

नाम Name _____	<b>प्राप्त अंक Marks Awarded</b>  <b>अनुदेशक का अध्याक्षर Instructor Initial</b>
अनुक्रमांक Roll No. _____	
पाठ्यक्रम Course _____	
दिनांक Date _____	

### Fusion Splicing

**OBJECTIVE:** After completion of this experiment trainees are able to understand and perform fusion splicing of 24 fibre armored optic fibre cable.

**INTRODUCTION:** Fiber splicing is the process of permanently joining two fibers together. In fusion splicing, two fibers are welded (fused) together by an electric arc. Fusion splicing is the most widely used method of splicing as it provides for the lowest insertion loss and virtually no back reflection. Fusion splicing provides the most reliable joint between two fibers. Fusion splicing is done by an automatic machine called fusion splicer (fusion splicing machines).

#### Tools required for sheath Removal

S.No.	Name of tool	Function
1	Cable cutter	To cut the cable in full
2	Jacket remover	To remove outer jacket
3	Utility knife	To cut narrow jacket circumferentially
4	Scissors	To cut rip cord, Aramid yarn, & Binders
5	Diagonal cutting pliers	To cut central members, fillers etc.
6	Sheath Ripper	To cut the polythene binders
7	Vinyle insulation tape	For proper marking of cable
8	Gel off paper	To clean the jelly
9	Towel cloth	To clean the cable
10	Number Book	For cable and buffer tubes identifications
11	Measuring Tape	For different length measurements
12	Buffer Stripper	To strip the buffer tubes
13	Paint Marker	To mark on cable

#### Tools required for splicing

S.No.	Name of tool	Function
1	Fibre Stripper	To strip the plastic cover coating of fibre
2	Fibre Cleaver	To cut the fibre end perpendicular to the axis
3	Tissue Papers	To clean the fibre after stripping
4	Cleaning liquid	To clean the fibre and splicing machine's lens, V groove etc.
5	Jewellers Screw	To adjust some potentiometer in fusion splicing machine
6	Cotton swab	To clean the fibre and splicing machine's lens, V groove etc.
7	NO-NIK Tool	To remove white colour coating of tight buffer tube
8	Flash Light	To test the pig tails (tight buffer tube)

#### Fusion Splicing Machine

It melts the two ends of fibre optic cables together to form a continuous cable. To do this properly, machines must align the cable, touch the ends together, and send heat or an electric arc through the joint to melt the glass. This process requires a great deal of precision and accuracy.

**Fusion Splicing:** Fusion splicing involves the melting and jointing of optical fibres using heat generated by an electric arc between electrodes. Optical fibre cores observed with a microscope are positioned with the help of image processing so that they are concentrically aligned. Then, an electric arc is applied to the fibre cores. The fusion splicer used has cameras for observation and positioning in two directions.

### **Preparation of cable for jointing**

- (a) During the installation, a minimum of 10 meter of cable at each end is coiled in the jointing pit to provide for jointing to be carried out at convenient location as well as spare length to be available for future use in case of failures.
- (b) The pit size shall be so as to ensure the length of the wall on which joint is mounted is greater than closure length plus twice the minimum bending radius of the cable. A pit length of 1 meter is sufficient for most of the cable and joint closures. Bracket to support cable coil are also fixed on the wall of the pit.
- (c) The cable is then coiled on to the pit wall in the same position as required after the joint is complete. The marking is done on all the loops so that it will be easier to install it later.
- (d) The distance from the last centre to the end of the cable must be at least 1.8 meters. This is the minimum length to be stripped for preparation of joint.
- (e) Sufficient cable length at both ends up to the jointing vehicle/enclosure is then uncoiled from the pit for jointing.

### **Stripping/Cutting of the Cable**

- (a) The cable is stripped of outer and inner sheath with each sheath staggered approximately 10mm from the one above it.
- (b) Proper care must be taken when removing the inner sheath to ensure that the fibres are not scratched or cut with the stripping knife or tool. To prevent this, it is better to score the inner sheath twice on opposite sides of the cable, rather than cutting completely through it. The two scores marking on either side of the cable can be easily stripped of the inner sheath by hand.
- (c) The fibres shall be then removed from cable one by one and each fibre is cleaned individually using kerosene oil to remove the jelly.
- (d) Armouring shall remain outside the gland and will not be connected through.

### **Stripping and Cleaving of Fibre**

- (a) Prior to splicing, primary protective coating of each fibre shall be stripped off up to length of 50 mm. by using fibre stripper. Fibre strippers shall be manufactured to fine tolerances and only score the coating without contacting the glass fibre.
- (b) The bare fibre shall be then wiped with a lint tissue paper rinsed with ethyl alcohol.
- (c) Cleaving of the fibre shall then be performed to obtain as close as possible to a perfect 90 degree face on the fibre.

### **Fusion splicing of fibre:**

Some of the general steps with full automatic micro processor control splicing machines shall be as under:

- a) Hands shall be thoroughly washed prior to commencing this procedure.
- b) The clean bare fibre shall be dipped in the beaker of ethyl alcohol of the ultrasonic cleaver and ultrasonic cleaver switched on for 5-10 seconds.
- c) The bare fibre shall then be placed inside 'V' groove of the splicing machine by opening clamp handle, in such a way so that 1 mm gap is available between the electrodes and the end of fibre being spliced and heat shrink protector inserted.
- d) The start button on the splice controller shall be pressed.
- e) The machine shall pre-fuse set align both in 'X' and 'Y' direction and then finally fuse the fibre.
- f) The splice shall be inspected on monitor provide on the fusion splicing machine, there shall be no nicking, bulging and cores are adequately aligned. The above procedure shall be repeated if the splice is not visually good looking.

- g) The heat shrink protector shall be slid over the splice and tube shall be placed in tube heater. Heating shall be considered complete when soft inner layer is seen to be 'oozing' out of the outer layer of the protector.

### **Organising fibre and finishing joints**

- a) After each fibre has been spliced, the heat shrink protection sleeve shall be slipped over the bare fibre before any handling of fibre takes place as uncoated fibres are very brittle and cannot withstand small radius bends without breaking.
- b) The fibre shall then be organized into its tray by coiling the fibres on east side of the protection sleeve using the full tray side to ensure the maximum radius possible for fibre coils.
- c) The tray then shall be placed in the position.
- d) OTDR reading shall be taken for all splices in this organized state and recorded on the test sheet to confirm that of all fibres attenuation is within specified limits. The OTDR test confirms that fibres were not subjected to excessive stress during the organizing process. Care should be taken that the fibres are not interchanged while jointing.
- e) The joint shall then be closed with necessary sealing etc. and considered ready for placement in the pit.

### **SAFETY PRECAUTIONS**

1. Fusion Splicer is precision instrument .For best results keep the unit clean and handle it with care.
2. Handle glass fibers with care. They can easily puncture skin and break off.
3. Do not use alcohol near heat, flames, nor electric arcs, including the arc in fusion splicer.
4. Use a grounded three pin AC power source to electrically ground the main body of the splicer and protect against accidental electrical shocks.
5. Do not lubricate any part of the splicer. Oil based residues on the V groove, electrodes or fiber checks will limit the effectiveness of the equipment.

### **Review Questions**

Write step by step process of splicing briefly?

**Signature of the trainee**