3M

MS²™ Modular Splicing System

Instructions

May 2001
78-8130-4094-2-A

Contents:

1.0 General

1.1 These instructions describe MS^{2TM} Modular System Splicing, including modules, tools and applications.

2.0 Module Description

2.01 3M MS^2 modules will:

- Connect and trim off 25 pairs of conductors at one time without stripping insulation.
- Accept 22-28 AWG (.6 - .32 mm) solid copper conductors insulated with PIC, pulp or paper with a maximum insulation O.D. of .065" (1.7 mm).
- Accept a variety of wire gauges and insulation types in one module.

2.02 3M MS^2 modules have:

- Individual elements
- Cutoff blades
- Test entry ports
- Removable covers and bases for reentry

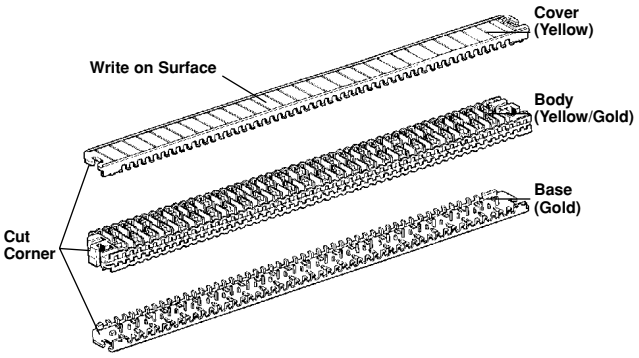
Note: ***Encapsulated versions are also available:***

- ***4000-G Straight splice***
- ***4008-G Half-tap***
- ***4005-GBM Bridge module***

Module Types

2.1 **Super-Mini**

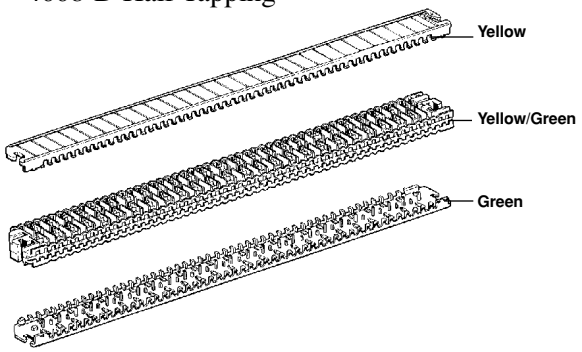
4000-D Straight Splicing



Note: ***4000-D CO is all gray in color.***

843004

4008-D Half Tapping

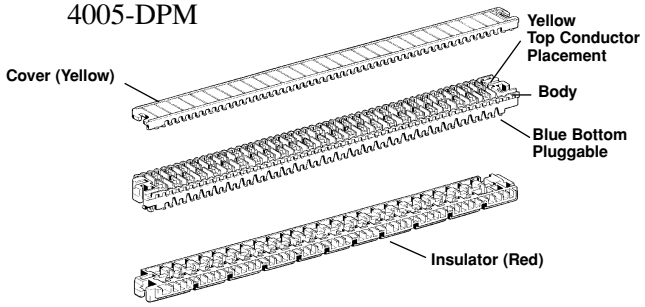


Note: ***4008-D CO is all gray in color.***

843004

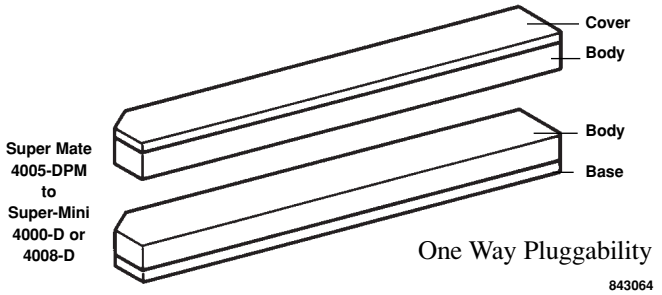
2.2 **Super-Mate Pluggable**

4005-DPM



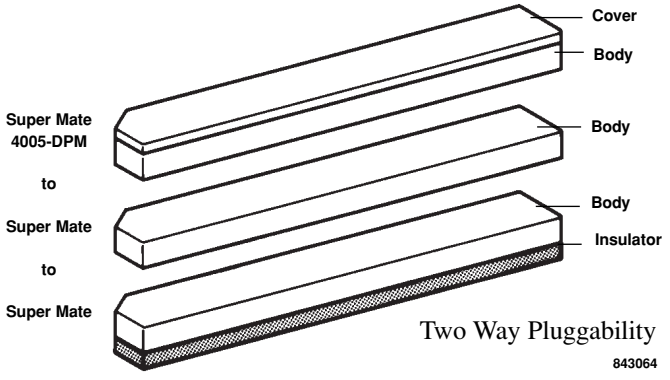
843006

Note: ***4005-DPM/FR is gray/blue in color.***



One Way Pluggability

843064



Two Way Pluggability

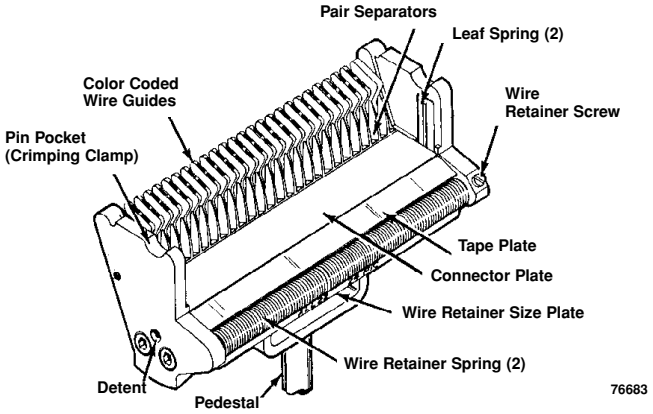
843064

3.0 Tool Description

3.1 Main Splicing Rig Components

The 4041 Splicing Head is used with a support rig for:

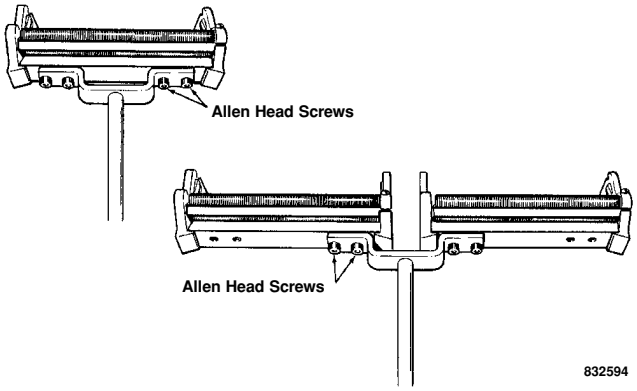
- Initial termination of conductors in the modules.
- Making connections with preterminated modules.



4041 Splicing Head

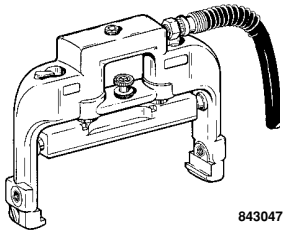
3.1.1 The splice head allows you to arrange and hold conductors in their proper locations during the splicing procedure. The splice head will hold the following module combinations:

- 1 Super-Mini and 1 Super Mate
- 2 Super Mates
- 3 Super Mates

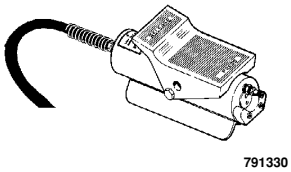


Double Head Set Up

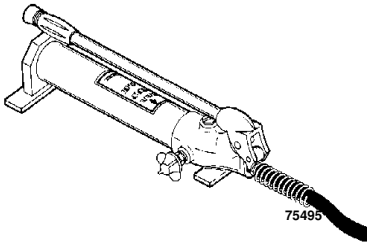
3.1.2 Air hydraulic and hand hydraulic crimping units are used with the 4041 Splice Head to crimp modules. A mechanical crimper is also available to crimp modules.



Crimping Clamp

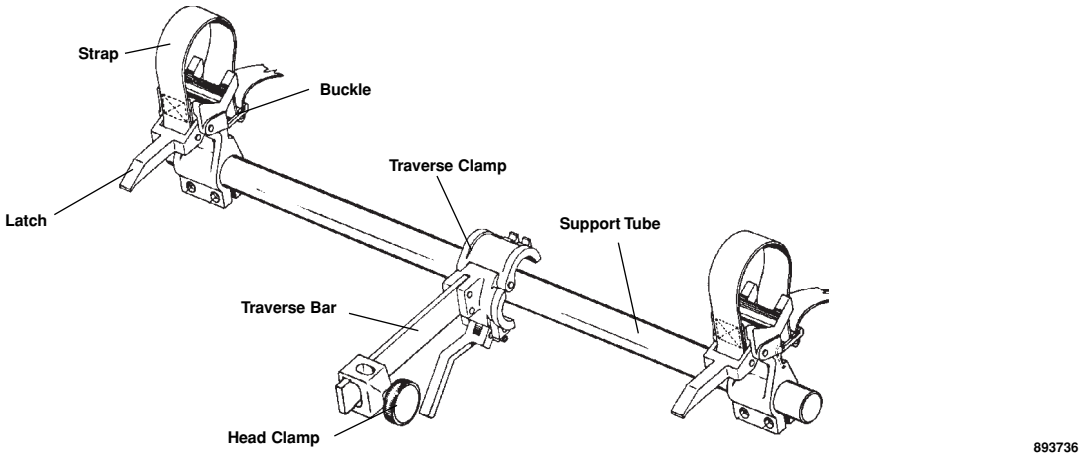


4030 / Air Crimping Unit



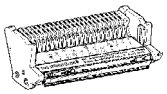
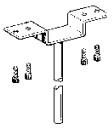
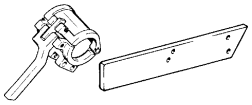
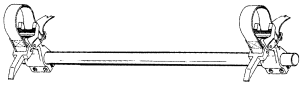
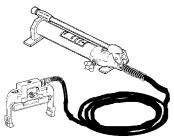
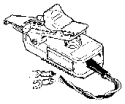
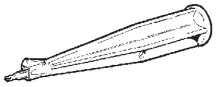
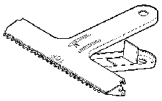
4031 / Hand Hydraulic Crimping Unit

3.1.3 The support tube and related components provide support for cables and tools while splicing is being done.

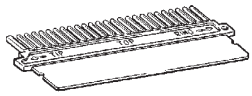
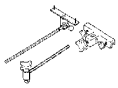
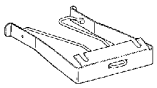
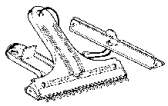
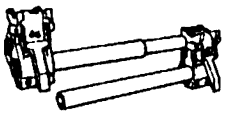
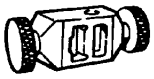


3.2 Rig / Kit Components

Type of Rig or Kit

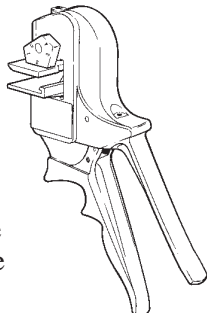
	4020M	4021M	4021M-2	4022M	4025K	4045K	4046A	4046-AT	4046-B	4046-BT
 4041 Splicing Head Assembly	•	•	••	••	•	•				
 Pedestal	•	•	•	••		•				
 Traverse Clamp Assy w/ Long Bar	•	•	•	••						
 Short Traverse Clamp	•	•	•	•						
 Head Clamp	•	•	•	••						
 4042 Support Tube Assembly	•	•	•	•						
 4031 Hand/Hydraulic Crimping Unit		•	•		•	•				
 4047 Pair Test Plug	•	•	•	•	•	•			•	•
 4051 Wire Insertion & Cutoff Tool	•	•	•	•	•	•			•	•
 4053 Cover Removal Tool	•	•	•	•	•	•			•	•
 Allen Wrenches	•	•	•	•	•	•	•	•	•	•

Type of Rig or Kit

	4020M	4021M	4021M-2	4022M	4025K	4045K	4046A	4046AT	4046-B	4046BT
 4052-T Check Comb	••	••	••	••	••	•	•	•	•	•
Carrying (Rig) Case	•	•	•	•	•	•	•	•	•	•
 4025 Modular Connecting Head with Support Assembly					•					
 4044 Quick Connect Splicing Head Frame Adapter					•					
 4045 Universal Splicing Head Support Assembly						•				
 4053-PM Removal Tool									•	•
 Collapsible Support Tube									•	•
 Head and Bar Clamp							•	•	•	•
 4046 Adjustable Traverse Clamp							•	•	•	•

3.3 Hand Tools - 4255 Hand Presser

Used for crimping covers or bases on 4000-D Super-Mini Modules or for plugging combinations of two modules together.

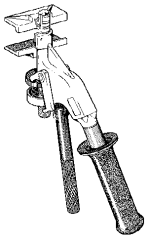


822380

- Base, Body, Cover
- Male to Female (precon)
- Super-Mini to Super-Mate
- Super-Mate to Super-Mate

3.3.1 Hand Tools - 4270-A Series Hand Presser

Used for plugging a combinations of from two through seven modules together.



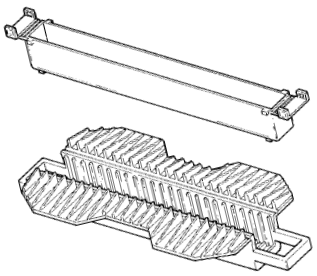
893724

4270-A Hand Presser

4.0 Accessories

4.1 4075-S Super-Mini Sealant Boxes with Insertion Tool

Designed for moisture protection and reentry applications. The boxes can be applied to both foldback and inline splices. The 4075-S is designed to be used in all 2-wire 4000-D Super-Mini splice applications.

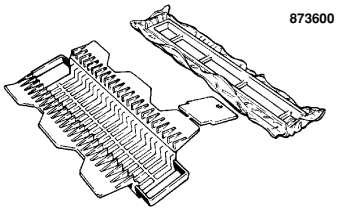


75516

4.2 4077 Series Sealant Boxes with Insertion Tool

873600

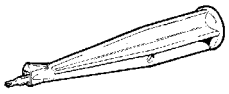
The 4077 Series Sealant Box is designed for use with the 4005-DPM module.



- 4077-A - One Super-Mate Module
- 4077-B - One Super-Mate / One Super-Mini Module
- 4077-C - Two Super-Mate Modules
- 4077-D - Three Super-Mate Modules

4.3 4051 Wire Insertion and Cut Off Tool

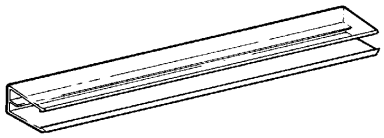
Individual conductors can be inserted into elements by using the 4051 Wire Insertion and Cut Off Tool.



781181

4.4 4078-C Half Tap Cover

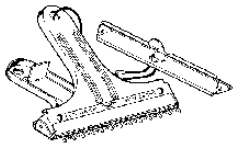
Used to protect wire ends after the half-taps has been cut out of the Super-Mini 4008 Half Tap Module in pulp/paper and pressurized PIC cable splices and vault splices.



832569

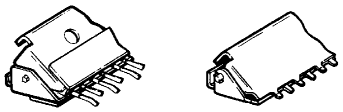
4.5 4053-PM Separator Tool

a. The 4053-PM is the only tool recommended for unplugging Super-Mate Modules.



863422

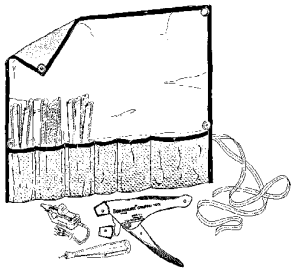
b. The enlarged pins of the tool distinguish the 4053-PM from the 4053 Cover Removal Tool. **The 4053-PM tool cannot be used to remove covers or bases.**



863423

4.6 4047 Super-Mini Reentry Maintenance Kit

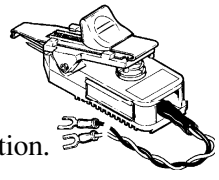
This kit is designed for maintenance and repair work on Super-Mini Modules.



781184

4.7 4027 Pair Test Plug

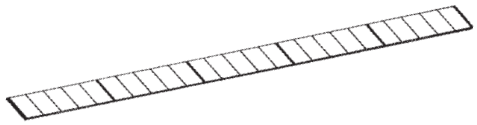
The MS^2 4047 Pair Test Plug is a connector probe which permits pair checking through the test entry port without damaging wire insulation.



781247

4.8 4079-S Super-Mini Tagging Labels

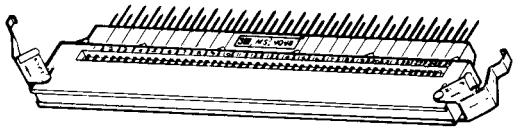
Permits easy and accurate recording of pair counts during tagging operations.



76607

4.9 4048-S 25-Pair Pocket Probe

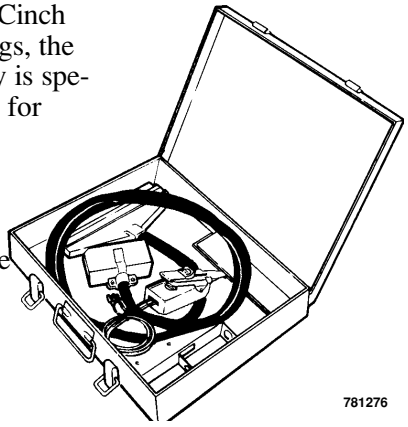
Designed to interface with Super-Mini and Super-Mate Modules, the probe provides access for identification of cable pairs.



832640

4.10 4048-SA1 Kit Super-Mini 25-Pair Probe Assembly

Provided with Cinch Jones male plugs, the probe assembly is specially designed for accurate continuity testing and tagging of all Super-Mini and Super-Mate Modules.



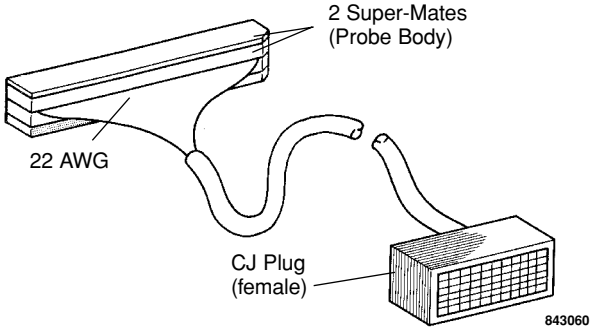
781276

4.11 4048-DPM CJ Super-Mate Module Probe

Used to transition between test equipment and modular spliced conductors.

Field fabrication of the probe body is possible, but it should be done only in the configuration shown below:

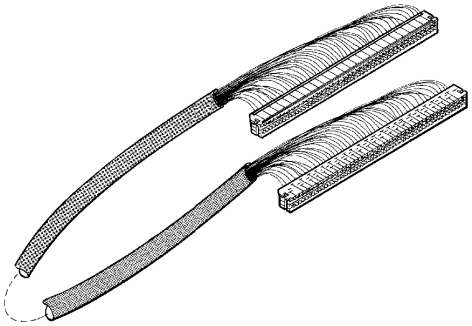
Note: ***Stranded conductors must not be used in MS^2 modules.***



843060

4.12 4005-DPM /BTP (Bottom Test Plug)

Test plug assembly consisting of 4005-DPM module attached by a 24" jumper to a module designed to plug into the bottom of a Super-Mate Module.



873540

4.13 4026 Module Maintenance Kit

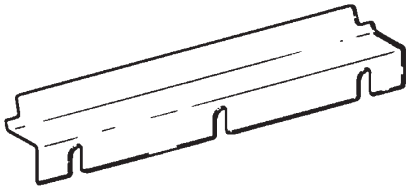
Contains the tools necessary for reentry of Super-Mini and Super-Mate Modules.

Kit Contents:

- 4270-A Hand Presser
- 4051 Wire Insertion and Cut Off Tool
- 4053-PM Separator Tool
- 4053 Cover Removal Tool
- 4047 Pair Test Plug
- DPM/DPM Jumper Assembly (2)
- 4005-DPM/BTP Bottom Test Plug
- Jumper Assembly (2)

4.14 4041 Rear Spring Holder

Allows the addition of a second set of wire retaining springs to the back of the 4041 MS^2 Splice Head. Used in the conversion of Super-Mini splices to pluggable Super-Mate splices and for cutting in Super-Mate Modules on through cables.



883640

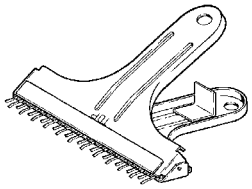
4.15 4041-2.....2" Unilength Hook
4041-4.....4" Unilength Hook

Attaches to all MS^2 splicing heads to facilitate splicing in the unilength configuration.

883640

4.16 4053 Cover Removal Tool

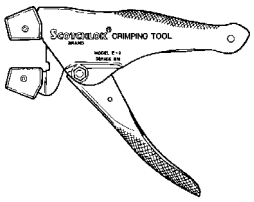
Recommended tool for the removal of MS^2 module covers and bases.



74011

4.17 E9-BM Crimping Tool

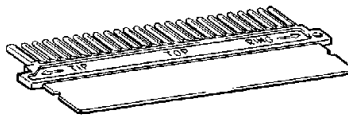
Crimps MS^2 module bases and covers onto connector bodies.



81203

4.18 4019 Check Comb

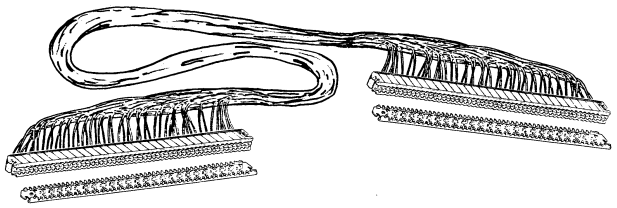
Used to detect splicing errors prior to module crimping. Also used as a temporary module cover in certain splicing applications.



903882

4.19 4000-D/PTJ Preterminated Jumper Assemblies

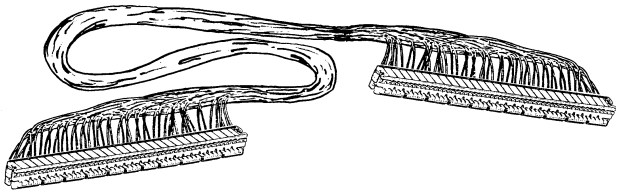
Consists of 24 AWG, PIC, unsheathed binder group terminated on each end with a 4000-D body/cover combination. Available in 36" (91.4 cm) or 72" (182.9 cm) lengths, the jumpers enable fast restoration of cut or damaged cables.



903882

4.20 4005-DPM/PTJ Preterminated Jumper Assemblies

The 4005-DPM/PTJ consists of 24 AWG, PIC, unsheathed 25-pair binder group terminated on each end with a 4005-DPM Module. Available in 36" (91.4 cm) or 72" (182.9 cm) lengths, the jumpers enable fast restoration of cut or damaged cables. Also used in maintenance of Super-Mate Module splices where uninterrupted service is required.

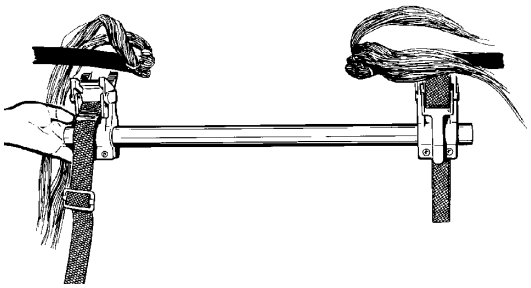


903882

5.0 Use of Tools and Modules

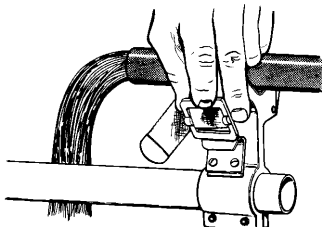
5.1 **Rig set-up as follows:**

5.1.1 Attach support tube to cable.



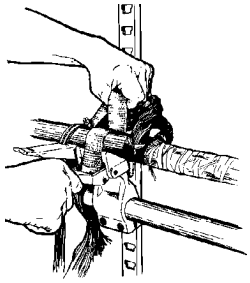
832593

5.1.2 Attach buckle.



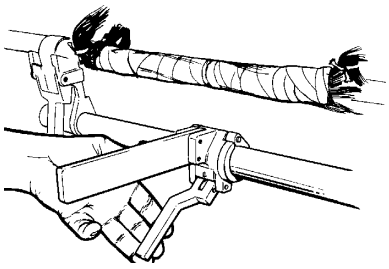
832593

5.1.3 Tighten strap.



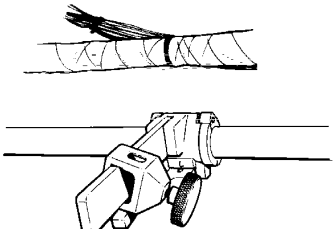
75419

5.1.4 Attach traverse clamp assembly.



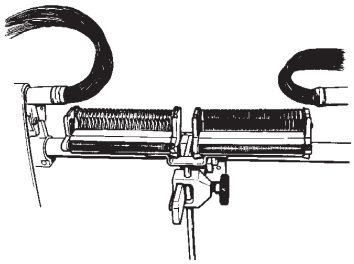
75420

5.1.5 Slide head clamp on traverse bar.



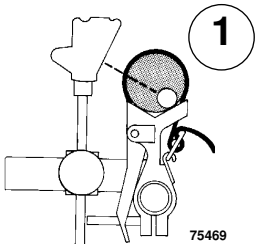
75421

5.1.6 Insert pedestal in head clamp.

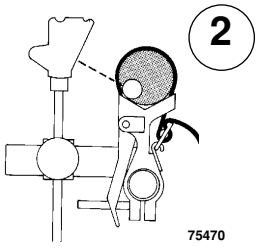


75426

5.1.7 Splice back, bottom group first.



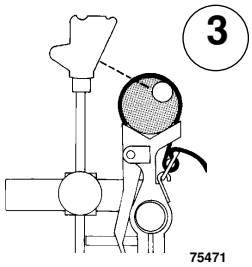
75469



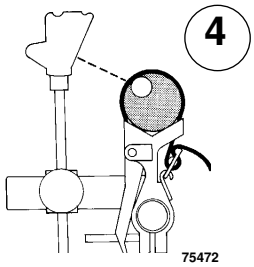
75470

For inline splicing, adjust head(s) to group being handled.

Note: ***Splice head should be higher than group being spliced.***

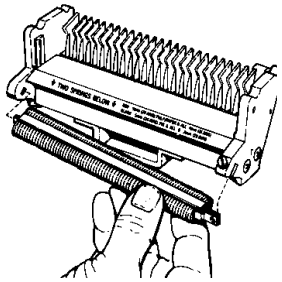


75471



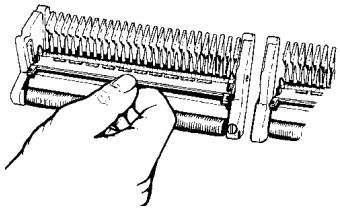
75472

5.1.8 Set retainer spring to proper wire gauge.



75430

5.1.9 In the 4041 Splice Head, the gold splice adapter is used with the **Super-Mini Modules only.**



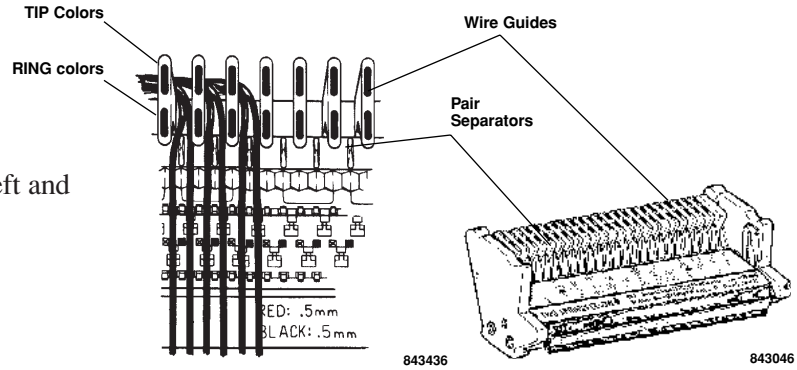
832595

5.2 Wire Placement in Module

Note: Follow Color Code.

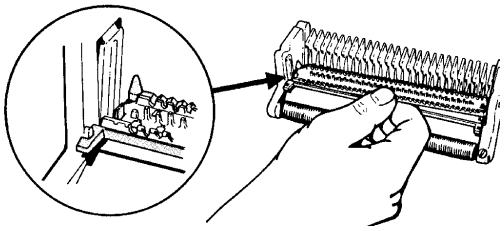
5.2.1 Wire pair to right side of corresponding color coded wire guide.

Separate pair over pair separator, TIP left and RING right.



5.2.2 Using Super-Mini – Install base
Using Super-Mate – Install body/insulator

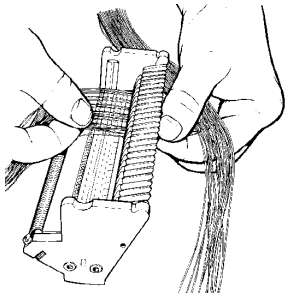
Module Cut Corner Upper Left

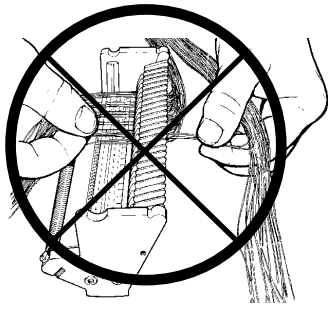


5.2.3 Select a 25-pair group and place wires in module according to color code.

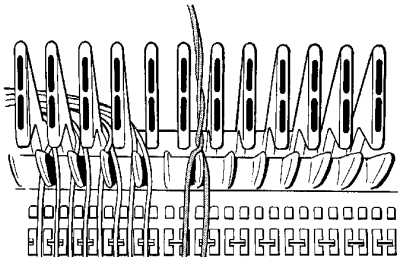
Draw wires snug into wire channels in module.

Secure in retainer springs.





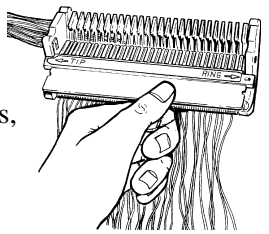
Thumb placed too far from rear of head, could cause twist in pair resulting in "shiners."



5.2.4 Make sure all wires are lying flat in module channel.

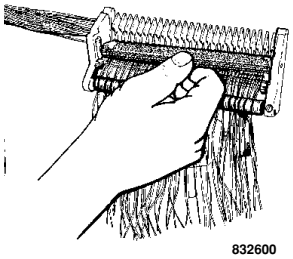
Check for empty channels, 2 wires in one channel or reversed pairs.

Slide comb left, only TIP wires should show. Slide comb right, only RING wires should show.

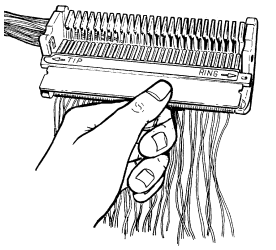


5.2.5 Install next module component.

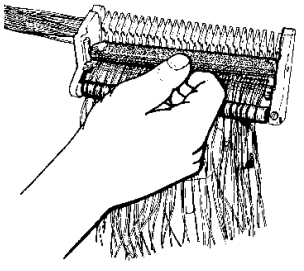
Place pairs from corresponding group.



5.2.6 Check for correct wire placement using the orange check comb.



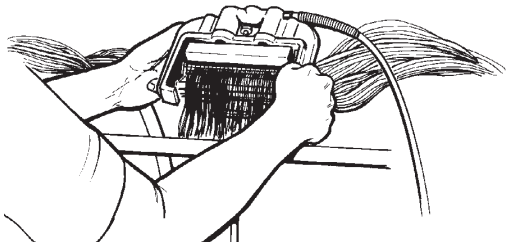
5.2.7 Install module cover.



5.3 Crimping Modules

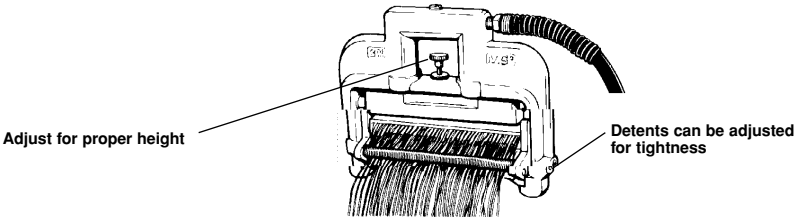
5.3.1 Hydraulic Crimpers

5.3.1.1 Hydraulic hose can face left or right. Rest crimper on splice head with legs angled toward you.



75442

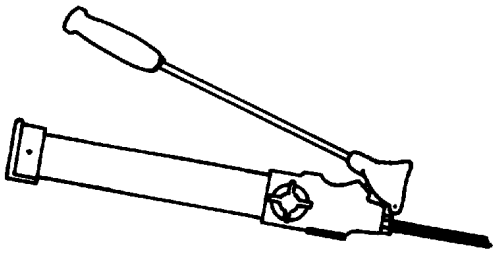
5.3.1.2 Rotate the clamp until it is locked in an upright position by the detents.



781167

Hand / Hydraulic Pump

Note: ***Always position output end level or lower than rear.***

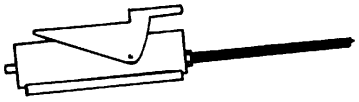


75444

Close the pressure release valve and operate the pump handle until the audible bypass is heard, then pump three additional times. Leave the crimping clamp closed until the cut conductors are removed.

Air / Hydraulic Pump

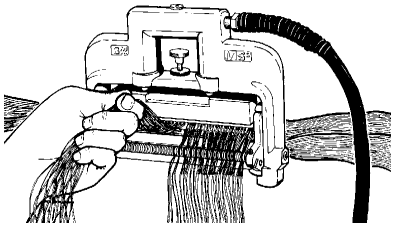
Note: ***Always position output end level or lower than rear.***



75444

Operate the PRESS/RELEASE control to the PRESS position and hold until the pressure bypass is heard to operate. This signifies a completed crimp. Leave crimping clamp closed until the cut conductors are removed.

5.3.1.3 Remove one fourth to one third of the cut conductors at a time by lifting them straight up from the retainer spring.

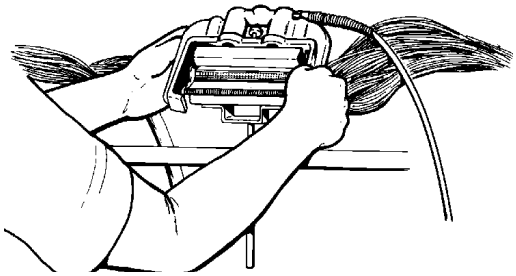


781170

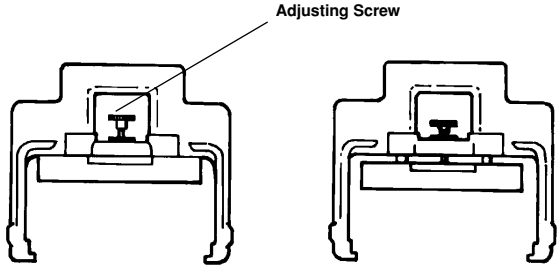
Note: ***To avoid damaging the retainer spring, do not attempt to remove all the conductors at once.***

Note: ***An adjustment screw on crimping clamp can be set to limit return on crimping bar. This screw can be adjusted to reduce the number of strokes required for crimping a two-wire splice when using the hand pump, but must be completely backed off for crimping 3-wire bridge splices..***

5.3.1.4 Remove crimping clamps.



75446



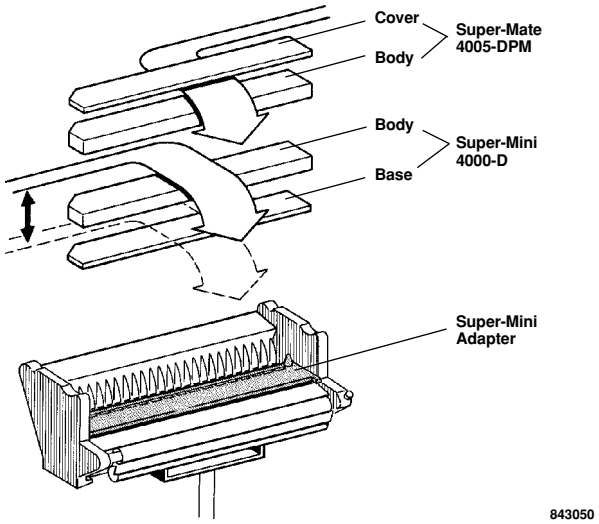
75447

5.4 Basic Module Connections

5.4.1 **One Way Pluggable Connection**

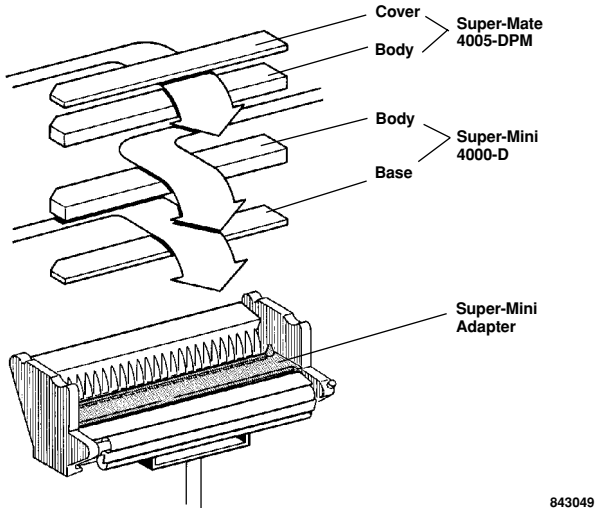
This combination connects two conductor groups by plugging the Super-Mate Module to the body top of the Super-Mini Module.

Conductors can be terminated either in the body bottom or body top of the Super-Mini Module.



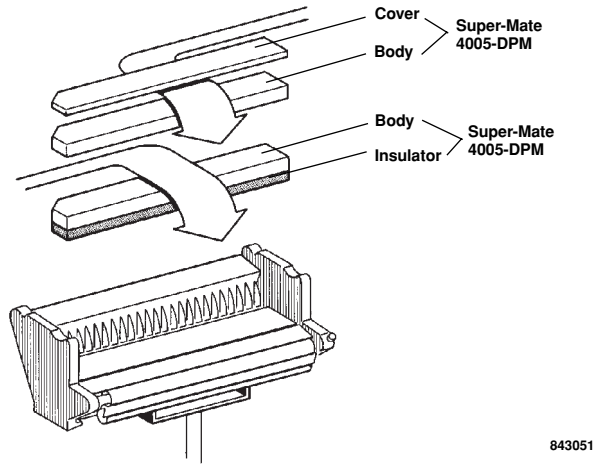
5.4.2 **Pluggable Bridge Connection**

This combination makes a three conductor connection (bridged) by plugging a Super-Mate Module to the body top of the Super-Mini Module.



5.4.3 **Two Way Pluggable Connection**

This combination makes a two conductor connection by plugging a Super-Mate Module to either the body top or body bottom of another Super-Mate Module.

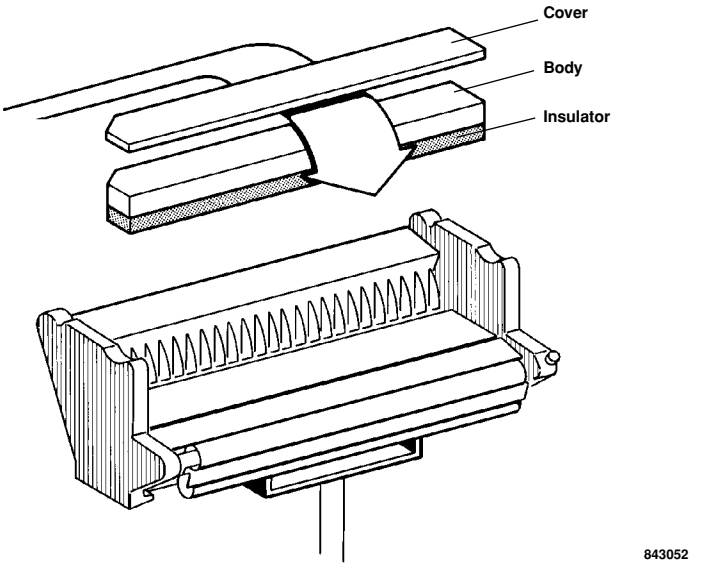


5.5 **Preterminated Module Connections**

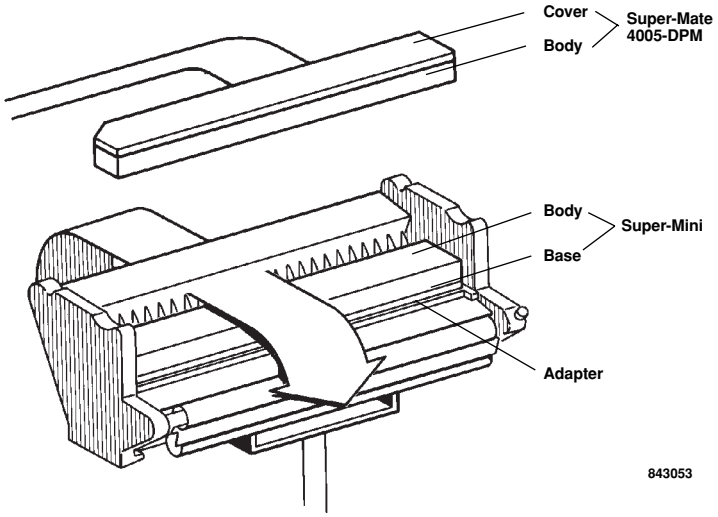
Preterminated Super-Mate Modules can be used as pluggable units with:

- Other modules during splice construction
- Modules in existing splices

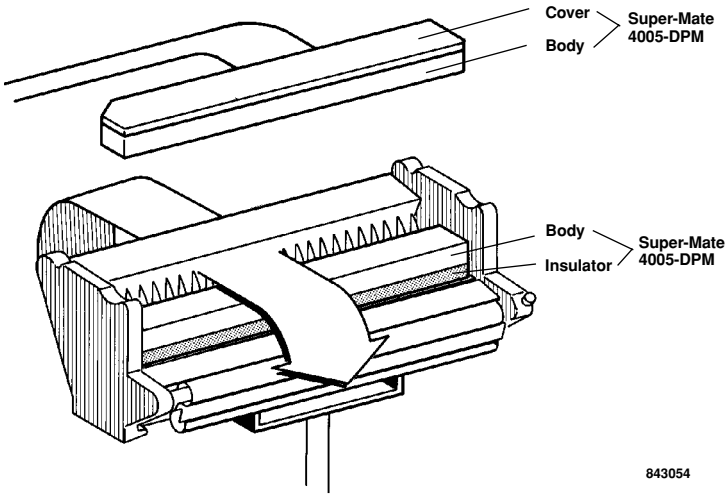
5.5.1 Pretermination of one Super-Mate Module



5.5.2 Preterminated Super-Mate, plugged to a new Super-Mini splice.



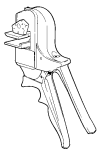
5.5.3 Preterminated Super-Mate, plugged into a new Super-Mate splice.



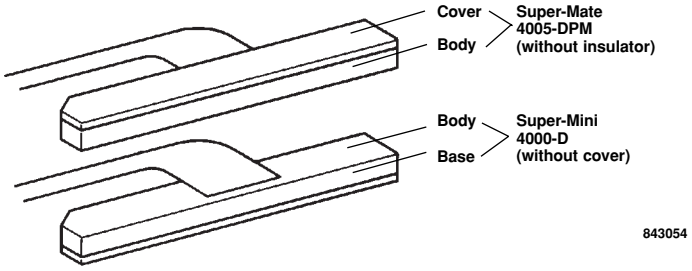
5.5.4 Preterminated Super-Mate Plugged to Preterminated Super-Mini

Note: ***A stripped splice head may be used.***

4270-A Hand Presser



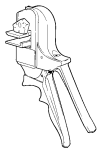
4255 Hand Presser



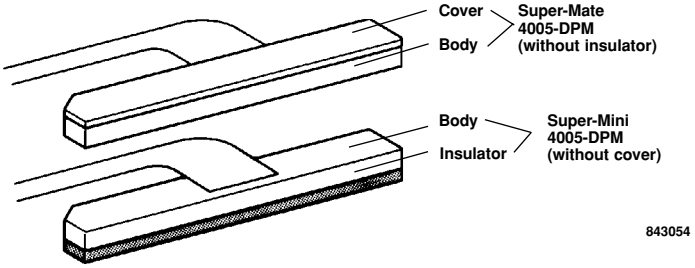
5.5.5 Preterminated Super-Mate Plugged to Preterminated Super-Mate

Note: ***A stripped splice head may be used.***

4270-A Hand Presser



4255 Hand Presser

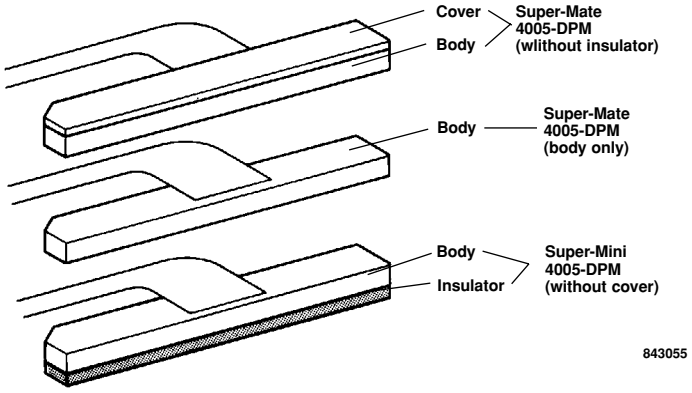


Base

5.5.6 Three Super-Mate Modules (3 Conductor Splice)

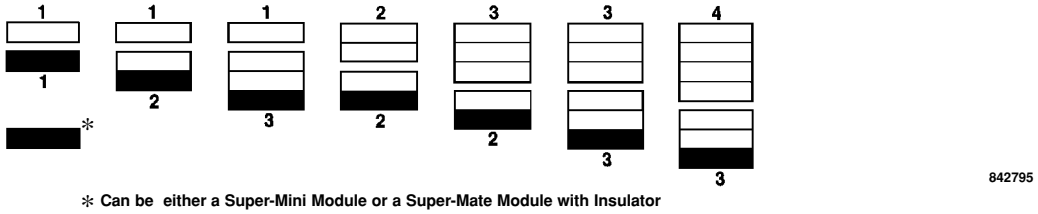
Note: ***A stripped splice head may be used.***

4270-A Hand Presser



5.5.7 Preterminated Super-Mate Module Combination, Plugged to Preterminated Super-Mate or Super-Mini Module Combination.

Any two module combination from two single modules to a total of seven modules may be plugged together. Only a combination of up to three modules may be done in a stripped splice head.



* Can be either a Super-Mini Module or a Super-Mate Module with Insulator

Note: ***If a Super-Mini Module is used, it must always be on the bottom of the final configuration.***

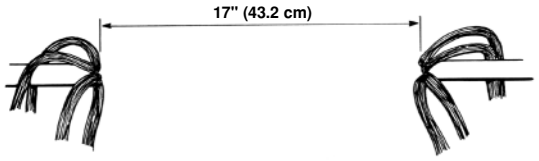
Note: ***It is recommended that only one module combination should be plugged together at a time.***

6.0 Application

Note: ***Splice modules so that equal number of modules will fall in each bank.***

6.1 Inline Splicing (2 Bank)

6.1.1 Splice opening must be that recommended for closure used, with a minimum of 17" (43.2 cm) for a 2 bank splice.



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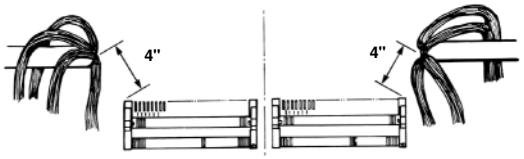
Free conductors length (each cable) = 1.5 X splice opening

6.1.2 Attach rig using double heads. Center heads in opening.



893756

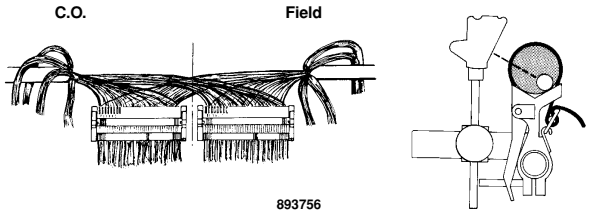
Note: Splice heads set 4" (10.2 cm) from butt of group being spliced and slightly higher.

6.1.3 When splicing with Super-Mini Module, splice head adapter must be used.

Select back bottom 25-pair group from C.O. cable.

Lay pairs into module base on C.O. side of splice opening.

For easy group ID, place odd groups to left side, even groups to right side.



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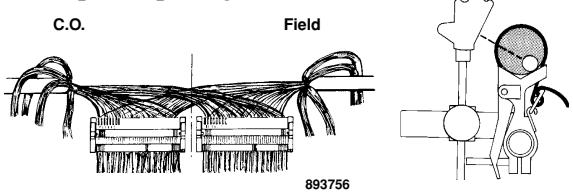
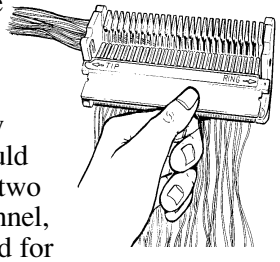
6.1.4 Select next back bottom 25-pair group from C.O. cable.

Lay pairs into module base on field side of splice opening.



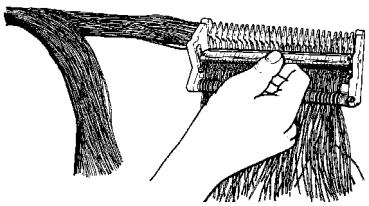
893756 75469

6.1.5 Place the check comb over the base and slide it to the left, only TIP conductors should show. Slide the check comb to the right, only RING conductors should show. Also check for two conductors in one channel, for vacant channels and for reversed pairs.



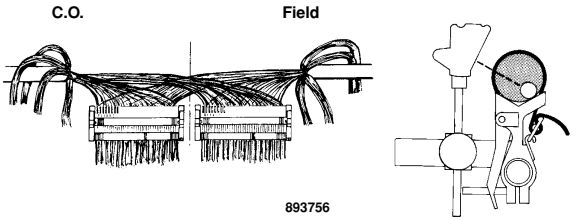
893745

6.1.6 Place body into leaf spring tracks of both splice heads with cut corner to left of rear splice heads.



832600

6.1.7 Select matching 25-pair groups from field cable. Lay pairs into module bodies.



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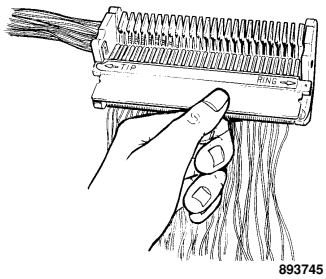
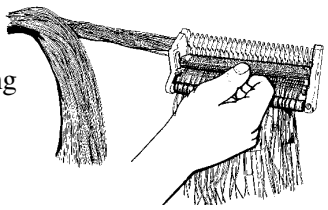
6.1.8 Check for correct placement of pairs.



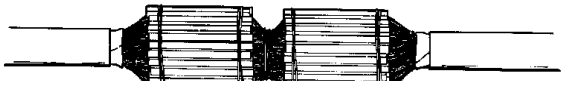
893745

6.1.9 Place covers and crimp. Repeat process for remaining 25-pair groups.



832601

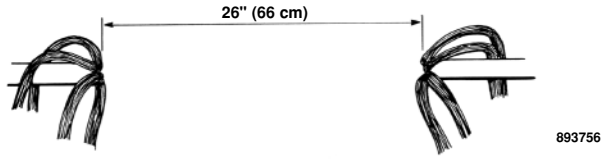
6.1.10 Tie down splice bundle in center first, working any slack toward both cable butts.



75473

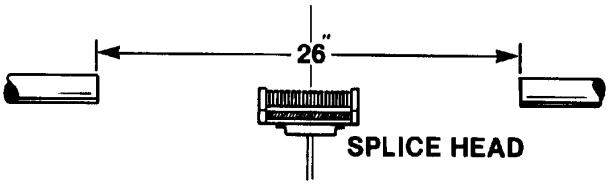
6.2 Inline Splicing (3 Bank)

6.2.1 Splice opening must be that recommended for closure used, with a minimum of 26" (66 cm) for a 3 bank splice.

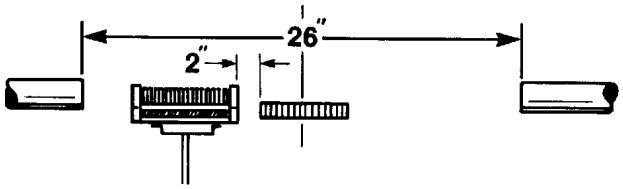


Free conductors length (each cable) = minimum splice opening plus 6" (152 mm)

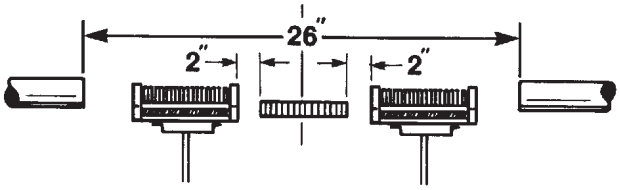
6.2.2 Attach rig using single head. Splice first connector following wire handling procedure Inline Splicing (2 bank.)



6.2.3 Adjust splice head for second connector. Splice per standard procedure (6.1).



6.2.4 Adjust splice head for third connector.

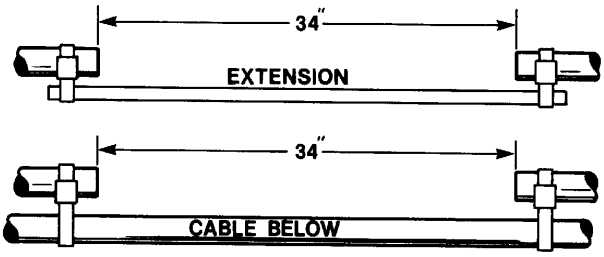


6.2.5 Complete splicing and bundling.

6.3 Inline Splicing (4 Bank)

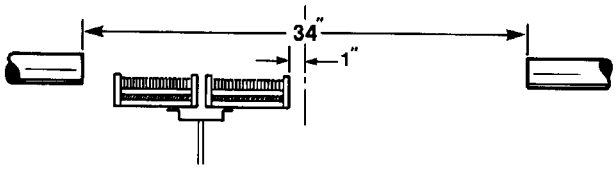
6.3.1 Splice opening must be that recommended for closure used, with a minimum of 34" (86.4 cm) for a 4 bank splice.

Note: ***This opening will require an extended support tube to attach to the cable butts; or support tube can be attached to a lower adjacent cable.***

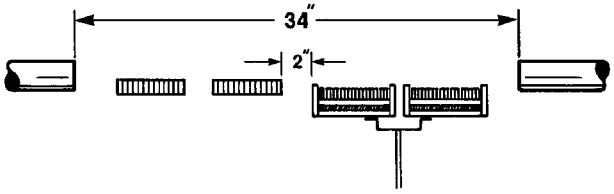


Free conductors length (each cable) = minimum splice opening plus 6" (152 mm)

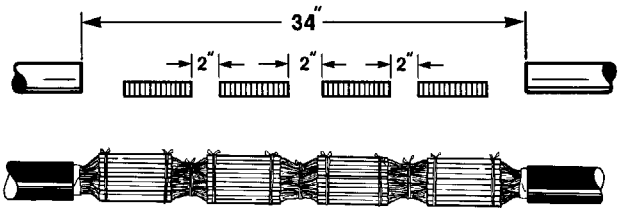
6.3.2 Attach rig using double heads. Splice 100-pair in both heads in this position.



6.3.3 Adjust splice head for next 100-pair.

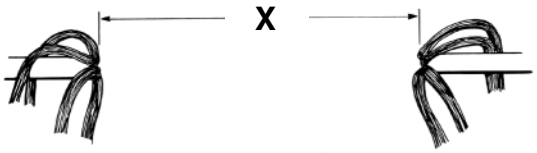


6.3.4 Adjust splice head for next 100-pair.



6.4 Foldback Splicing (Two Bank)

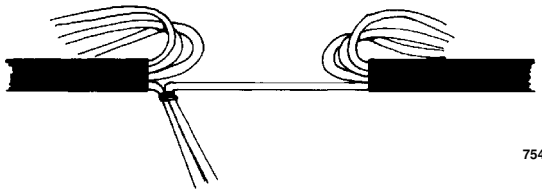
6.4.1 Splice opening must be that recommended for closure use.



Free conductors length (each cable) = 2 X splice opening plus 6" (152 mm)

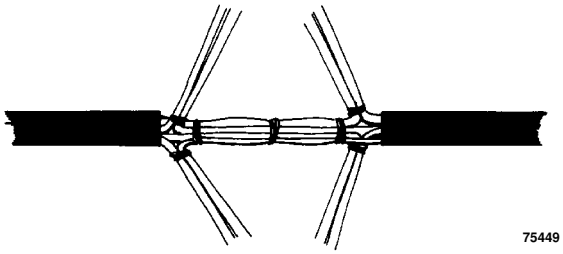
6.4.2 Identify all binder groups. Starting with lower back groups, tightly tie matching groups together as close to cable butt as possible.

For easy group ID, **foldback odd number groups to left side and even number groups to the right.**

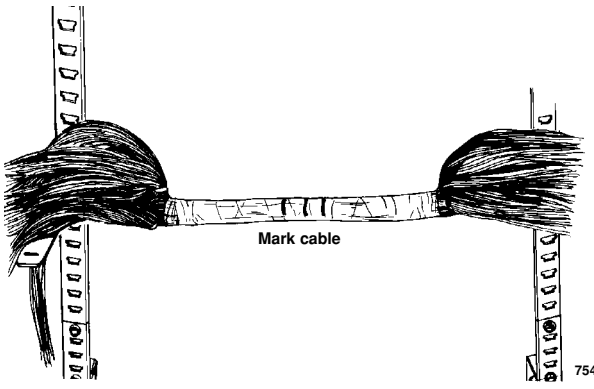


6.4.3 Alternate tie points from side to side until all matching groups are tied.

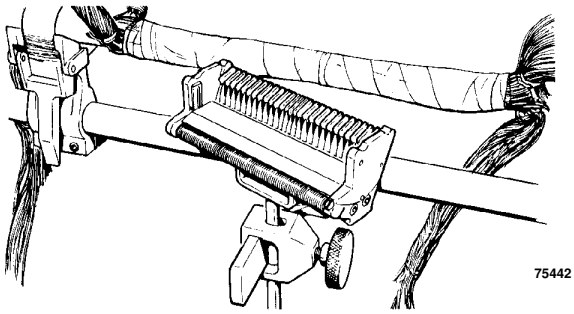
Note: ***Tie down core of splice with three ties or as per your company practice.***



6.4.4 Wrap core with polyethylene on PIC, muslin on pulp, or paper, per your company practice.

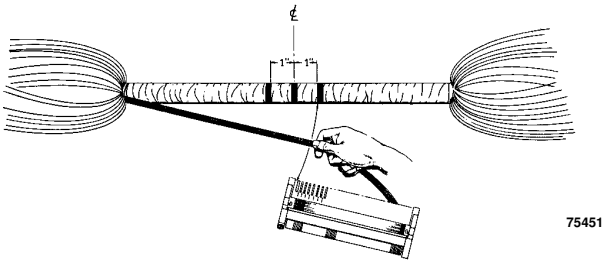


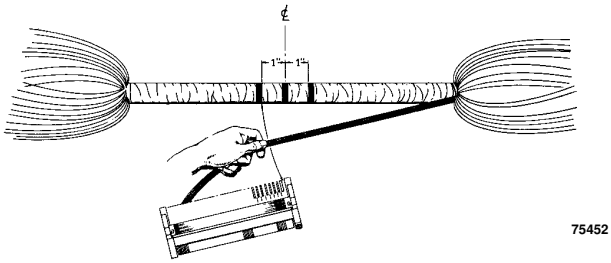
6.4.5 Set up splicing rig.



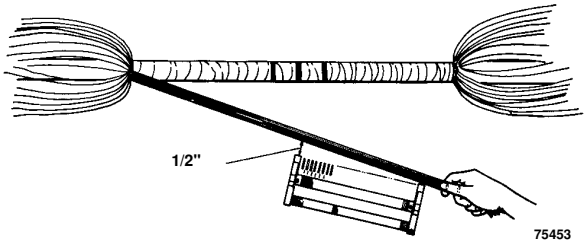
6.4.6 Three measurements must be repeated for each binder group to be spliced.

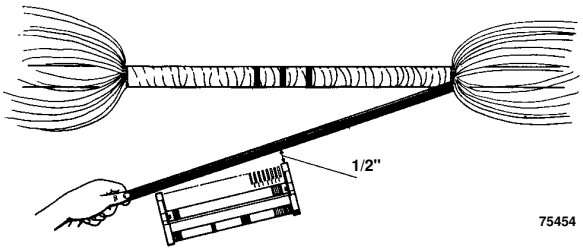
FIRST
Align splicing head with marks to prevent modules from overlapping at center of splice or laying over tie points.





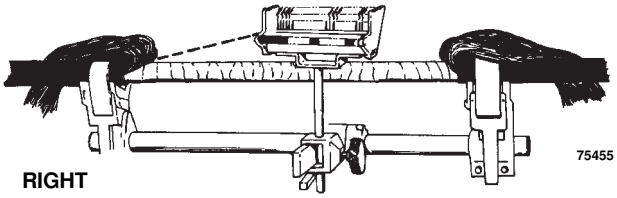
SECOND
Rotate splicing head to assure that modules will lay parallel with core.



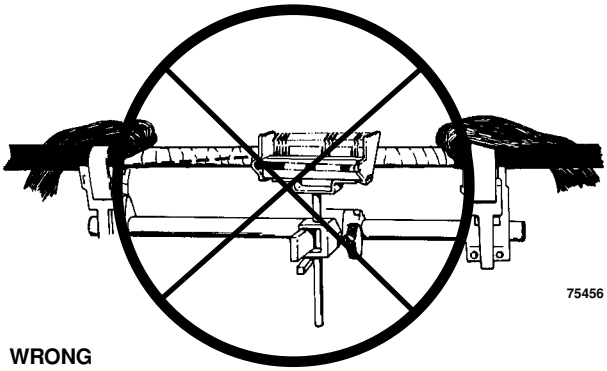


THIRD
Adjust height of splicing head to prevent conductors from lifting out of wire channels before module is crimped, and to assure easy removal of module from head after crimping.

Position head slightly higher than origin of group to be spliced so that wires are running at a slight angle up into splicing head.



RIGHT



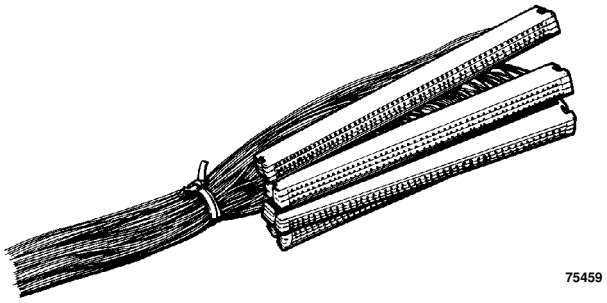
WRONG

6.4.7 Bundle modules as they are being spliced.

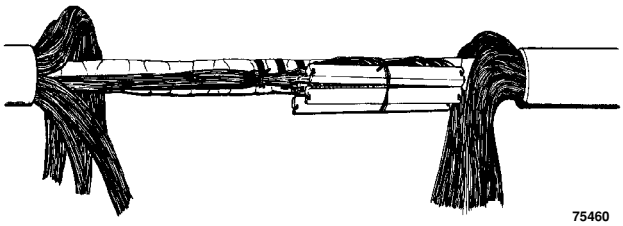
Plan first module location.

Splice first 100-pair group at proper location. Mark each module with binder group number for identification. Use indelible marker on matte-finish of module cover.

Place tie around group near modules for eace of bundling and group identification.

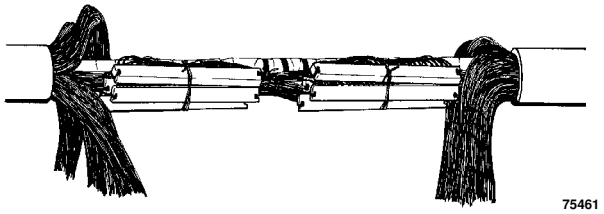


Lay group against core and bundle.



Move head to other side. Plan second group location.

Splice second group, identify and bundle to core. Repeat above, alternating left and right until splice is completed.

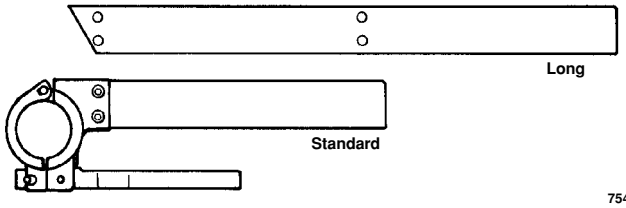


6.5 Foldback Splicing (Two Person)

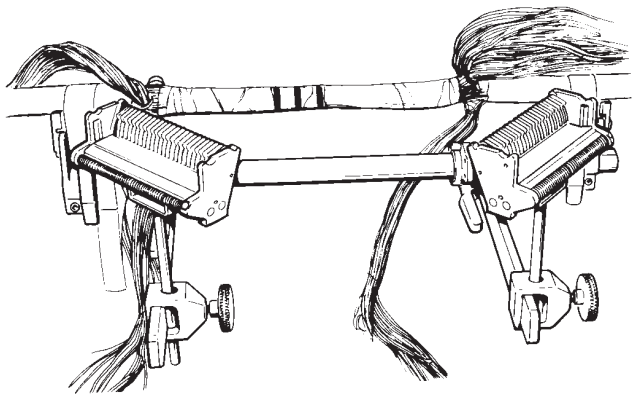
Set up two splicing heads using LONG traverse bar.

Put long traverse bars on two traverse clamps. A 3/16" allen wrench is supplied.

Note: ***For two person foldback splicing you will need two long traverse bars. (There may only be one to a rig.)***

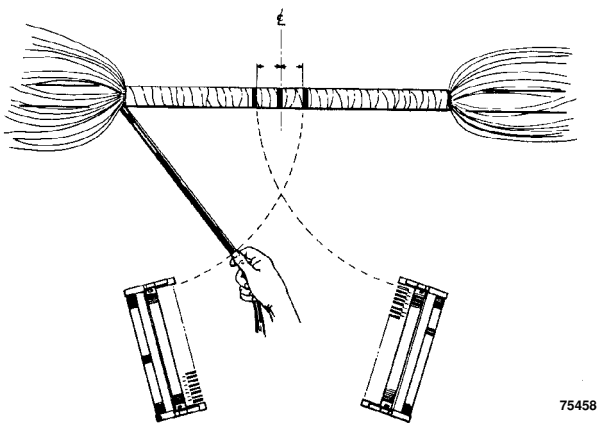


75423



75424

Each craftsperson will splice from one side, making the three basic measurements, described in Section 6.4.6. The modules spliced on the left will swing to the right of center and vice versa.

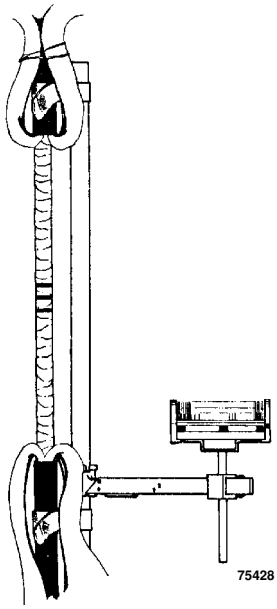


75458

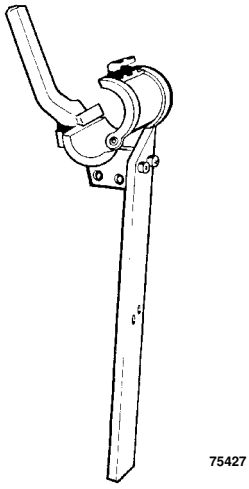
6.6 Foldback Vertical Splicing (Two Bank)

Mount support tube assembly to vertical cable.

Mount long traverse bar in **top holes** of traverse clamp with 3/16" allen wrench supplied.



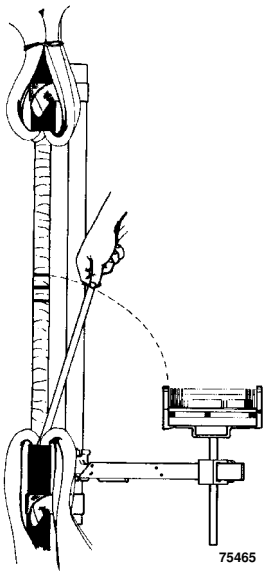
75428



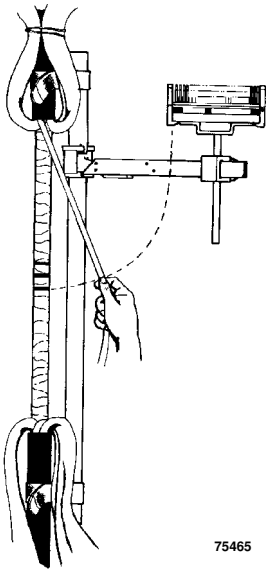
75427

Attach traverse clamp assembly, head clamp and splicing head assembly onto support tube.

Measure an upper binder group so modules will fall below the lower 1" (25 mm) mark.



75465

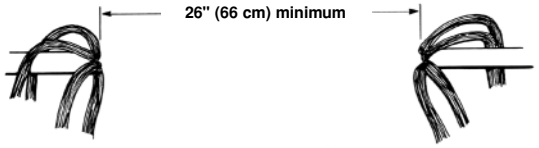


75465

Measure an lower binder group so modules will fall below the upper 1" (25 mm) line.

6.7 Foldback Splicing (Three Bank)

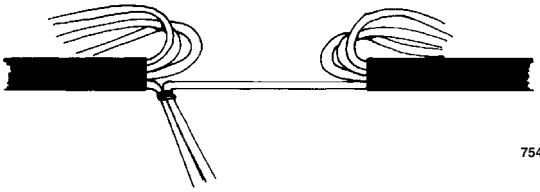
6.7.1 Splice opening must be that recommended for closure use.



Free conductors length (each cable) = 2 X splice opening plus 6" (152 mm)

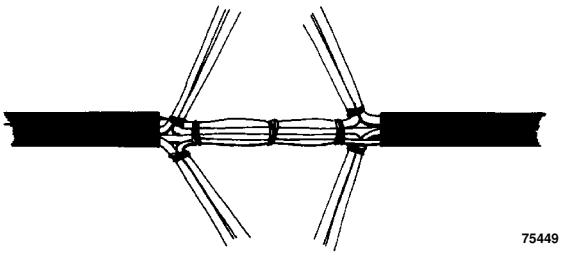
6.7.2 Identify all binder groups. Starting with lower back groups, tightly tie matching groups together as close to cable butt as possible.

For easy group ID, **foldback odd number groups to left side and even number groups to the right.**

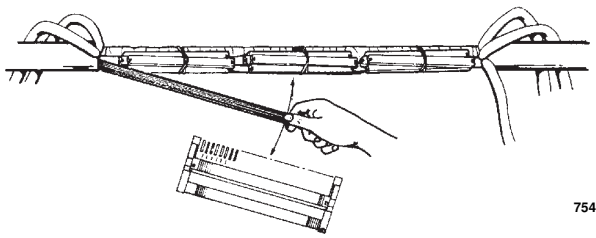


6.7.3 Alternate tie points from side to side until all matching groups are tied.

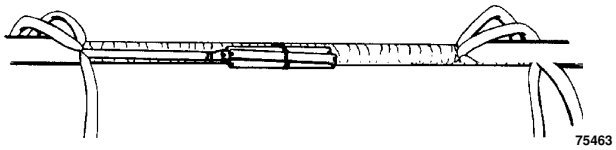
Note: ***Tie down core of splice with three ties or as per your company practice.***



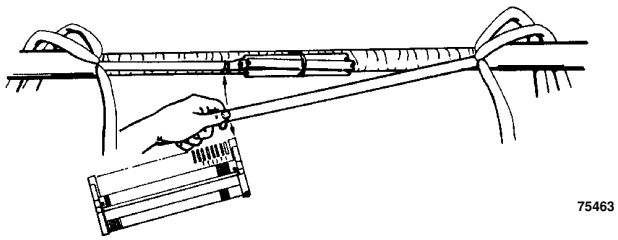
6.7.4 Mark center of splice and position head for first of 3 bank splice.



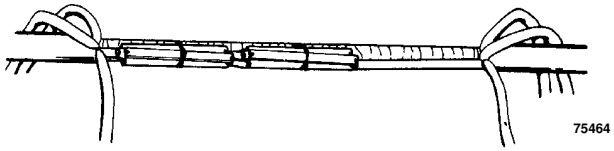
6.7.5 Splice first group, identify and bundle to the core.



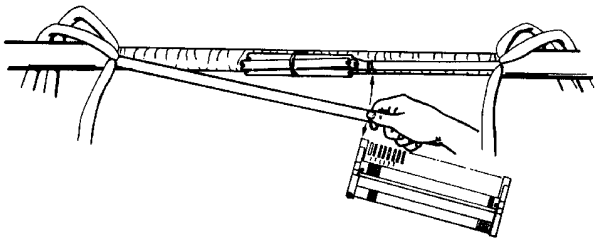
6.7.6 Position head for second group.



6.7.7 Splice second group, identify and bundle to the core.



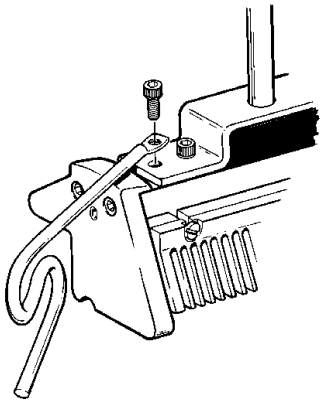
6.7.8 Splice third group.



Note: ***When making three bank foldback splices, bundle while splicing. Splice a 100-pair group in one position, bundle to core; repeat procedure in another position and fit modules into vacant locations. Splice so that approximately an equal number of modules fall in each of the three positions.***

6.8 Unilength Splicing using 4005-DPM Super-Mate

6.8.1 Attach unilength hook to splice head as shown. Hook can be attached on either side depending on which side of the splice opening the cable is entering from.



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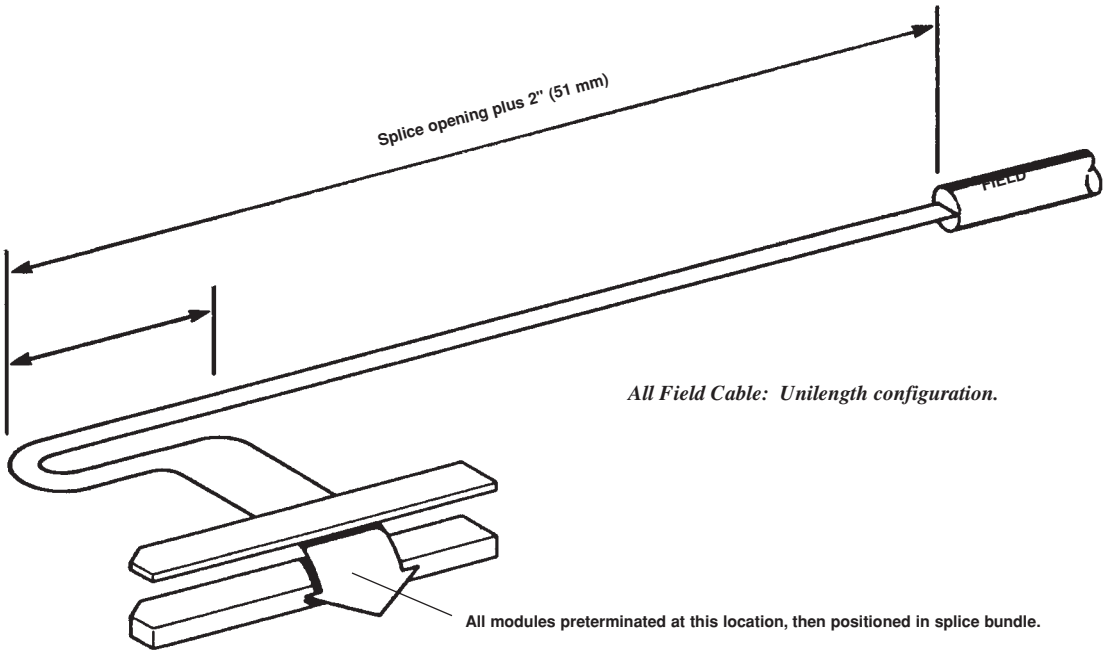
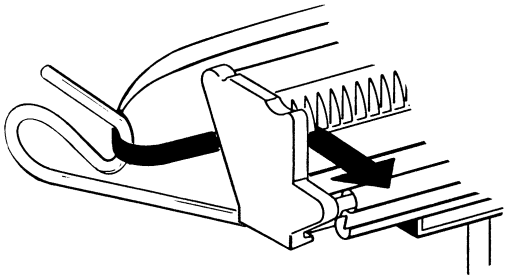
Note: ***Refer to Section 8.6.2 for a definition of unilength splicing.***



All Field Cable: Unilength configuration.

893736

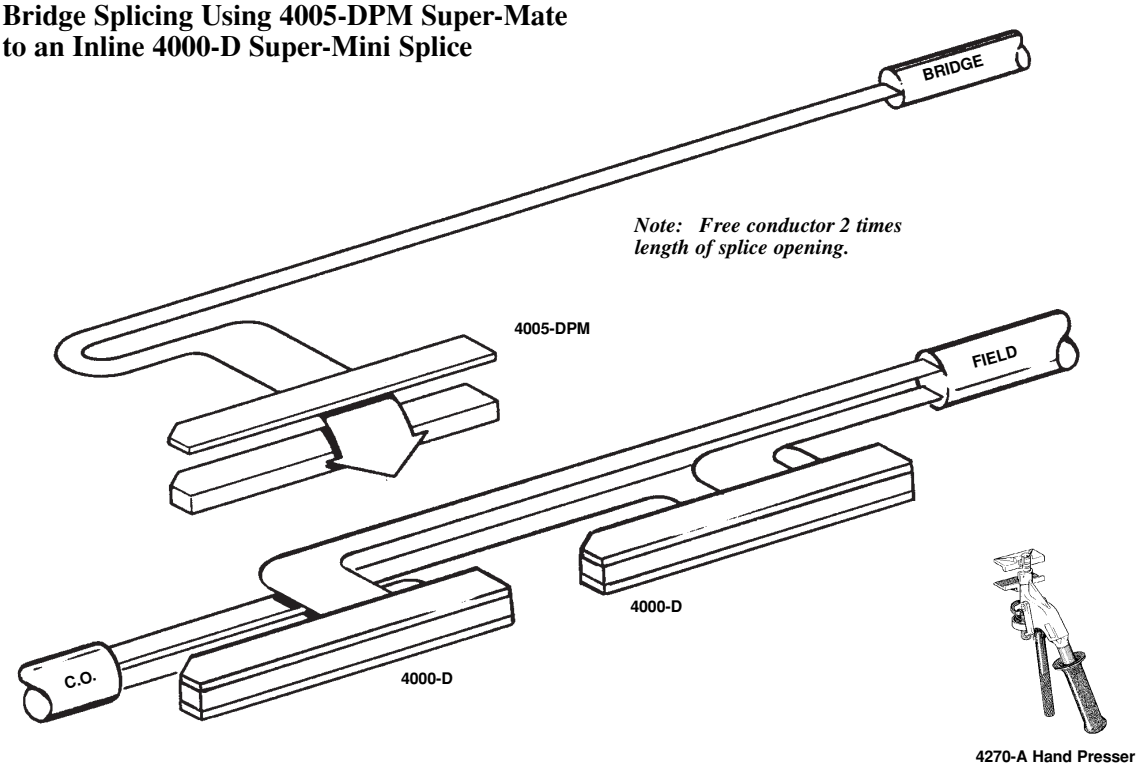
6.8.2 Bring wire across the splice opening, then fold back 2" (51 mm) and splice.



Note: ***Unilength measurement is always used when stubs are added to a splice and for any distribution cables in a modified fold-back splice.***

Configuration	Splice Openings	Unilength
2 bank	17" (43.2 cm) – 19" (48.3 cm)	19" (48.3 cm) – 21" (55.3 cm)
3 bank	27" (68.6 cm) minimum	29" (73.7 cm)
4 bank	36" (91.4 cm) minimum	38" (96.5 cm)

6.9 Bridge Splicing Using 4005-DPM Super-Mate to an Inline 4000-D Super-Mini Splice



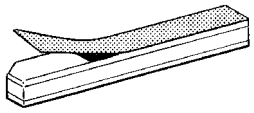
Note: A stripped splice head may be used with a crimper instead of hand tools.

6.9.1 PIC Cable

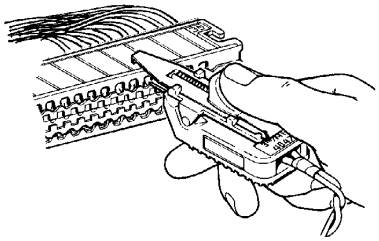
6.9.1.1 Preterminate Super-Mate Module, then plug to corresponding groups.

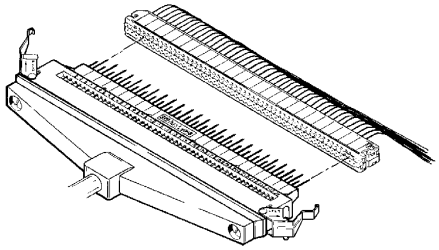
6.9.2 Pulp Cable

6.9.2.1 Tag modules that receive stub count using 4079-S Tagging Labels.

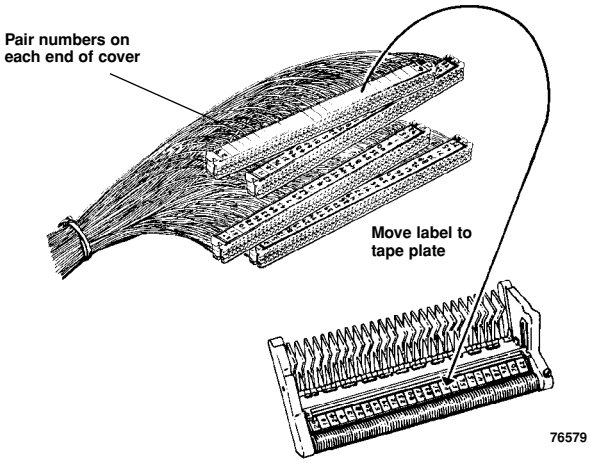


6.9.2.2 Access with 4047 or 4048 Test Probe.





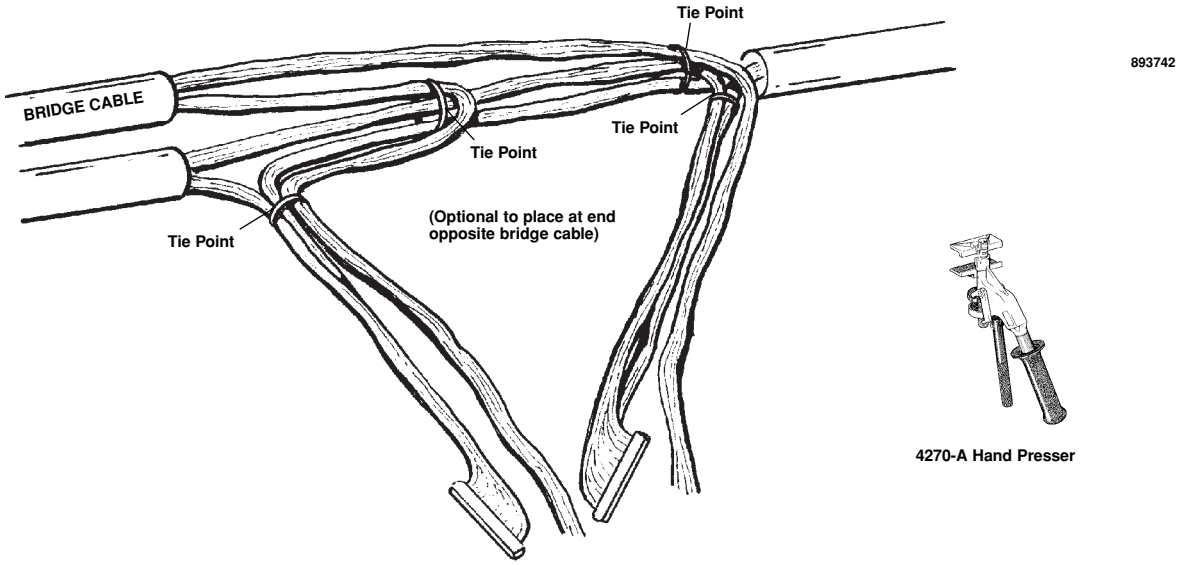
6.9.2.3 Begin pretermination stub by removing tagging label from module in splice and placing it on the tape plate of splicing head. Immediately identify module from which tagging label was removed by marking the pair number on each end of the cover.



6.9.2.4 Preterminate Super-Mate Module, then plug to corresponding groups according to label.

6.10 **Bridged Foldback Splicing**

6.10.1 Tie binder groups from branch cable to corresponding groups in the splice so that slack exists for future transfers.



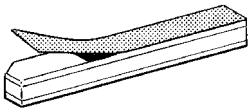
Note: ***A stripped splice head may be used with a crimper instead of hand tools.***

6.10.2 PIC Cable

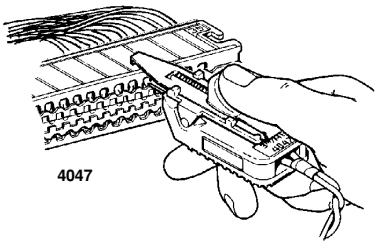
6.10.2.1 Preterminate Super-Mate Module, then plug to corresponding groups.

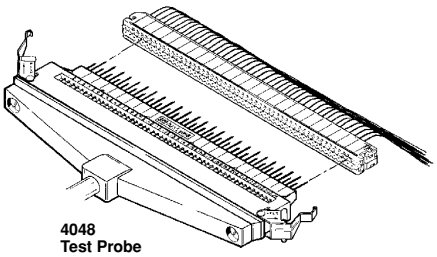
6.10.3 Bridging PIC Stup Pulp Splice.

6.10.3.1 Tag modules that receive stub count using 4079-S Tagging Labels.

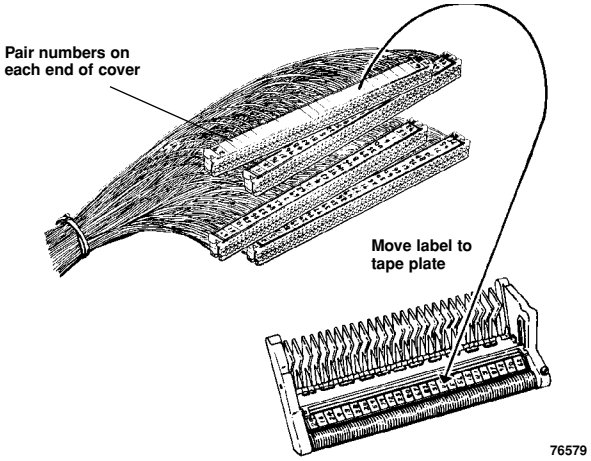


6.10.3.2 Access with 4047 or 4048 Test Probe.





6.10.3.3 Begin pretermination stub by removing tagging label from module in splice and placing it on the tape plate of splicing head. Immediately identify module from which tagging label was removed by marking the pair number on each end of the cover.



6.10.3.4 Preterminate Super-Mate Module, then plug to corresponding groups according to label.

6.11 Half Tapping Using 4008 Half Tap Module

The MS^2 Splicing System can be used to half tap a run or through cable without cutting the conductors by using the 3M brand 4008 Half Tap Module. The base and body/bottom of the module are colored green and contain no cut-off blades. Through wires placed in the base will be electrically connected by the elements, but not cut-off.

SLACK

Minimum Requirements:

600 Pair or less ....8" (205 mm)
600-1500 Pair .....8" (205 mm) – 14" (355 mm)

The preferred splicing sequence is to start with the back bottom groups working up the back side.

Note: ***Exception – Layered cable must be spliced starting with the center groups. This requires a larger opening to assemble the cable in 25-pair groups.***

When pulling slack, always allow binder groups to fall so that they will be on each side of the support tube when it is mounted. The cable twist will establish the most natural position.

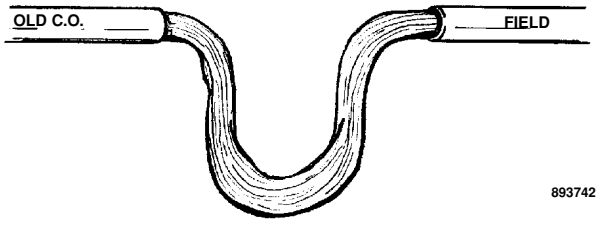
It is preferred to last the tap cable on top of the cable to be removed.

Lay run (or through) conductors only in the module base with conductors to be removed out the front of module (spring side.) Use one splicing head.

6.11.1 Open cable sheath and expose conductors the length of the splice closure plus the amount of necessary slack.

893742

6.11.2 Pull cable slack until sheath ends are at recommended opening for splice closure.

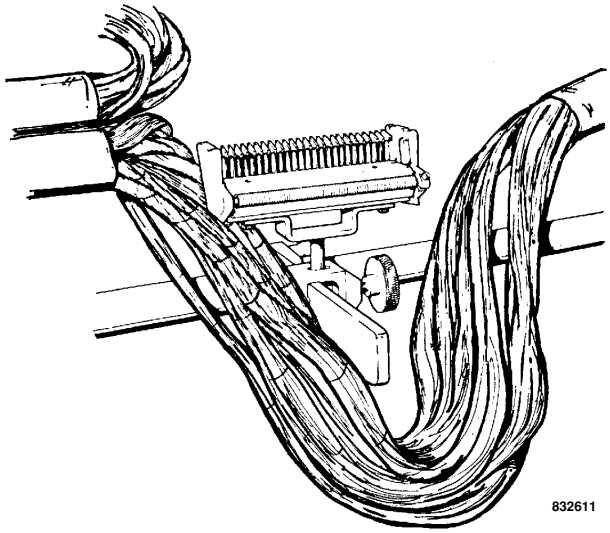


893742

6.11.3 Identify binder groups.

Note: ***Layered cable must be counted and identified in 25-pair groups. Verify all spare pairs.***

6.11.4 Mount splicing rig. Use one splice head on short traverse bar.



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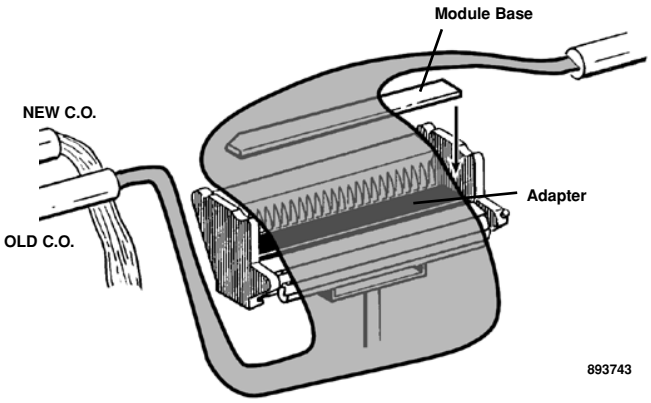
Splice head should be positioned so that the two banks of modules will end up positioned 1" (25 mm) to the left of center of the opening, and 1" (25 mm) to the right of center. See Section 6.11.11.

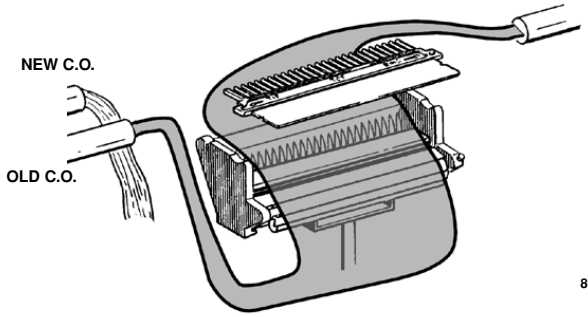
6.11.5 Place adapter in splice head. Place module base onto adapter in splice head.

Always place run (or through) wires into base, making sure to pull slack toward cable to be removed.

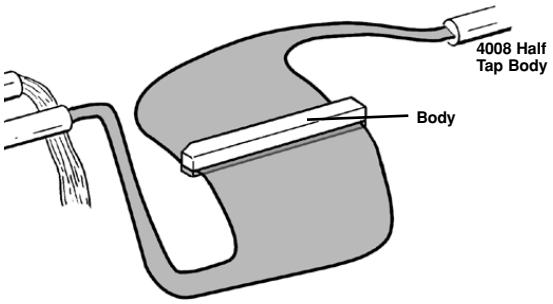


893743

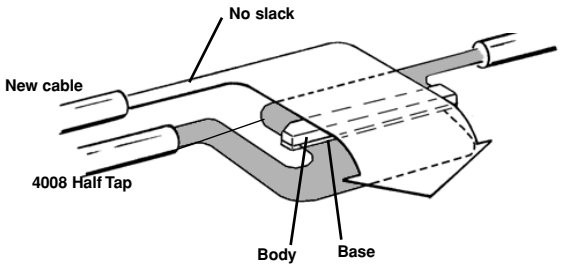
6.11.6 Use check comb.



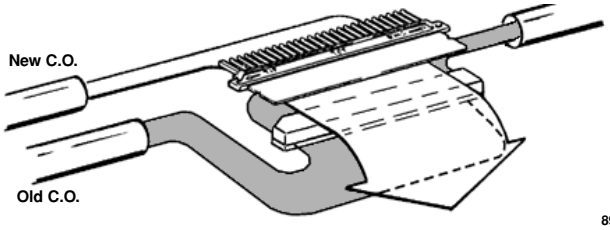
6.11.7 Place 4008 Module body, green side down.



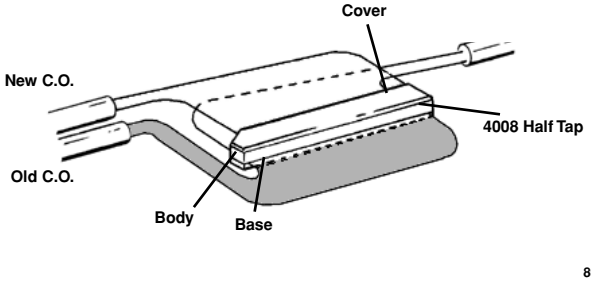
6.11.8 Lay new wires in module body top.



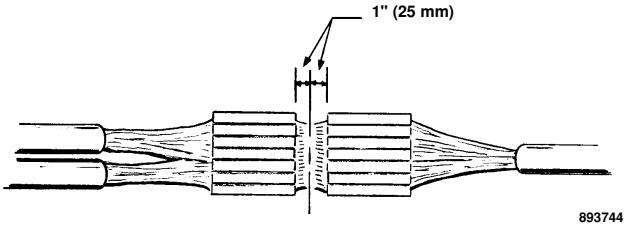
6.11.9 Use check comb.



6.11.10 Place cover and crimp.



6.11.11 Finish splicing 100-pair at this location and bundle. Keep slack toward leg to be removed. On larger pair count cables, gently fold excess slack behind the module while bundling to keep splice diameter and shape as small and as uniform as possible.

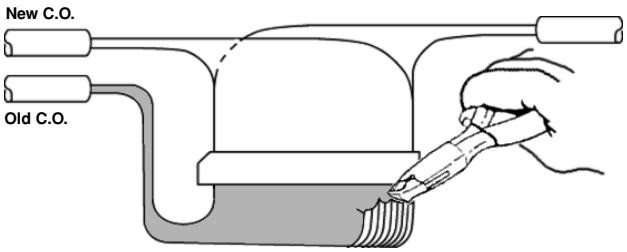


Move head to opposite side. Set so that module will be 1" (25 mm) from center. Slack will still be pulled toward leg to be removed.

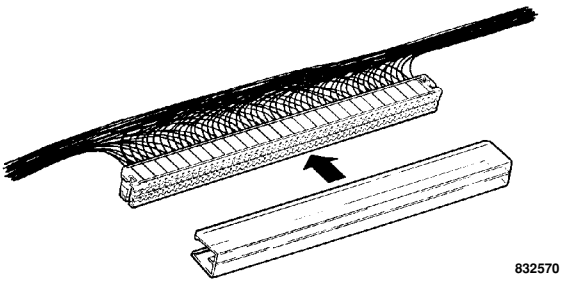
Splice 100-pair at this location. Bundle.

Move back to opposite side and do another 100-pair. Bundle. Repeat above, alternating left and right.

6.11.12 To remove half tapped cable, use a flush cut offset pair of pliers to allow one conductor to be cut at a time. Care should be taken not to short against adjacent cut conductors.



Insulate all cable cut ends with 4078-C Half Tap Cover or a 4075-S Sealant Box, depending on application requirements.

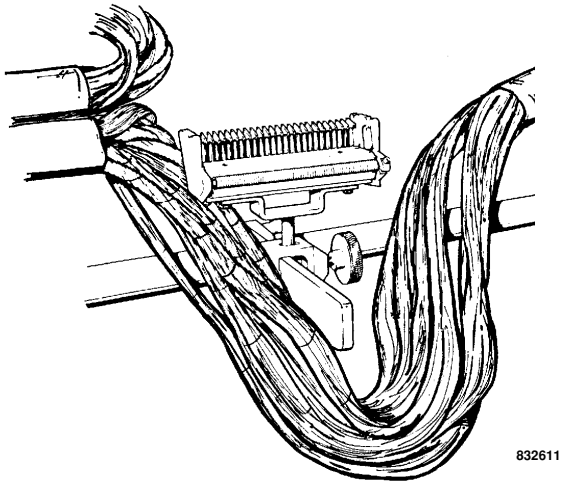


Bundle splice.

6.12 **Half Tapping Using 4000-D Super-Mini – 4005-DPM Super-Mate**

6.12.1 Open existing tap cable (new cable.) Provide free conductor length and slack according to standard MS2 Procedures for Half Tapping.

Mount splicing rig with one splice head on cables.

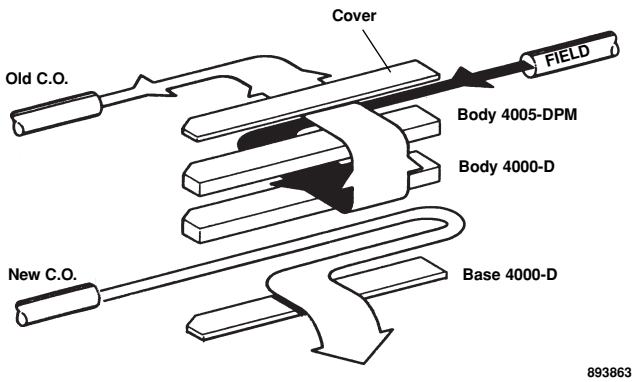


6.12.2 Lay tap (new) conductors into base of a 4000 Super-Mini Module in unilength configuration. Crimp 4000 Super-Mini Module body using the back edge of the check comb as a temporary cover and remove cut conductors.

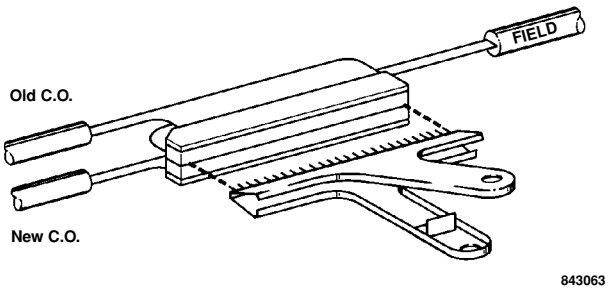
Lay field conductors into Super-Mini body top, but **DO NOT CRIMP**.

Place Super-Mate body onto Super-Mini body. Place corresponding through pair (old) and lay into matching wire channels of the Super-Mate Module.

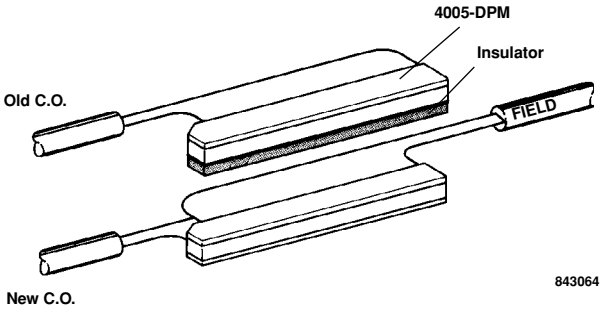
Place cover, crimp and remove.



6.12.3 When related work is complete and the removal of the old C.O. is needed; use the 4053-PM Separator Tool to separate the old cable that is in the Super-Mate Module.



6.12.4 Crimp a new cover onto the 4000 Super-Mini Module and place a red insulator on the Super-Mate Module.



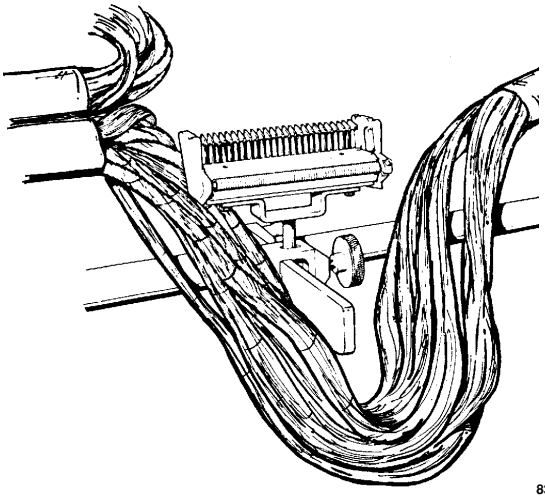
6.13 **Half-Tapping Using 4005-DPM Super-Mate**

An alternative method of half-tapping existing cables, using only 4005 Series Super-Mate Pluggable Modules, is available where the advantages of a completely pluggable half-tap splice are desired.

Note: ***When half-tapping using all Super-Mate Series Modules, the wire guide and wire separator should be raised to their maximum height by loosening the 3 screws at the back of the splice head and raising both the wire guide and separator, and re-tightening the screws.***

6.13.1 Open existing tap cable (new cable.) Provide free conductor length and slack according to standard MS^2 procedure for half-tapping.

Mount splice rig with one splice head on cables.



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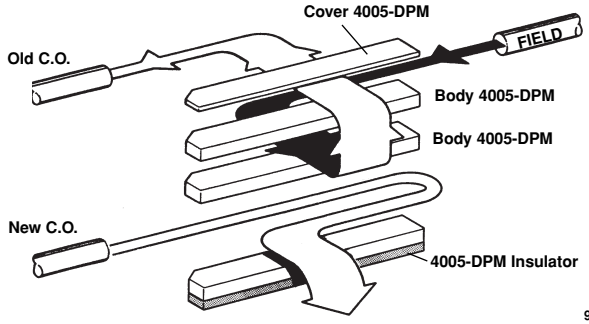
6.13.2 Lay tap (new) conductors into a 4005 Series Super-Mate Module in the unilength configuration. Place a second 4005 Series Super-Mate into the splice head and crimp, using the back edge of the check comb as a temporary cover and remove cut conductors.

Lay the field conductors into the second Super-Mate Module, but **DO NOT CRIMP**.

Place a third Super-Mate Module into the splice head. Lay corresponding pairs (old) into the matching wire channels of the third Super-Mate Module.

Place cover, crimp and remove conductors.

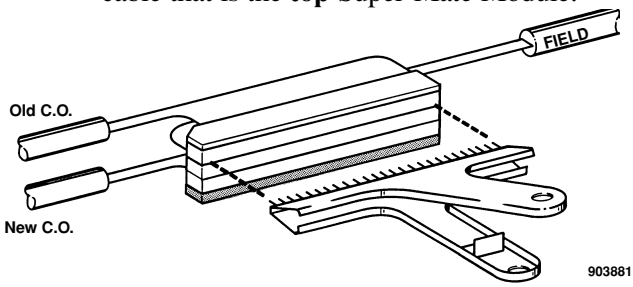


903881

Optional Method:

New C.O. cable may be preterminated in the unilength configuration. Old C.O. and Field Cable may be handled as described in Section 6.14 Slack Removal, using 4005-DPM Super-Mate Modules.

6.13.3 When related work is complete and the removal ov the old C.O. is needed; use the 4053-PM Separator Tool to separate the old cable that is the **top** Super-Mate Module.



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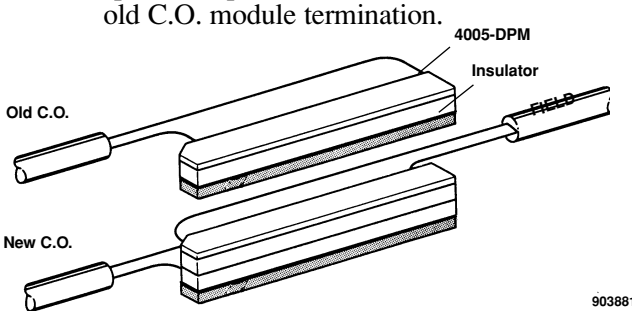
6.13.4 Crimp a new cover onto the Super-Mate splice and place a red module insulator on the old C.O. module termination.



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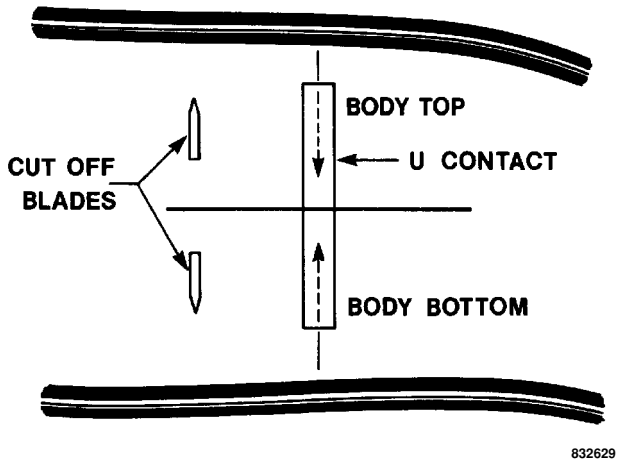
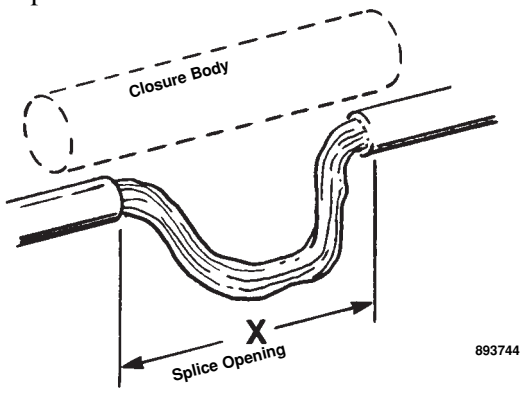
6.14 Slack Removal

Note: ***In 4000 Series Modules, connection is made in "U" contact before wire is cut.***

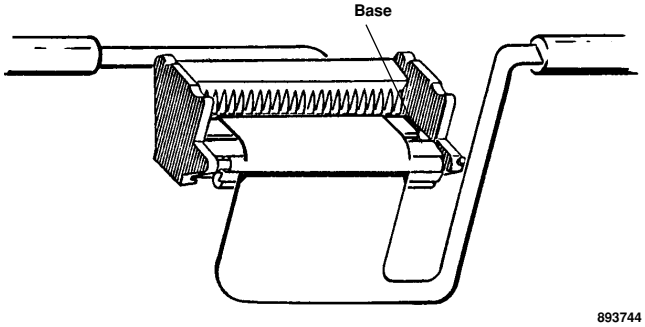


6.14.1 Remove sufficient sheath so that once slack is removed, the splice opening remaining will accommodate closure to be used.

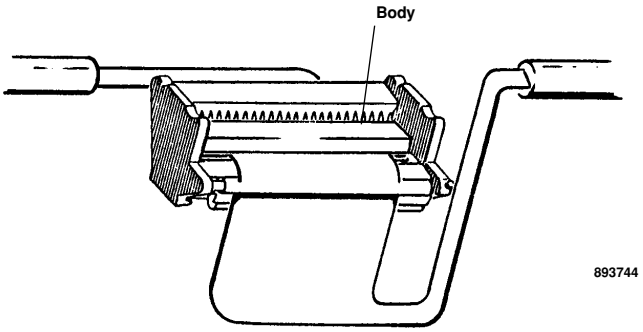
Set up splice rig with single head and adapter.



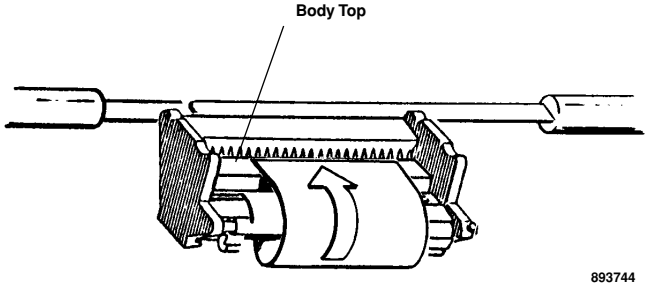
6.14.2 Place 4000 base in splice head and place a 25-pair group in base. Let slack loop fall down in front and below retainer springs.



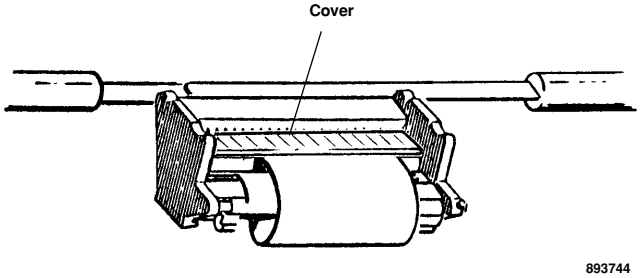
6.14.3 Place body in head.



6.14.4 Take conductors from other side of splice opening and place in body top.



6.14.5 Fill body/top completely, add cover and crimp. Slack can now be removed.

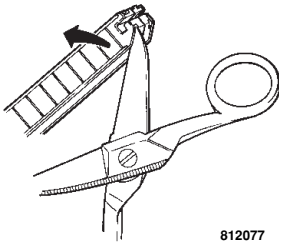


7.0 Maintenance

7.1 Module Reentry

7.1.1 Insert the blade side of a pair of snips under the cut corner area of the base or cover. (There are no latches in this immediate area.)

A 4053 Cover Removal Tool may also be used.



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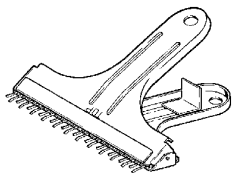

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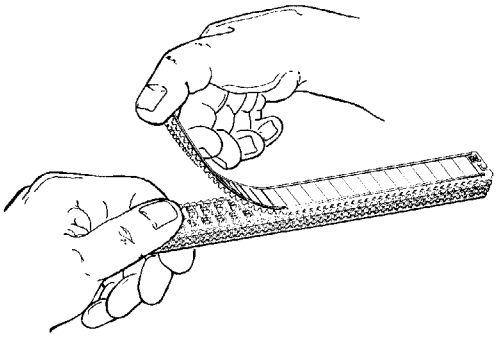
7.1.2 Peel cover or base away.

Note: ***Do not reuse covers or bases. Covers or bases can be placed on the module using the following tools: E9BM, 4041/4030 or 4031 or 4036 and 4270A.***

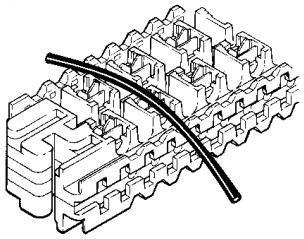


781194

7.2 Wire Insertion

The 4051 Wire Insertion and Cut Off Tool is used to insert wires into the "U" contact and to cut off excess wire in Super-Mini Modules when conductor or Super-Mate rearrangements are made inside the module.

7.21 Pull wire across top of "U" contact and cut off blade.



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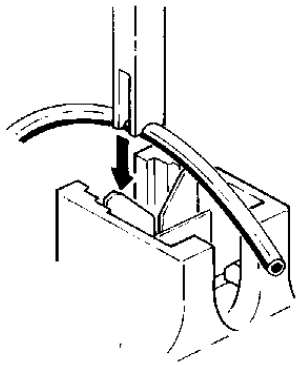
7.2.2 Align 4051 Tool with "U" contact and wire. The slot is aligned with the "U" contact and the groove with the wire.



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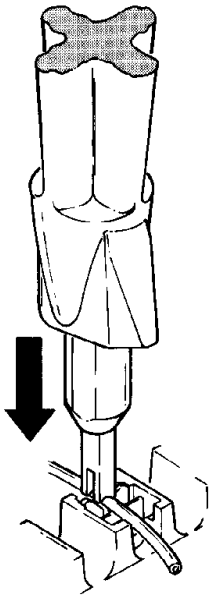
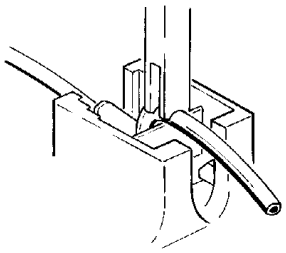
7.2.3 Push **straight down** forcing the conductor into the "U" contact. **DO NOT ROCK TOOL BACK AND FORTH.**



781186

7.2.4 To cut off wire, align slot with cut off blade and groove with wire. Push **straight down**. Remove excess wire from module. **DO NOT ROCK TOOL BACK AND FORTH.**



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7.3 Splice Conversion to 4005-DPM Modules

When:

- 50% or more of the conductors will be rearranged.
- Deteriorated splices.
- Discrete connector splices.
- Splices already partially converted.

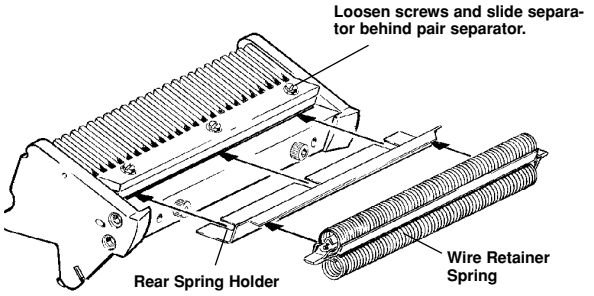
Slack Requirements:

- Inline .....6" (152.4 mm min.)
- Straight Through....6" (152.4 mm min.)
- Foldback .....Slack already built in.

Note: ***This operation requires using the rear spring holder and the front wire retainer spring.***

Prepare Splice Head:

Place spring on holder by sliding onto the flat plate of the rear spring holder.



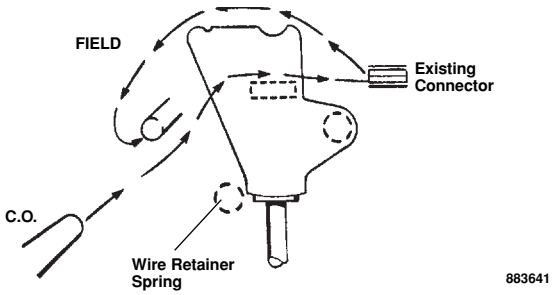
7.3.1 Foldback Conversion: (Maintaining Foldback Configuration)

7.3.1.1 Place the splice head into the approximate position of the original connectors when they were spliced. Remove front wire retainer spring.

7.3.1.2 Straighten the wires at the rear of the existing (old) connectors.

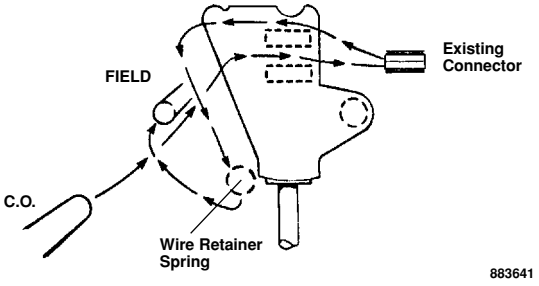
7.3.1.3 Place DPM into splice head and secure existing connector to tape panel.

7.3.1.4 Fan C.O. wires into body and place excess wire into rear spring.



7.3.1.5 Add second body.

7.3.1.6 Fan Field wires into second body and place excess wire into wire retainer spring, add cover and crimp.



Note: ***Care must be taken same pair of conductors in the body/top wire channels that appear in the body/bottom channels. Pair One on top must match Pair One on bottom.***

Note: ***It may be necessary to adjust the tie point to maintain a neat splice.***

7.3.2 Foldback Conversion: (To Inline)

Cut the tie points, expose the core and place available slack wire length in splice head.

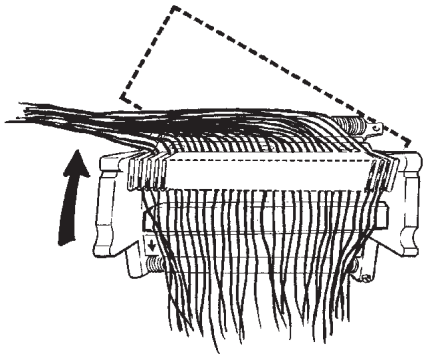
7.3.3 Inline – PIC:

A minimum of 6" (152.4 mm) of slack is required to convert an Inline PIC splice. Follow steps used in the Foldback Conversion procedure. (section 7.3.1)

7.3.4 **Straight Through Conversion: (6" Slack Required)**

7.3.4.1 Separate color groups to be spliced, i.e., white, red, black, etc., and begin with the primary colors, i.e. w/bl, w/o, w/g, etc., and lay wires into splice head in consecutive order in the
first DPM.

Note: ***Turn splice head to open the rear spring angle and to allow entry of conductors into the rear wire retainer spring.***



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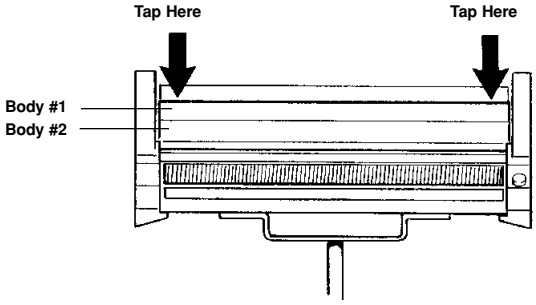
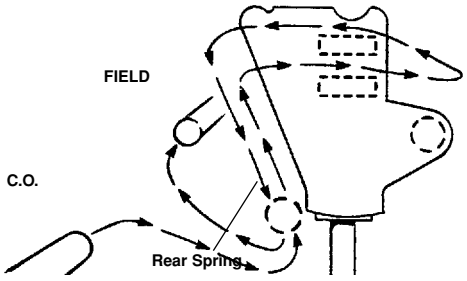
7.3.4.2 Lay in second DPM body and lightly tap the body on each end set latches and reduce movement.



883634

7.3.4.3 Fold wires up and over themselves, across the second body and lay wires into the rear spring.

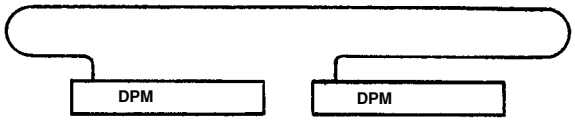


883641

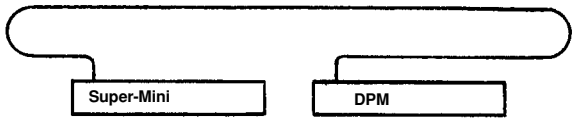
Place cover and crimp.

7.3.5 **Straight Through Conversion (No Slack) Using Two 4041 Splice Heads:**

7.3.5.1 Build a piece out jumper using the DPM Modules. Use sufficient slack to allow mobility within the splice.



To reduce splice bundle size, build piece out jumpers using 4000D Super-Mini and 4005-DPM Modules. Alternate Super-Mini and 4005-DPM Modules between right and left banks.



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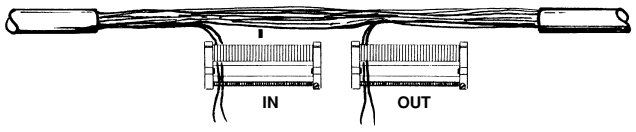
7.3.5.2 Center double head set-up into splice opening.

7.3.5.3 Place appropriate piece out of jumper into each splice head.

7.3.5.4 Place second body into each head and crimp.

7.3.5.5 Verify group to be cut.

7.3.5.6 Cut first straight through cable pair at pair 17 (y/o) of left hand splice head. After pair has been cut, place left cut end in first wire way of body/top (bl/w) of left splice head; place right cut end in first wire way (bl/w) of right splice head.



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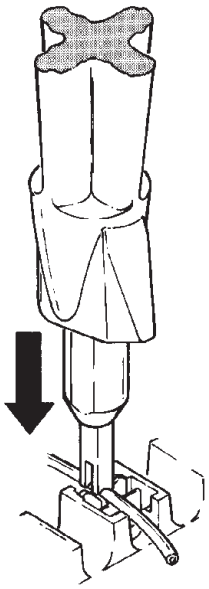
Note: ***If pair is working, use bridge clips.***

7.3.5.7 Insert conductors in contacts body/top using 4051 Wire Insertion Tool.



7.3.5.8 Cut second straight through cable pair at pair 18 (y/gr) of left hand splice and insert in pair number two (o/w) locations on each splice head. Continue cutting each successive pair in the 25-pair group, moving over one pair each time, until both module body/tops are filled. The last of the 25-pair group will be made at pair number seven (r/o) of the right hand splice head.

7.3.5.9 Add cover and crimp.

7.3.6 **Pulp Splices – Random Foldback**

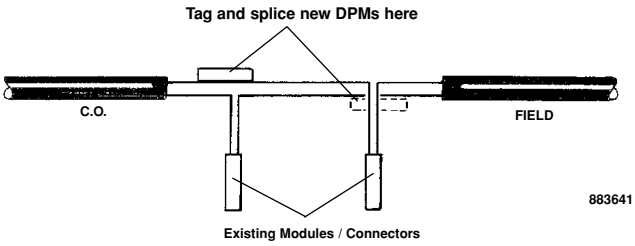
To convert a random pulp splice into DPM modules, the following requirements must be observed.

Note: ***Ideally, an extended sheath opening should be made, however, if this is not possible observe the following steps.***

7.3.6.1 The splice must be a foldback .. configuration with at least 27" (68.6 cm) of slack at its longest section.

7.3.6.2 The cable count to be converted must be tagged.

7.3.6.3 The new DPM module must be placed in the splice at the point between the cable butt and the first cable tie point.



7.3.6.4 Remove all tie points.

7.3.6.5 Mount single splicing head in a position 2" (52 mm) from cable butt. Place DPM module in head.

7.3.6.6 As pairs are identified, place in numerical order in module, i.e., cable pair #6 into module position #6 and so on.

7.3.6.7 Add second DPM body, fold pair over itself and place pair into rear spring.

7.3.6.8 After the first 25-pair are completed, crimp the DPM.

7.3.6.9 Continue on until the entire cable count to be converted are in DPMs in numerical order.

7.3.6.10 Once sections have been tested and verified per your company pracice and the old section ready to cut, remove old section from the splice using the 4053-PM Separation Tool.

8.0 Engineering

8.1 **Job Planning** – A major consideration while planning is the maximum protection of the feeder plant network. Restriction of reentry into the main feeder splice must be emphasized.

8.2 **Moisture Protection** – All MS^2 module types are available in either dry versions for pressurized, vault or inside splice applications; encapsulated versions for moisture resistance in free-breathing aerial splice closures; or in a dry version with sealant box for maximum moisture protection in non-pressurized PIC splicing applications.

8.3 **Fire Retardancy** – All dry MS^2 module types are available in flame retardant versions for vault and inside splice applicaitons. All fire retardant MS^2 modules meet UL Standard 94-VO requirements and possess an Oxygen Index of 28 or greater per ASTM Test Method D2863.

8.4 **Rebuilding Existing Splices** –

8.4.1 **Reasons:**

- 50% or more of the conductors require rearrangement
- Deteriorated splices
- Discrete connector splices
- Splices already partially converted

8.4.2 **Disadvantages:**

- Costly
- Time Consuming

8.4.3 **Advantages:**

- Ability to plug and unplug
- Improve life and usability of splice
- Ease of maintenance

8.4.4 **Special Considerations:**

- Inline splices require 10" to 12" (254 to 305 mm) of slack for conversion
- Without required slack, piecing out is necessary
- Piecing out requires additional modules in splice, resulting in reduced splice capacity in splice closure
- Use proper symbols to fully identify all splice points

Note: ***If Rear Spring Holder is used, a minimum of 6" (152 mm) of slack is required.***

8.5 **Rebuild Coding** – Engineering, by chart computation, will determine how many module banks will be required to complete a specific splice. Splice bank configurations and splice types are listed on the work print at each splice location according to a simple coding system.

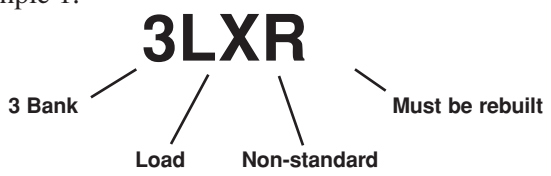
This system tells the splicer what connectors are required and what configuration the splice is to be built in. It also indicates to the engineer what flexibility the splice has for the future. This coding is added to the cable records for future reference.

S	–	Straight
F	–	Facility
J	–	Junction
L	–	Load
X	–	Non-standard
RN	–	Rebuilt needed
RC	–	Rebuild completed

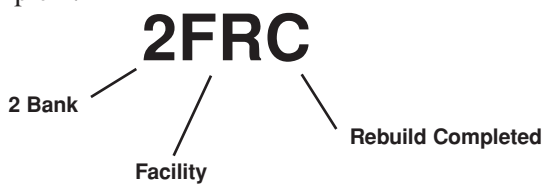
Note: ***Code always starts with a number representing the number of banks in a splice. One of three configurations will be used.***

Configuration	Splice Opening	Unilength
2 Bank	17" - 19" 43.2 cm - 48.3 cm	19" - 21" 48.3 cm - 55.3 cm
3 Bank	27" (68.6 cm) min	29" (73.7 cm) min
4 Bank	36" (91.4 cm) min	38" (96.5 cm) min

Example 1:



Example 2:



8.6 Splice Planning

8.6.1 Splice sizing is necessary to determine the proper sheath opening and the proper splice closure size. Too many cable conductors spliced in a closure without adequate splice banks may stress wires with module movement. Reentry and churning conductors without proper planning leads to rapid deterioration of cables at their weakest point – the splice.

Calculate splice and closure size using the following factors:

- Cable pair count
- Wire gauge
- Connector type
- Splicing method

8.6.2 Unilength Splicing Method

Wire is brought across the splice opening plus 2" (51 mm.) Wire bundle must be folded back and then spliced into the module.

Unilength measurement is always used when stubs are added to a splice and for any distribution cables.

8.6.3 Inline Splicing Method

Wire is placed in a straight across arrangement. This method is not designed to be rearranged and should have minimum handling.

8.6.4 Fold Back Splicing Method

Conductors are folded into the splice to provide slack in the conductors for maintenance, rearrangement or transfer of conductors.

8.6.5 Splice Data

Data in the following tables was obtained from splices prepared according to the instructions in this practice. When the Bundle O.D. is close to Splice Case or Sleeve I.D., the craftsperson must use extra care not to exceed the maximum O.D.. If sealant boxes are used, increase values approximately 25%.

8.6.5.1 Two Bank Inline Splice Data (Super-Mini)

Pair Count	AWG		Recommended Splice Opening		Inline Splice Dia.	
		mm	in.	mm.	in.	mm
400	26	.4	17	432	2.6	66
	24	.5			2.9	74
	22	.6			3.2	81
600	26	.4			3.1	79
	24	.5			3.5	89
	22	.6			4.6	117
900	26	.4			3.8	94
	24	.5			4.2	107
	22	.6	17	432	5.6	142
1100	26	.6	19	483	4.0	102
1200	26	.4	17	432	4.2	107
	24	.5	17	432	4.7	117
1500	26	.4	19	483	4.9	124
	24	.5			5.5	140
1800	26	.4			5.4	137
	24	.5			6.0	152
2100	26	.4			5.8	147
	24	.5			6.5	165
2400	26	.4			6.2	157
2700	26	.4			6.6	168
3000	26	.4	19	483	7.0	178
3600	26	.4	19	483	7.7	196

8.6.5.2 Two Bank Fold Back Splice Data (Super-Mini)

Pair Count	AWG		Recommended Splice Opening		Inline Splice Dia.	
		mm	in.	mm.	in.	mm
400	26	.4	17	432	2.8	71
	24	.5			3.3	89
	22	.6			4.0	102
600	26	.4			3.2	81
	24	.5			3.9	99
	22	.6			4.8	122
900	26	.4			4.1	104
	24	.5			5.0	127
	22	.6	17	432	5.8	147
1100	22	.6	19	483	6.5	165
1200	26	.4	17	432	4.7	119
	24	.5	17	432	5.0	127
1500	26	.4	19	483	5.4	137
	24	.5			5.7	145
1800	26	.4			6.0	152
	24	.5			6.3	160
2100	26	.4			6.2	157
	24	.5			6.7	170
2400	26	.4			6.5	165
2700	26	.4			7.2	183
3000	26	.4	19	483	7.6	193
3600	26	.4	19	483	8.0	203

8.6.5.3Maximum Bundle Size for Closures

8.6.5.3.1 26 AWG Two Bank Straight Splice*

Main Cable Pair Count	Straight Splice Measurement in Inline Configuration (4000-D Super-Mini Modules) Zero	Number of Pair Bridged (4000-D Super-Mini and 4005-DPM Super-Mate Modules) 100	200	300	400	600	900	1200	1500	1800	2100	2400	2700	3000
100	1.3	1.7												
200	1.9	2.1	2.4											
300	2.2	2.6	2.7	3.0										
400	2.6	2.9	3.0	3.2	3.7									
600	3.1	3.4	3.5	3.8	4.1	4.4								
900	3.8	4.0	4.2	4.4	4.7	4.9	5.3							
1100	4.0	4.4	4.6	4.8	5.0	5.1	5.6							
1200	4.2	4.5	4.8	5.0	5.2	5.3	5.8	6.3						
1500	4.9	5.1	5.4	5.6	5.7	6.0	6.3	6.7	7.0					
1800	5.4	5.6	5.9	6.0	6.1	6.4	6.6	7.1	7.3	7.6				
2100	5.8	6.1	6.3	6.4	6.5	6.8	7.2	7.5	7.6	7.9	8.3			
2400	6.2	6.5	6.7	6.8	6.9	7.2	7.6	7.9	7.9	8.2	8.6	8.8		
2700	6.6	7.0	7.1	7.2	7.3	7.6	7.8	8.2	8.3	8.6	8.9	9.4	9.6	
3000	7.0	7.4	7.5	7.6	7.7	8.0	8.3	8.6	8.6	8.9	9.3	9.8	10.1	
3600	7.7	8.2	8.3	8.4	8.5	8.7	9.0	9.1	9.2	9.6	9.9	10.3	10.6	10.9

VALUES IN INCHES

**NOTE:* *For 22 AWG conductors, increase values by 25%*
For 24 AWG conductors, increase values by 12%
If sealant boxes are used, increase values approximately 25%

8.6.5.3.2 26 AWG Three Bank Straight Splice*

Main Cable Pair Count	Straight Splice Measurement in Inline Configuration (4000-D Super-Mini Modules) Zero	Number of Pair Bridged (4000-D Super-Mini and 4005-DPM Super-Mate Modules) 100	200	300	400	600	900	1200	1500	1800	2100	2400	2700	3000
300	1.8	2.1	2.4	2.7										
600	2.6	2.8	3.1	3.3	3.4	3.7								
900	3.3	3.5	3.8	4.0	4.1	4.3	4.8							
1200	3.9	4.1	4.3	4.5	4.7	5.0	5.5	5.7						
1500	4.5	4.6	4.7	4.9	5.1	5.5	5.9	6.3	6.6					
1800	5.1	5.2	5.3	5.4	5.5	5.9	6.3	6.7	7.0	7.3				
2100	5.5	5.6	5.7	5.8	5.9	6.3	6.7	7.0	7.4	7.7	7.8			
2400	5.9	6.0	6.1	6.2	6.3	6.6	7.0	7.3	7.7	8.0	8.1	8.4		
2700	6.2	6.3	6.4	6.5	6.6	6.9	7.2	7.6	8.0	8.3	8.5	8.7	8.8	
3000	6.5	6.6	6.7	6.8	6.9	7.2	7.5	7.9	8.2	8.6	8.7	9.0	9.1	9.3
3600	6.9	7.0	7.1	7.2	7.3	7.6	7.9	8.3	8.6	8.9	9.2	9.4	9.5	9.7

VALUES IN INCHES

**NOTE:* *For 22 AWG conductors, increase values by 25%*
For 24 AWG conductors, increase values by 12%
If sealant boxes are used, increase values approximately 25%

8.6.5.3.3 26 AWG Four Bank Straight Splice*

Straight Splice Measurement in Inline Configuration (4000-D Super-Mini Modules)

Number of Pair Bridged (4000-D Super-Mini and 4005-DPM Super-Mate Modules)

Main Cable Pair Count	Zero	100	200	300	400	600	900	1200	1500	1800	2100	2400	2700	3000
400	2.0	2.1	2.2	2.3	2.5									
600	2.3	2.5	2.6	2.7	2.9	3.1								
900	2.8	3.0	3.1	3.2	3.4	3.6	3.9							
1200	3.2	3.4	3.5	3.6	3.8	4.0	4.3	4.7						
1500	3.7	3.8	3.9	4.0	4.2	4.3	4.7	5.1	5.3					
1800	4.2	4.2	4.3	4.4	4.6	4.8	5.1	5.4	5.7	6.1				
2100	4.6	4.6	4.7	4.8	5.0	5.2	5.6	5.8	6.1	6.4	6.6			
2400	4.9	4.9	5.1	5.2	5.4	5.6	5.9	6.1	6.4	6.7	6.9	7.0		
2700	5.4	5.4	5.5	5.6	5.7	5.9	6.2	6.4	6.7	7.0	7.2	7.4	7.5	
3000	5.7	5.7	5.8	5.9	6.0	6.2	6.5	6.7	7.0	7.3	7.5	7.8	7.9	8.2
3600	6.2	6.3	64	6.5	6.6	6.8	7.0	7.3	7.6	7.9	8.2	8.6	8.9	9.4

VALUES IN INCHES

**NOTE:* *For 22 AWG conductors, increase values by 25%*
For 24 AWG conductors, increase values by 12%
If sealant boxes are used, increase values approximately 25%

8.6.5.3.4 26 AWG Two Bank Super-Mate Apparatus Splice*

Straight Splice Measurement in Inline Configuration (4005-DPM Super-Mate Modules)

Number of Apparatus Pairs Unilength Cofiguration (4005-DPM Super-Mate Modules)

Main Cable Pair Count	Zero	50	100	200	300	400	600	900	1200	1500	1800
50	1.3	1.6									
100	1.6	1.9	2.3								
200	2.3	2.6	2.7	3.3							
300	2.7	3.1	3.3	3.8	4.2						
400	3.1	3.4	3.8	4.2	4.6	5.2					
600	3.7	4.1	4.4	4.8	5.2	5.8	6.3				
900	4.8	5.0	5.2	5.6	5.9	6.3	6.8	7.7			
1200	5.4	5.7	5.9	6.2	6.5	6.8	7.4	8.0	8.4		
1500	6.1	6.4	6.6	6.9	7.1	7.3	7.9	8.6	8.8	9.4	
1800	6.7	7.0	7.2	7.4	7.6	7.8	8.4	9.2	9.4	9.5	10.3
2100	7.3	7.5	7.7	7.9	8.1	8.4	9.0	9.6	9.9	10.2	10.6
2400	7.8	7.9	8.2	8.3	8.6	8.9	9.5	10.0	10.3	10.7	11.0
2700	8.3	8.3	8.6	8.7	9.1	9.5	10.0	10.4	10.8	11.1	11.5
3000	8.6	8.6	9.1	9.1	9.5	9.9	10.5	10.7	11.0	11.4	11.9
3600	9.5	9.5	9.7	9.9	10.2	10.8	11.2	11.4	11.7	12.1	12.4

VALUES IN INCHES

**NOTE:* *For 22 AWG conductors, increase values by 25%*
For 24 AWG conductors, increase values by 12%
If sealant boxes are used, increase values approximately 25%

8.6.5.3.5 26 AWG Three Bank Super-Mate Apparatus Splice*

Straight Splice Measurement in Inline Configuration (4005-DPM Super-Mate Modules)

Number of Apparatus Pairs Unilength Cofiguration (4005-DPM Super-Mate Modules)

Main Cable Pair Count	Zero	100	200	300	600	900	1200	1500	1800	2100
300	2.2	3.2	3.6	3.6						
600	3.1	4.0	4.4	4.4	5.7			*VALUES IN INCHES*		
900	4.0	4.8	5.1	5.1	6.2	6.5				
1200	4.9	5.5	5.8	5.8	6.8	7.2	7.8			
1500	5.7	6.3	6.5	6.6	7.3	8.0	8.4	9.1		
1800	6.6	7.1	7.3	7.3	7.9	8.6	9.0	9.5	10.0	
2100	7.3	7.8	8.0	8.0	8.4	9.2	9.5	9.9	10.4	10.6
2400	7.9	8.3	8.5	8.5	8.9	9.6	9.9	10.3	10.7	11.2
2700	8.3	8.7	8.9	8.9	9.3	9.9	10.2	10.8	11.4	11.9
3000	8.7	9.0	9.2	9.3	9.7	10.2	10.9	11.3	11.8	12.4
3600	9.2	9.6	9.8	9.8	10.2	10.6	11.6	12.0	12.6	13.2

NOTE:** **For 22 AWG conductors, increase values by 25%
For 24 AWG conductors, increase values by 12%
If sealant boxes are used, increase values approximately 25%

8.6.5.3.6 26 AWG Four Bank Super-Mate Apparatus Splice*

Straight Splice Measurement in Inline Configuration (4005-DPM Super-Mate Modules)

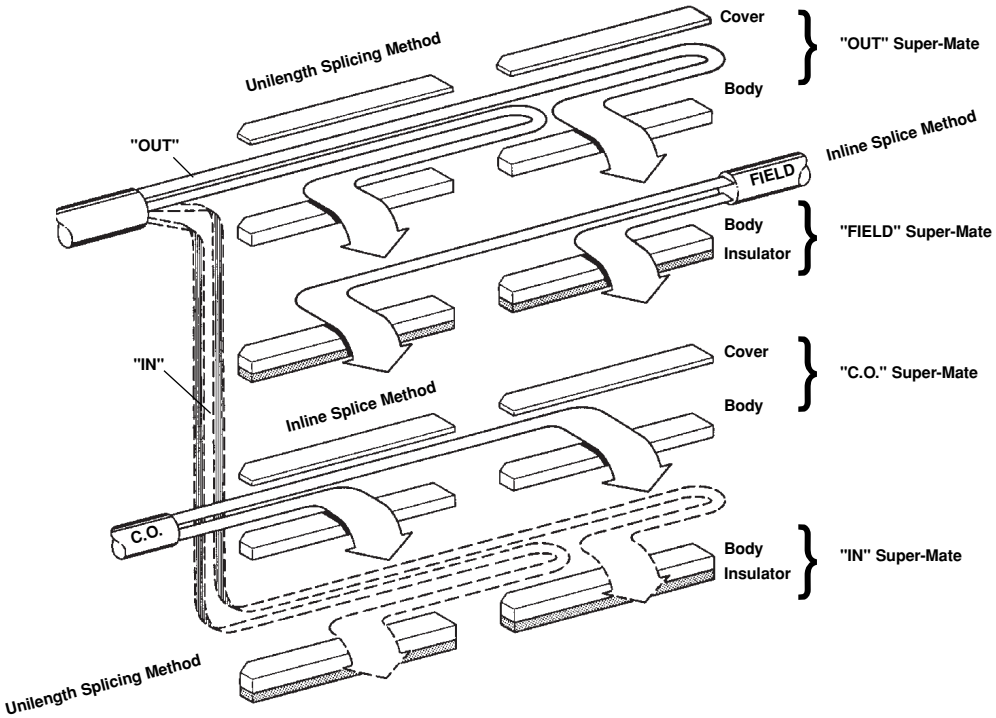
Number of Apparatus Pairs Unilength Cofiguration (4005-DPM Super-Mate Modules)

Main Cable Pair Count	Zero	100	200	300	400	600	900	1200	1500	1800	2100
400	2.3	2.7	3.1	3.7	3.9						
600	2.7	3.1	3.5	4.0	4.2	5.1		*VALUES IN INCHES*			
900	3.3	3.6	4.0	4.5	4.7	5.6	6.3				
1200	3.9	4.2	4.5	5.0	5.2	6.0	6.5	7.1			
1500	4.5	4.8	5.1	5.5	5.8	6.5	7.0	7.6	7.8		
1800	5.0	5.4	5.6	6.0	6.2	7.0	7.6	8.0	8.4	8.7	
2100	5.6	5.9	6.1	6.5	6.7	7.5	8.2	8.7	9.0	9.4	9.7
2400	6.2	6.5	6.6	7.0	7.2	8.0	8.8	9.4	9.8	10.6	10.9
2700	6.7	7.0	7.2	7.5	7.7	8.5	9.3	9.8	10.3	11.2	11.5
3000	7.3	7.6	7.7	8.0	8.3	8.9	9.8	10.3	10.8	11.6	11.9
3600	8.5	8.8	8.8	9.1	9.3	9.9	10.7	11.2	11.8	12.4	12.7

NOTE:** **For 22 AWG conductors, increase values by 25%
For 24 AWG conductors, increase values by 12%
If sealant boxes are used, increase values approximately 25%

8.7 Load Coil Splice "L" (Apparatus)

This splice is utilized where any apparatus having an "in" and "out" is to be added (i.e., load coil, carrier.)



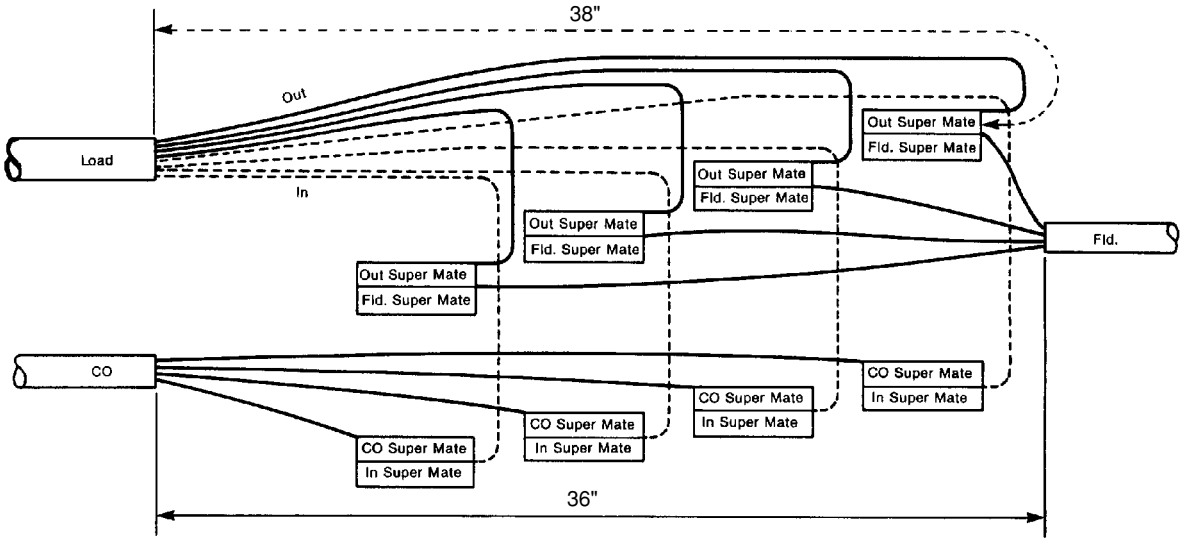
If apparatus is:

1. **Color Coded:** Lay into Super-Mate module in color code order.
2. **Quaded Pair:** Lay "in" and "out" pairs into corresponding position in appropriate Super-Mate modules.

On feeder routes, engineers should note the proper measurements on the work print where equipment could be added. Construction can then build that splice with Super-Mate Modules for simple plugging and unplugging as needed in the future.

Load coil splicing requires more modules than regular splicing. Refer to the apparatus bundle charts to determine if 3 or 4 bank splicing may be needed.

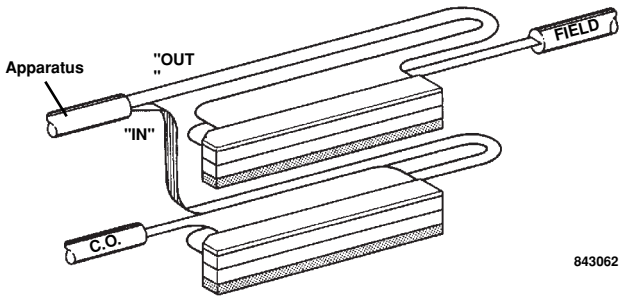
Four Bank Super-Mate Apparatus Splice



8.8 Loading

By building the apparatus/load coil splice with Super-Mate modules, loading/deloading can be performed without interruption of service.

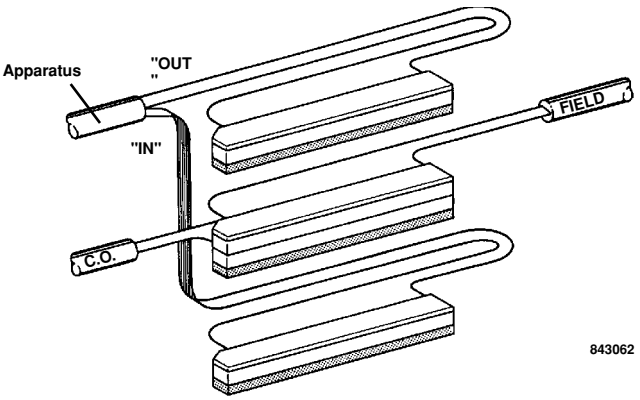
1. C.O. to FIELD spliced in Super-Mate Modules
2. Crimp load modules using 4270-A Tool: "IN" to C.O. Super-Mate and "OUT" to FIELD
3. Separate FIELD and C.O. modules using 4053-PM Separator Tool
4. Load modules should be placed in position where the C.O. and FIELD modules can be connected

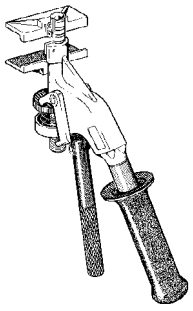


8.9 Deloading

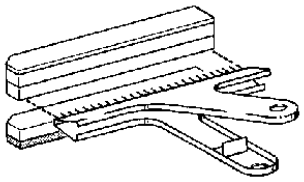
By building the apparatus/load coil splice with Super-Mate modules, loading/deloading can be performed without interruption of service.

1. Crimp the corresponding loaded groups together (C.O. to FIELD) using the 4270-A Hand Presser
2. Using the 4053-PM Separator Tool, remove load coil Super-Mate (IN and OUT) from the group
3. Replace module covers and insulators as required.





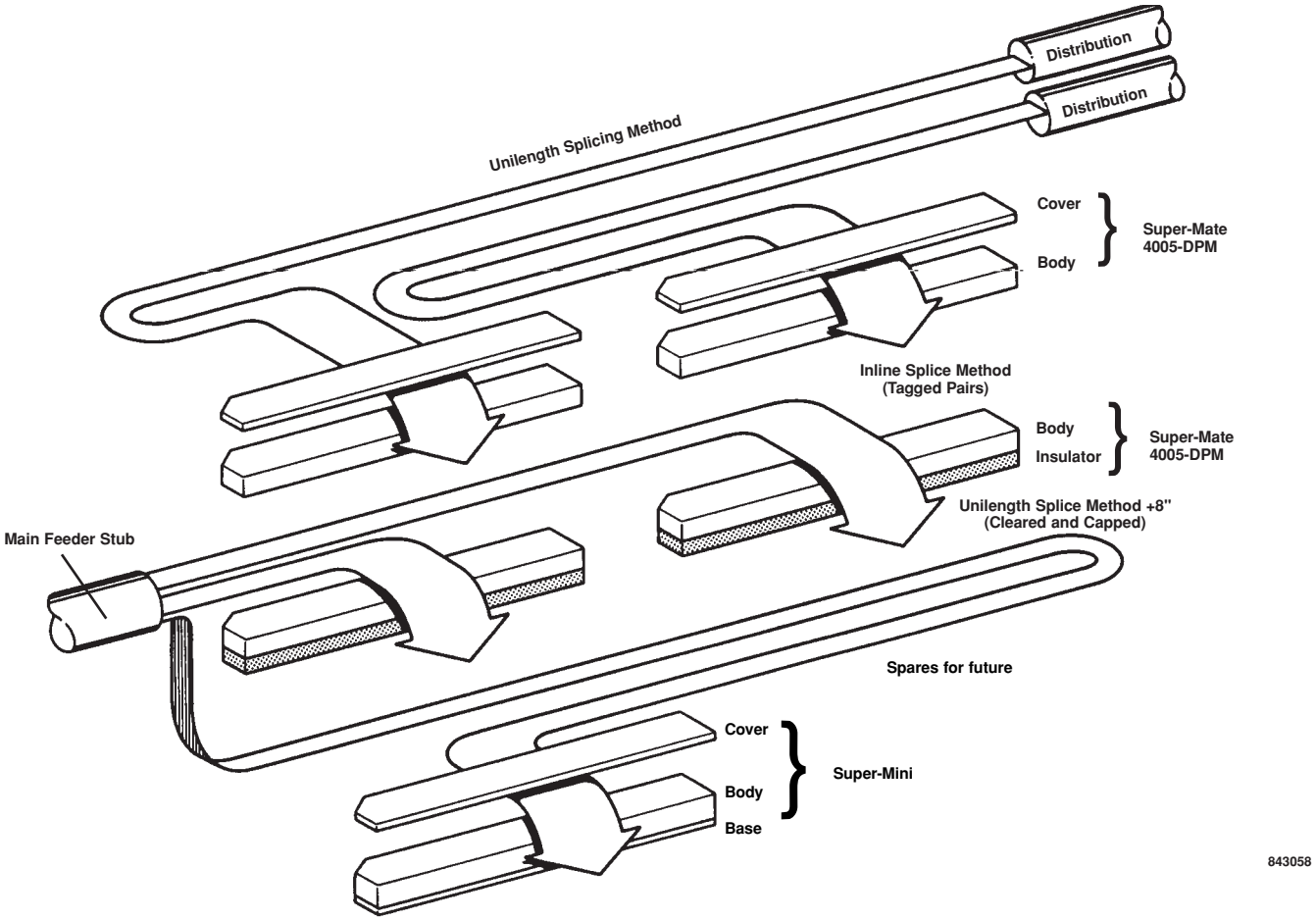
4270-A Hand Presser



4053-PM Separator Tool

8.10 Transfer – Access Splice/Facility Splice "F" (Modified Fold Back Configuration)

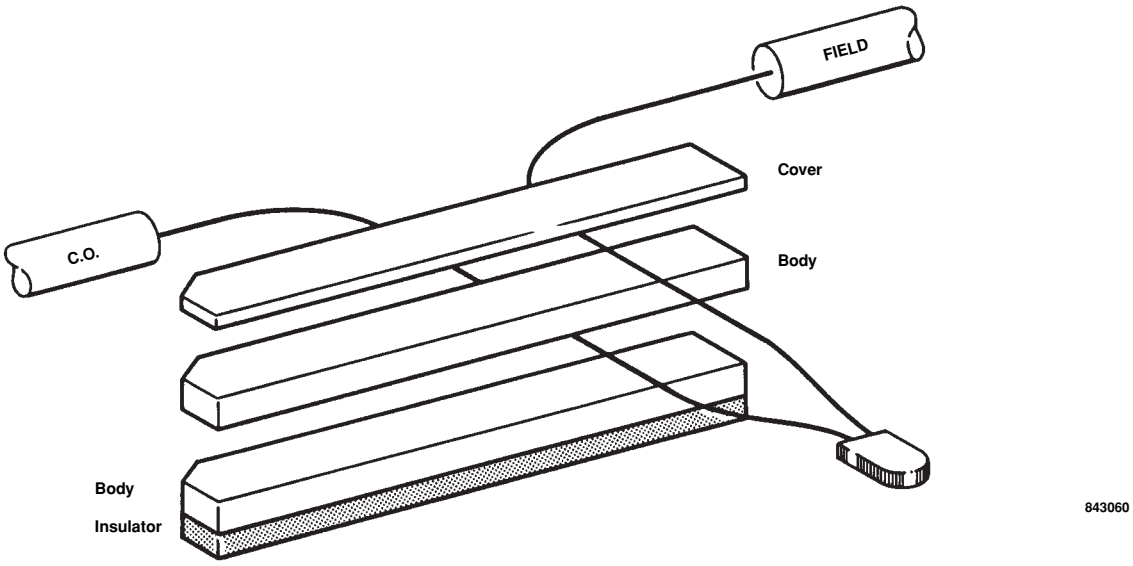
This splice provides a tagged access to a main feeder cable count by the use of a stub. Future distribution additions, transfers and rearrangements can be made without reentering main cable splices.



8.11 Cable Transfer – Conductor Termination

New cable – New conductor groups involved with a transfer must be terminated in Super-Mate Modules according to 3M MS^2 Splicing Procedures and local transfer plan.

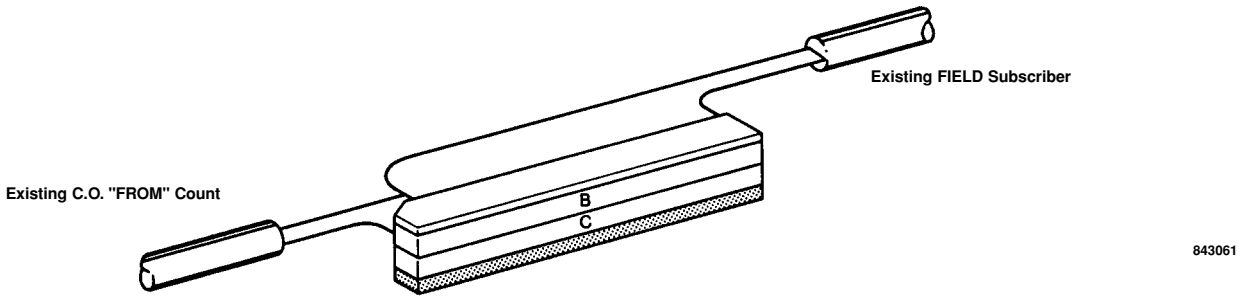
Existing splices – If these existing groups are terminated in anything other than a Super-Mate Module, they must be converted to Super-Mate Modules in numerical sequence or color code order.



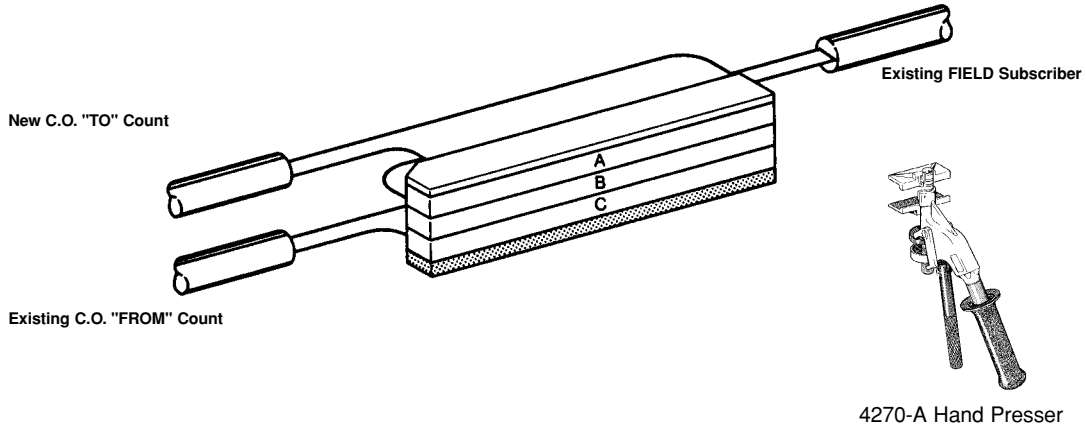
Lay pairs into Super-Mate Modules. Make sure that all existing C.O. and FIELD conductors are placed in corresponding wire channels in each Super-Mate Module.

8.12 Cable Transfer – Using the Module

The subscriber, existing and new C.O. count pairs, should be terminated in Super-Mate Modules.

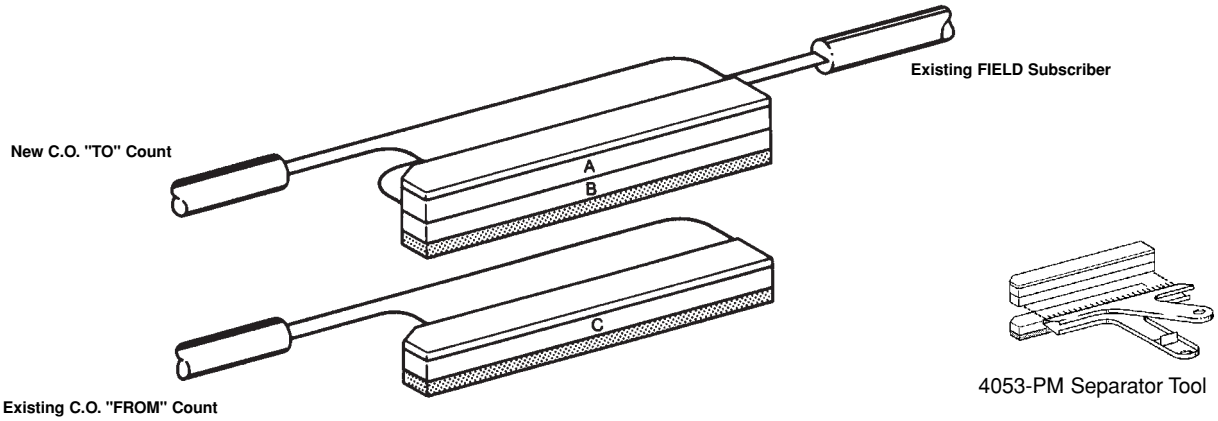


After testing has been completed, identify the proper pair count and crimp the new C.O. count (transfer "TO") module to the subscriber module using a 4270-A Hand Presser.



4270-A Hand Presser

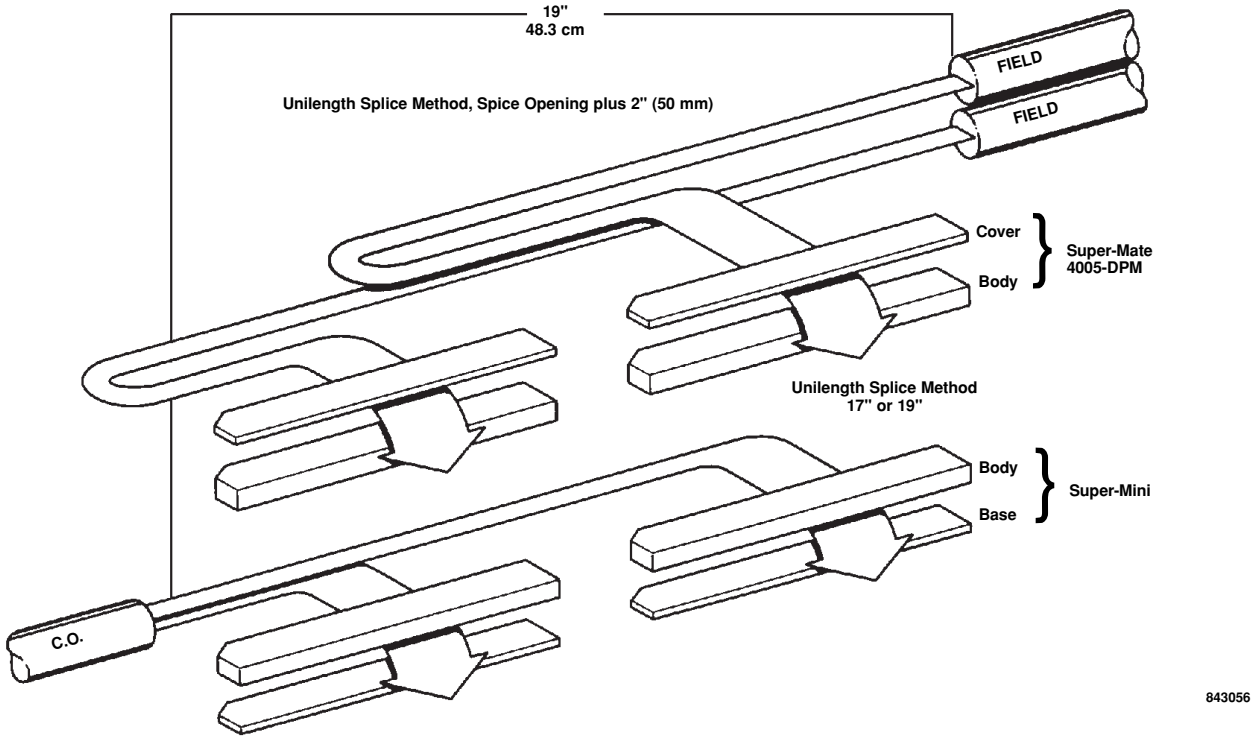
Remove old count (transfer "FROM") module from the subscriber module using a 4053-PM Separator Tool. After transfer is complete, make sure that any exposed elements or conductors are protected with a red insulator or cover.



4053-PM Separator Tool

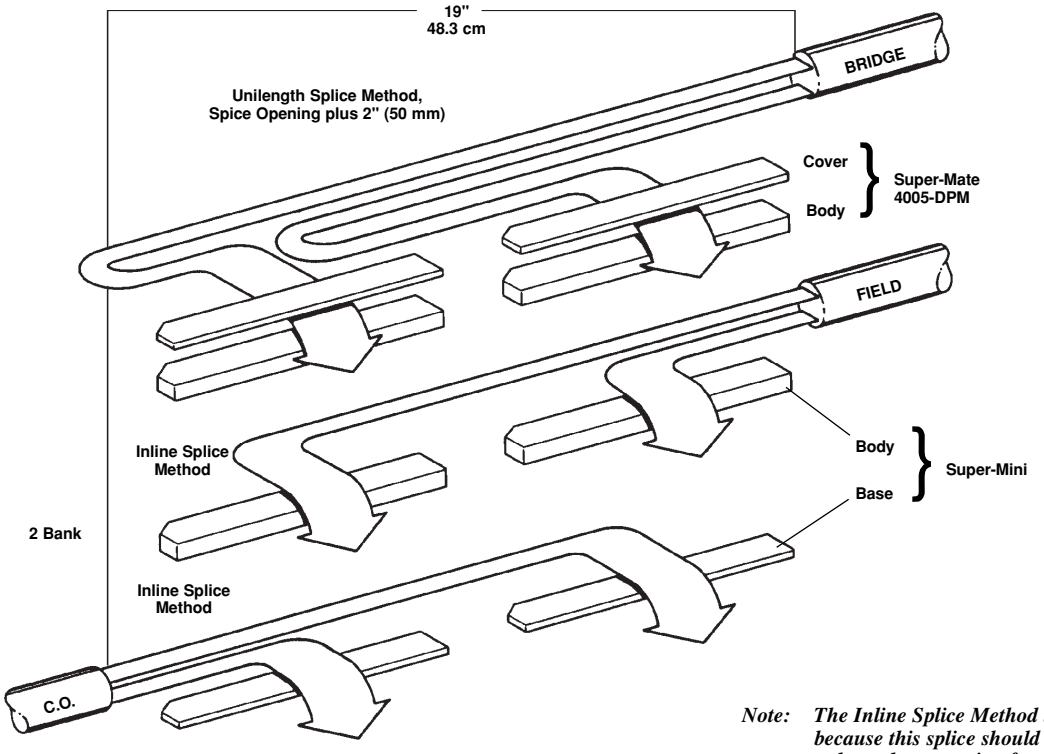
8.13 Taper Feeder Splice / Junction Splice "J"

This splice is used when circuits cannot be multiplied because of bridge tap (excessive conductor) and engineering restrictions.

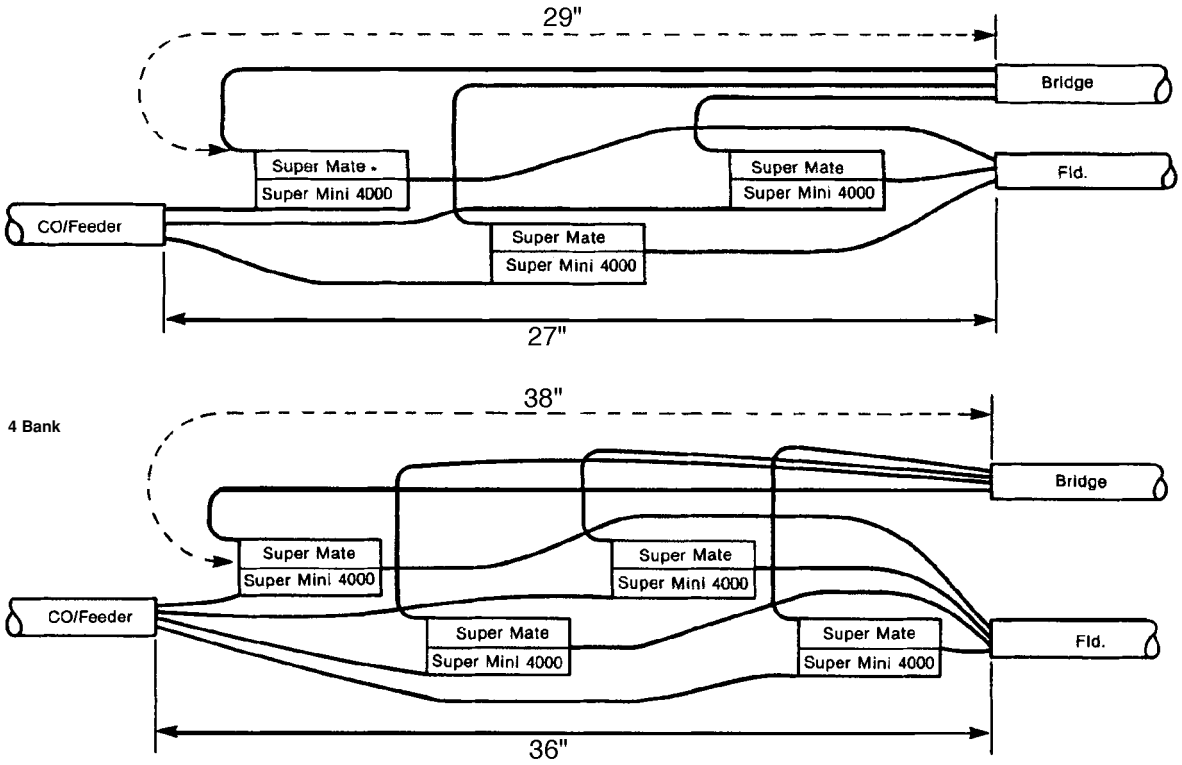


8.14 Bridged Feeder Splice / Multiplied Straight Splice "S"

This splice connects cables that run continuously from the beginning to the end of the main feeder area with the cable count multiplied at specific locations where bridged tap is not a concern.



Note: The Inline Splice Method is recommended because this splice should be treated only as a through connection for the main cable and an access point for multiplied cable.



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Telecom Access Division
3MTelecommunications
6801 River Place Blvd
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