaning is performed.

5.07 Place the connector on the wire so that the set screws are accessible for maintenance purposes. Be careful, especially of wire in small sizes, that strands are not caught between the flat surfaces of the connector.

5.08 Tighten the set screws with an R-2485 or R-2486 Allen wrench so that the connectors are both mechanically and electrically secure.

5.09 The maximum amount of "shiner" (exposed wire between insulation and connector body), permitted for each side and with cover removed, is 1/16" as gauged by eye.

5.091 To correct excessive shiners fill in with friction tape to the thickness of the insulation and finished with 1-1/2 to 2 turns of friction tape over the outer wire covering. Apply one coat of shellac.

5.10 Select the correct cover knockout and break out by forcing outward. This may be done by holding the knockout disc firmly between the flat side of a screw driver blade held on the inside, and the thumb on the outside of the disc. Pull straight away from the cover in the direction of the thumb. Remove irregularities at the break-out points only when they interfere with the proper seating of the cover. Place cover halves over the connector and snap the flat spring into the groove. Refer to Figure 5.

5.101 With the cover in place and pressed against the side of the wire insulation exposing the largest opening, the opening between the wire insulation and cover shall not be greater than 1/8". A shank of a 1/8" drill may be used to gauge the opening. For protection while checking live connections tape drill.

5.102 Should a cover opening break out badly, remedy the fault in one of the following ways:

(a) Pair it with a better cover half so the combination will be acceptable.

(b) Provide supplementary insulation between the cover and the connector end by applying two layers of friction tape or by closely fitting against the connector end around the wires, two layers of RM-583101 gray sheet fiber.

(c) With cover removed, add friction tape to build up wire insulation adjacent to the connector and apply a coat of shellac.

(d) Order new covers.

5.11 Locate near the connector, a strain relief tie when the tap wire is likely to be disturbed or when the absence of a tie results in any strain imposed on the connector by the weight of the tap wire. The tie may be in the form of a Chicago stitch made with sewing twine or an R-4265 Nylon Cable Tie installed with an R-4266 Cable Tie Fastening Tool. See Handbook 9, Section 205 for their use.

6. CONNECTORS - CROSSTAP TYPE NO. 2632

6.1 Prepare, connect, and place covers for the crosstap connector in a manner similar to Paragraph 5 for parallel connectors. Tighten the set screws with an R-3028 wrench (long handle). (See Figure 6.)

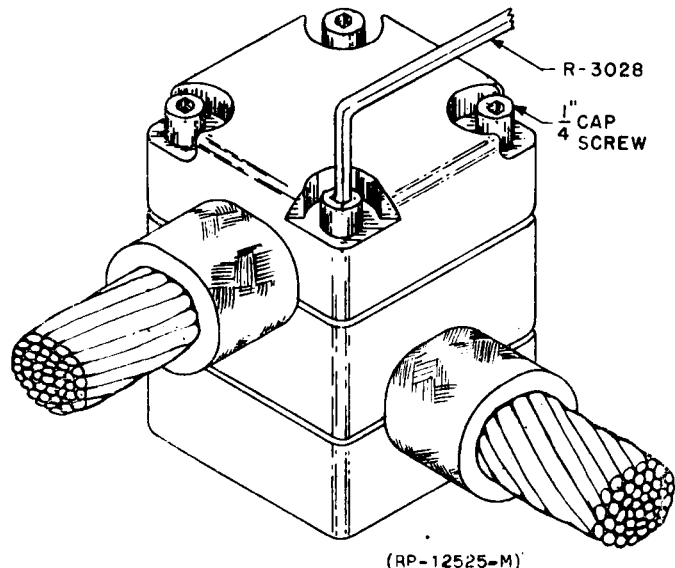


FIG. 6 FRANKEL CAT. NO. 2632 CROSSTAP (PAR. 6.1)

7. CONNECTORS - TWO-WAY TYPE NO. 2560C (IN LINE)

7.1 The Frankel Catalogue No. 2560C connector is used essentially for extensions of existing power feeders in working offices due to growth. (Splices of long, new power feeders made necessary by limitations of reel size, are joined with solder type sleeves as covered in Section 7C.)

7.2 Before making a connection with the No. 2560C connector place the details of the insulating cover over the wire insulation with one end cap on one wire and the other cap and the tubular cover on the other wire prior to making the splice and far enough along the wire as not to interfere with the connector assembly. See Figure 7.

7.3 Remove wire insulation equivalent to the distance on the 2560 connector from its center or from the wire stop ring when provided, to the end of the split sleeve. Use the R-2761 skinning knife or the R-2884 power wire stripper as described in Section 7A. Should the rubber adhere to the strands, scrape clean with the skinning knife.

7.4 The contact surfaces of the wire and connector shall be clean.

TABLE "C"
PARALLEL CONNECTORS KS-5537 FOR STRANDED POWER WIRE (PAR. 5.05)

FIG. 1

LIST NO	CABLE SIZE STRANDED		MAX. DIM.		
	MAIN	BRANCH	A	B	C
201	800,000 & 750,000	800,000	2-9/16	3-13/16	2-19/32
202		&750,000			
203		700,000			
204		600,000			
205		500,000			
206		400,000			
207		&350,000			
208		300,000			
209		0000			
210		&0000			
211	700,000	00&0	2-3/8	2-7/8	2-1/4
212		1 & 2			
213		4 & 6			
214		8 & 10			
215		12 & 14			
216		300,000			
217		0000			
218		&0000			
219		00&0			
220		1 & 2			
221	600,000	4 & 6	2-3/16	2-7/16	1-7/8
222		8 & 10			
223		600,000			
224		500,000			
225		400,000			
226		&350,000			
227		300,000			
228		0000			
229		&0000			
230		00&0			
231	500,000	1 & 2	2-3/8	2-7/8	2-1/4
232		4 & 6			
233		8 & 10			
234		12 & 14			
235		300,000			
236		0000			
237		&0000			
238		00&0			
239		1 & 2			
240		4 & 6			

LIST NO	CABLE SIZE STRANDED		MAX. DIM.		
	MAIN	BRANCH	A	B	C
239	400,000 &350,000	400,000	2-3/8	2-7/8	2-1/4
240		300,000			
241		0000			
242		&0000			
243		00&0			
244		1 & 2			
245		4 & 6			
246		8 & 10			
247		12 & 14			
248		300,000			
249	300,000	0000	2-3/8	2-7/8	2-1/4
250		&0000			
251		00&0			
252		1 & 2			
253*		4 & 6			
254		8 & 10			
255		12 & 14			
256		0000			
257		&0000			
258		00&0			
259	0000 &0000	1 & 2	2-3/16	2-7/16	1-7/8
260		4 & 6			
261		8 & 10			
262		12 & 14			
263*		00&0			
264		1 & 2			
265		4 & 6			
266		8 & 10			
267*		12 & 14			
268*		300,000			
269	00 &0	00&0	1-7/32	1-25/32	1-1/4
270*		1 & 2			
271*		4 & 6			
272*		8 & 10			
273*		12 & 14			
274*		00&0			
275*		1 & 2			
276*		4 & 6			
277		8 & 10			
278*		12 & 14			
279	10	00&0	1-7/32	1-25/32	1-7/32
280*		1 & 2			
281*		4 & 6			
282*		8 & 10			
283*		12 & 14			
284*		300,000			
285*		0000			
286*		&0000			
287*		00&0			
288*		1 & 2			
289*	6	4 & 6	1-1/16	1-1/4	1-3/32
290*		8 & 10			
291*		12 & 14			
292*		300,000			
293*		0000			
294*		&0000			
295*		00&0			
296*		1 & 2			
297*		4 & 6			
298*		8 & 10			

* Connectors marked with asterisk will also accommodate solid branch conductors.

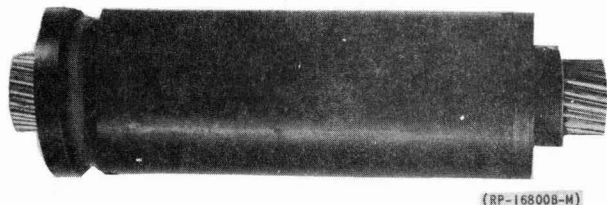
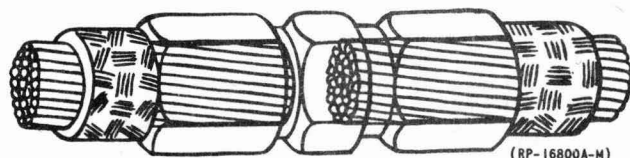


FIG. 7 NO. 2560 "TWO-WAY" CONNECTOR AND NO. 2560C "TWO-WAY" CONNECTOR WITH INSULATING COVER (PAR. 7.2)

7.5 Any oxide or corrosion shall be removed with fine abrasive paper. Dust with a dry cloth. Before the connection is made, apply NO-OX-ID "A" "SPECIAL" or NO-OX-ID "A" to contact surfaces of the wire end and the connector.

7.6 Insert the wires into the assembly and with the proper size wrenches, hold the connector body and tighten the clamping collars. As the collar screws away from the insulation, continue to slide the wire further in until the jaws grip sufficiently that this is no longer possible. Continue tightening each end while holding the center body until mechanically and electrically secure.

7.7 Slide the tubular cover over the connector and press the end caps into place.

7.71 If either end cap remains loose in the tubular cover or if there exists any exposed bare wire where the wire insulation does not go into the end caps, place several turns of friction tape around the wire and close to each end cap. Follow with a coat of shellac. Consider verification in Paragraph 13 before taping.

7.8 Connectors requiring insulation but not provided with a cover, may be taped. Verify connection in accordance with Paragraph 13 before insulating. Insulate with half-lapped rubber and friction tape, the combined thickness equal to at least that of the insulation. Follow with a coat of shellac except when in a raceway or other enclosure.

8. LUGS - KS-5517, KS-15562 AND T & B CAT. ATL TYPE

8.1 General

8.11 KS-5517 lugs are used to terminate a wire to bus bars, studs, iron work details, and battery and CEMF cell posts, etc. The wire is clamped in the connector and the connector in turn secured by clamping or bolting. Refer to Figure 8 for the various types and sizes available.

8.12 The KS-15562 connector as shown in Figure 9 consists of two halves which are clamped with hex head cap screws, nuts, and locknuts on to a bus bar without drilling. An opening on one or both halves provides a method of connecting to a wire end by clamping.

8.13 The T & B Cat. ATL type connector consists of two triangular shaped clamp halves secured to a bus bar without drilling, with three machine screws, nuts, and locknuts. Figure 10 shows how these wire connectors may be arranged to terminate one or two wire ends.

8.2 Connecting

8.201 Select the correct connector as shown in Figures 8, 9 and 10 and check the wire size as stamped on the connector.

8.202 Prepare wires for connecting by removing sufficient insulation to permit the wire to be placed the full depth of the hole in the connector, with the insulation flush with the face of the connector. Refer to Section 7A describing use of R-2884 power wire stripper and R-2761 skinning knife.

8.203 The contact surfaces of the wire and connector shall be clean.

8.2031 Clean any contact surfaces of the wire or connector which show signs of corrosion or oxidation with fine abrasive paper and dust with a dry cloth.

8.204 If the rubber should adhere to the strands scrape clean with the skinning knife.

8.205 Apply NO-OX-ID "A" "SPECIAL" or NO-OX-ID "A" compound to both clean and cleaned wire ends and corresponding connecting grooves avoiding contact with the wire insulation.

8.206 Place the wire in the connector. The inspection hole permits observation to determine that the wire is inserted the full depth.

8.207 Lug connectors having through or closed holes may be furnished. The exposed end of the wire shall extend at least 1/8 inch beyond the clamping plate where space permits, (1/16 inch in small sizes) and for lugs having through holes not more than 1/8 inch beyond the face of the lug.

8.208 Select the correct R-2670, R-2671, R-2762, R-2673, R-3074 or equivalent wrench, and insert the wrench into the locking screw and securely tighten the connection so that it is both mechanically and electrically secure. Some small lugs may be equipped with a slotted screw in which case they should be tightened with a screwdriver. In congested locations where there is insufficient clearance to insert the wrench, temporarily remove the lug until the clamping screw is properly tightened. After the lug is tightened and in place the clearance will have increased and should present no problem to maintenance personnel.

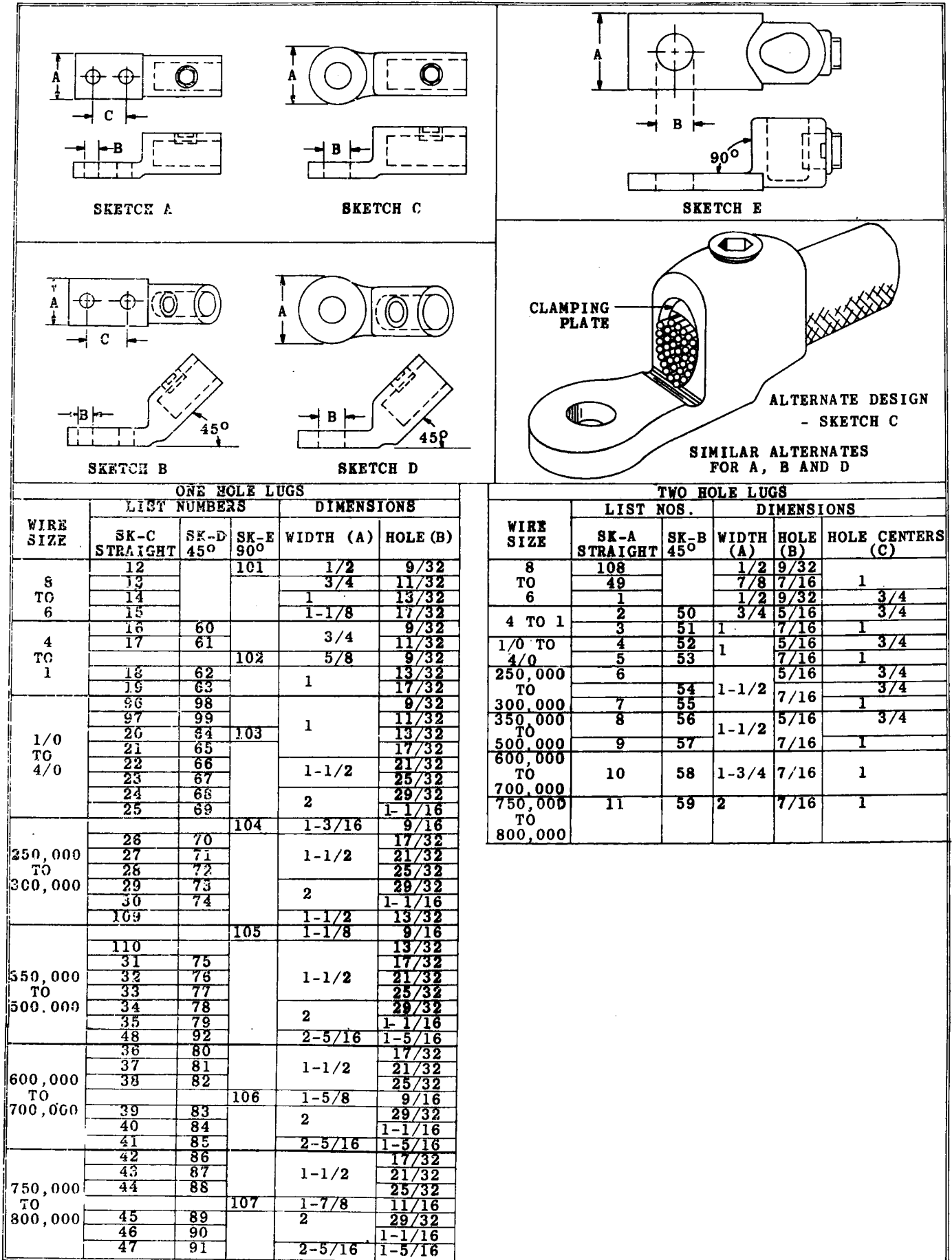
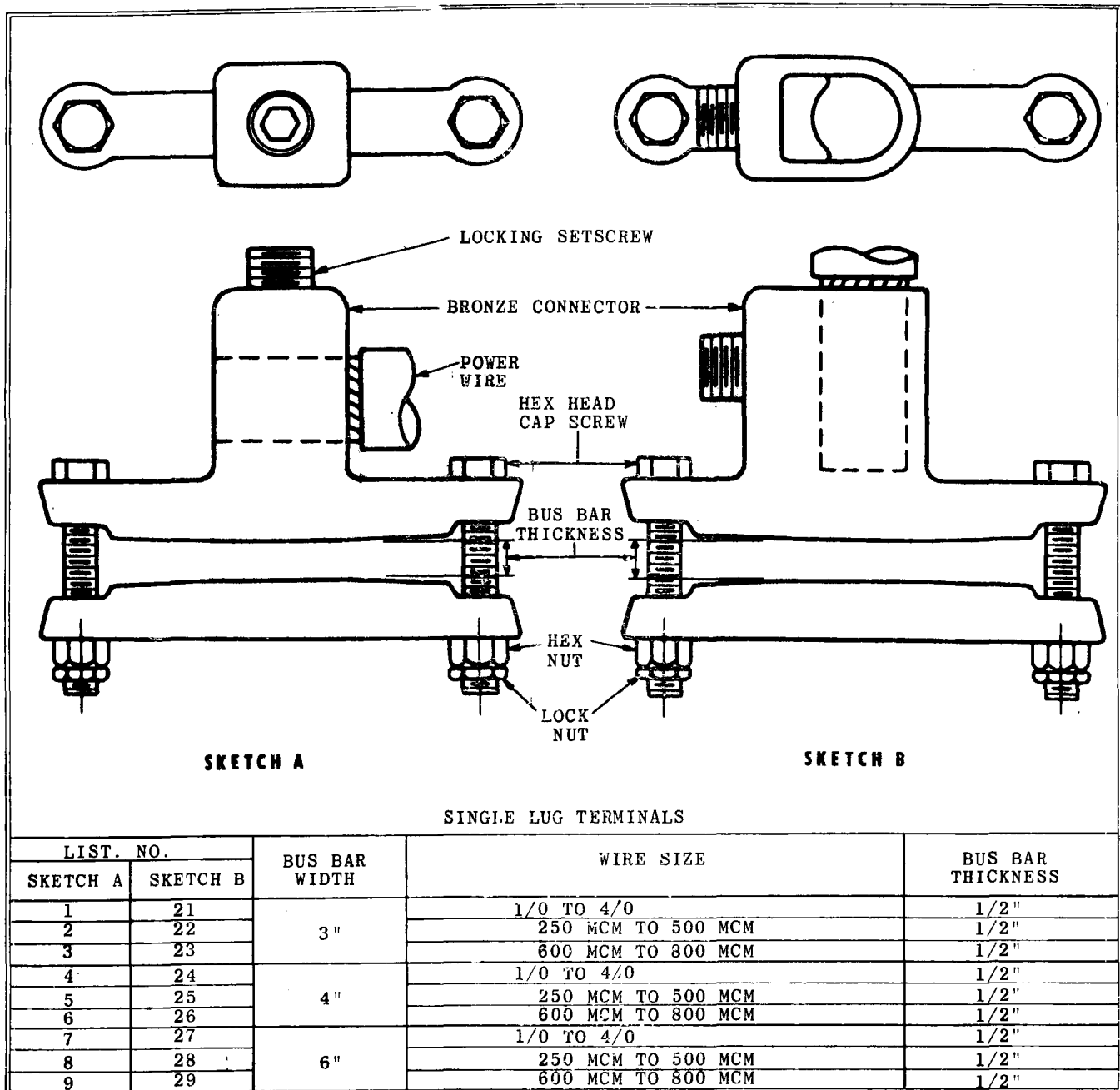


FIG. 8 KS-5517 SOLDERLESS TERMINAL LUGS (PARS. 8.11, 8.201, 8.211)

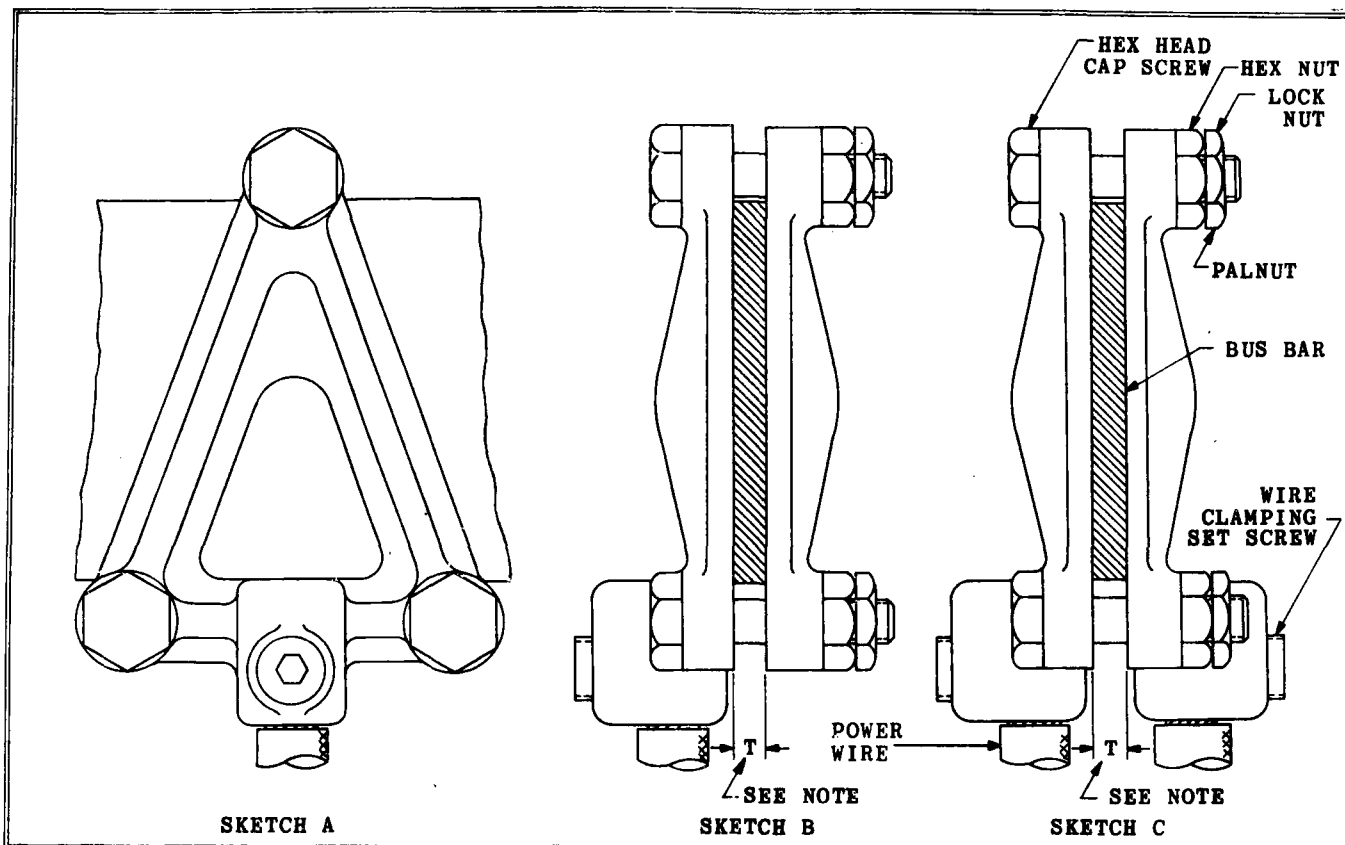
**DOUBLE LUG TERMINALS**

Same as sketches
A & B, except for
Double Lugs

LIST. NO.		BUS BAR WIDTH	WIRE SIZE	BUS BAR THICKNESS
SKETCH A	SKETCH B			
41	61	3"	1/0 TO 4/0	1/2"
42	62		250 MCM TO 500 MCM	1/2"
43	63		600 MCM TO 800 MCM	1/2"
44	64	4"	1/0 TO 4/0	1/2"
45	65		250 MCM TO 500 MCM	1/2"
46	66		600 MCM TO 800 MCM	1/2"
47	67	6"	1/0 TO 4/0	1/2"
48	68		250 MCM TO 500 MCM	1/2"
49	69		600 MCM TO 800 MCM	1/2"



FIG. 9 KS-15562 CONNECTORS (PARS. 8.12, 8.201, 8.211)



WIRE SIZE	CATALOG NOS.		BUS BAR WIDTH
	SKETCH A & B	SKETCH A & C	
8 to 4	ATL 17	ATL 17 AD	2
4 to 1	ATL 52 ATL 53 ATL 54	ATL 52 AD ATL 53 AD ATL 54 AD	2 3 4
1 to 2/0	ATL 70 ATL 71 ATL 72 ATL 65	ATL 70 AD ATL 71 AD ATL 72 AD ATL 65 AD	2 3 4 6
2/0 to 4/0	ATL 88 ATL 89 ATL 90 ATL 92	ATL 88 AD ATL 89 AD ATL 90 AD ATL 92 AD	2 3 4 6
4/0 to 300	ATL 106 ATL 107 ATL 108	ATL 106 AD ATL 107 AD ATL 108 AD	2 3 4
300 to 500	ATL 142 ATL 143 ATL 144 ATL 94	ATL 142 AD ATL 143 AD ATL 144 AD ATL 94 AD	2 3 4 6
500 to 750	ATL 187 ATL 188 ATL 189	ATL 187 AD ATL 188 AD ATL 189 AD	2 3 4

NOTE: ORDERS SHALL SPECIFY THOMAS & BETTS CO., CATALOG NUMBERS AND THE BUS BAR THICKNESS (T DIMENSION).

8.209 Spaces greater than 1/16" ("Shiners") between the wire insulation and the body of the connector constitute an appearance item and shall be wrapped with friction tape to a thickness equal to that of the insulation and followed with one coat of shellac.

8.210 All job installed lugs to be connected directly to alkaline type (wet) CEMF cells, or battery posts, or to details which in turn are connected directly to CEMF cell or battery posts, shall be treated as follows:

8.2101 After the wire is secured to the lug and no further forming is required, make a final verification of the clamp screw on KS-5517 lugs with the proper size wrench. The contact surface of the lug may be temporarily covered with tape to eliminate unnecessary cleaning of the sealing compound. This is especially recommended when dipping plated lugs. Immerse the lug in one of the following compounds to a distance of about 1/2" above the end of the lead insulation:

1st Choice - Clear Varnish R-4059
2nd Choice - Acid Resistant Enamel RM-646317

8.2102 Any lug used with dry type CEMF cells need not be immersed in one of the above mentioned sealing compounds. R-3126 Silicone Compound is required on the contact surface of all lugs connected to wet or dry type CEMF cells as called for in Section 7E.

8.211 Data in Figures 8, 9 and 10 can be used to identify connectors specified on job papers and for correct selection when additional ones are required.

9. LUGS - CROSSBAR END GUARD FUSE ASSEMBLY

9.1 Carefully cut the wire to avoid distorting the end of the wire strands as there is a limited clearance in the connector body of the Bull Dog fuse assemblies.

9.2 Skin the wire to a length which permits the end to project 1/8" to 1/4" through and beyond the body of the connector when the insulation is butted against the connector body. Refer to Section 7A describing use of R-2884 power wire stripper and R-2761 skinning knife.

9.3 If the wire ends are distorted or spread, they may be bunched to approximately the original diameter by inserting the skinned wire end in a short piece of 1/2" conduit and working the conduit around the wire end in a direction to bunch the strands. File any burrs which may prevent inserting the wire in the connector.

9.4 Clean and protect the contact surfaces of the wire and lug as covered in Paragraphs 8.203, 8.204 and 8.205.

9.5 On the Bull Dog fuse assemblies, insert the wire in the lug. Set up the clamping screw finger tight and spread the strands with a screw driver as shown in Figure 11.

9.51 Place the 3-1/4" section of the R-2865 wrench into the connector screw and apply pressure on the 4" section of the wrench to tighten the connection with a force or torque of 125 to 150 inch pounds. This torque is approximated by a pressure of 35 pounds on the end of the wrench. This is about the limit of effort that can be exerted on the wrench by a man of average strength.

9.6 On the Frank Adams fuse assemblies insert the wire into the lug and tighten securely with the R-2865 1/4" Allen type wrench. The wire strands are not spread in these lugs.

10. SCREW TERMINALS

10.1 Prepare the wire ends by removing sufficient insulation to permit the wire to wrap completely around the screw body. Remove oxidation or corrosion with fine abrasive paper or by scraping.

10.2 Form wire end into an eyelet in a clockwise direction or in the case of a captive screw (end staked over) form wire by approaching the screw from the left and wrapping completely around, but not so as to cross over itself. Stranded wire should first be twisted to confine the individual strands before forming. Solder should be applied to the stranded wire after forming unless cup washers are provided.

10.3 Also twist a limit of two wires together where height of screw presents no hazard and the screw head is wide enough for two wires. Where three wires are involved, the third wire may be twisted with the mid section of the loop lead or where clearance on head size presents no problem. Where the fourth wire is involved, it shall be added to the wire nut with the other two or three wires. See Figure 12.



FIG. 11 WIRE INSTALLED IN CROSSBAR END
GUARD FUSE ASSEMBLY CONNECTOR-
BULL DOG (PAR. 9.5)

10.4 Tighten screw securely with the proper tool making sure wire is not forced out from under screw head. Excess wire end may be cut off after tightening unless the wiring space is recessed. See Figure 12. Carefully observe the final tightening to insure there exists both a mechanically and electrically reliable connection.

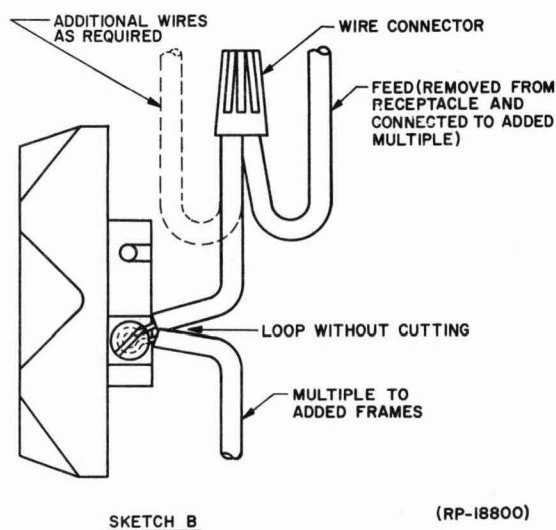
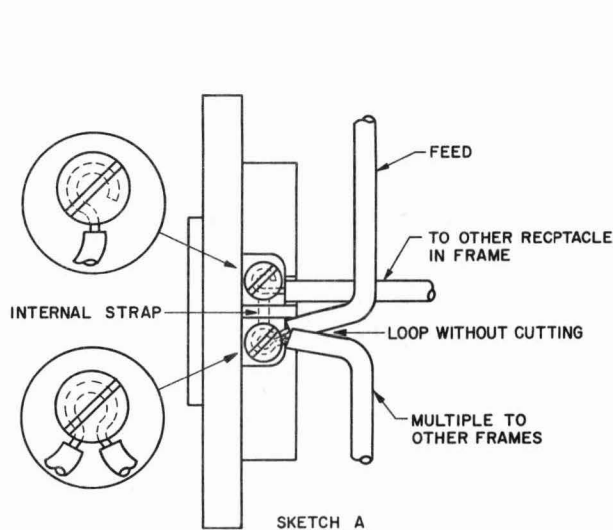
11. CONNECTORS - KS-5537 LIST 300 SERIES

11.1 This wire to bus bar connector requires the bus bar to be drilled. The connector is made of two halves each with grooves to receive two wire ends and is not provided with a cover. The outside of one half is machined flat for connecting to a bus bar or detail. The machine screws forming part of the connector, clamp both the wire in the connector channels and the connector to the bus bar. See Figure 13.

11.2 Remove sufficient insulation from the wire end that with the insulation against the connector the wire will extend the full length of the channel or even slightly beyond the connector.

11.3 Prepare the contact surfaces of the connecting wire and the corresponding channels on the connector halves as covered in Paragraphs 8.203 to 8.205.

11.4 The bus bar contact surface of the connector shall be clean and free from oxidation or corrosion.



(RP-18800)

FIG. 12 METHOD OF TERMINATING AND CONNECTING ONE AND TWO WIRES AT A RECEPTACLE
(PAR. 10.3, 10.4)

KS-5537 PARALLEL CONNECTORS

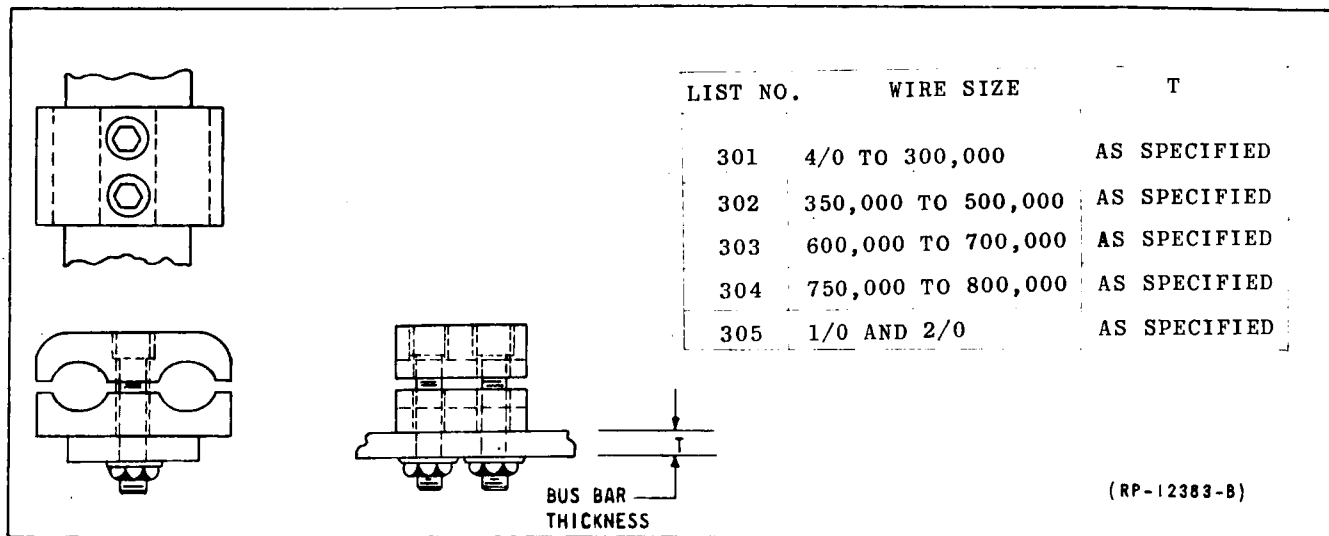


FIG. 13 SOLDERLESS CONNECTORS KS-5537 LIST 300 SERIES (PAR. 11.1)

11.41 When necessary, clean with fine abrasive paper. Apply NO-OX-ID "A" "SPECIAL" or NO-OX-ID "A".

11.5 Prepare contact surfaces of copper or aluminum bus bars as covered in section 8B of this handbook.

11.6 When assembling KS-5537 list 300 series connectors and only one wire is being terminated, it will be necessary to cut a dummy section of wire to clamp in the unused side.

11.7 Assemble wires in connector and connector onto bus bar or detail. Tighten clamping screws until assembly is electrically and mechanically secure.

12. PROTECTION AND INSULATION

12.1 These taping and protecting instructions supplement those contained on drawings and job papers.

12.2 Connectors used for joining wires together are furnished with their own covers. Those for connecting wires to bus bars and details do not have covers and normally do not require insulation.

12.3 Whether or not lugs, terminals and connectors associated with bus bars and studs are taped, is covered in Section 8C.

12.4 Otherwise when taping is required for lugs, connectors and splices, apply rubber tape and friction tape half-lapped extending tape on to the wire insulation. The combined thickness of the tape should total at least the thickness of the wire insulation. Except when the connection is in an enclosure, finish with one coat of shellac.

12.5 Where connectors with covers are located against a sharp surface such as the edge of an auxiliary framing bar or clip, cover the sharp edge of the metallic parts with fiber to a thickness of 1/32" minimum. Use two layers of 1/64" RM-583101 gray sheet fiber. Bend fiber across its grain to avoid breaking.

12.6 Fiber shall be secured by the weight of adjoining details or shall be tied by two strands of No. 12 twine or nylon twine at each end. If neither method is practical, secure the fiber with an adhesive.

12.7 Fiber is not required if a connector is on a flat surface such as the side of a cable rack stringer or the side of a frame upright unless required by drawings.

13. VERIFICATION FOR TIGHTNESS

NOTE: Toward the end of the installation period, shop and job assembled solderless connectors, lugs and splices shall be verified for tightness. Exceptions are those in shelf feeder connections on step-by-step frames, taped or painted connections or small wire splicing connectors (Paragraph 4).

13.1 Chuck type connectors for No. 6 and No. 8 gauge wire on No. 5 crossbar bays are checked by grasping the wire firmly near the connector. Push and pull to determine that there is no movement in the connection.

13.2 For "two-way" connectors and lugs with No. 6 wire and smaller, grasp the wire firmly and pull and push the wire steadily away from and toward the connector to determine that there is no movement in the connection.

13.3 Check for tightness, "two-way" connectors used on wire sizes No. 4 and larger, with proper size wrenches.

13.4 For terminal lugs larger than No. 6 wire, verify the tightness of the set screw in the lug. It is nearly always possible to tighten these screws slightly. A fractional turn is not an indication of previous looseness.

13.41 Where a dipped solderless terminal lug connects to a battery post or CEMF cells the connection of the lug to the post should be checked but the connection to the wire should not be checked unless breaks in the dipping material or other indications suggest that the lug may have loosened. Recoat any connection that may have been retightened.

13.5 For parallel type No. 8 thru No. 14 wire pull slightly on the wire. For connectors larger than No. 8 hold the wire and place a torque or twisting motion on the connector.

13.51 KS-5537 parallel connectors on step-by-step switch frame feeder assemblies, which are made up and supplied by the shop, should be rechecked for tightness at the time they are placed in the channel of the frame upright since they cannot be rechecked after installation due to inaccessibility. It is recommended that the feeder assemblies be placed in the channel upright prior to installation of the shelves, when drawings show this arrangement.

13.6 Cross taps should be verified by checking the tightness of the screws. It is nearly always possible to tighten these screws slightly. A fractional turn is not an indication of previous looseness.

13.7 Wire to bus bar connectors shall be verified by checking the wire clamping screw for tightness. A fractional turn is not an indication of previous looseness.

➔ Arrowed lines indicate new or changed information.

[Vertical line at side of paragraphs indicates requirements.

Manager, Product Engineering

Reason for Reissue:

1. To bring connector references up to date (Table "C" and Figs. 8, 9, 10 and 13).
2. To change references to NO-OX-ID "A" or NO-OX-ID "A SPECIAL".
3. To add information on method of terminating and connecting. (Par. 10.3 and Figure 12).
4. To remove information no longer applicable.
5. To make minor changes and corrections throughout section.