Drum Handling Brochure
Table of Contents

1 COMPANY PROFILE .................................................................................................................................................. 4

1.1 ABOUT US ............................................................................................................................................................ 4

1.2 QUALITY OF PRODUCTS ....................................................................................................................................... 4

1.3 RELIABILITY .......................................................................................................................................................... 4

1.4 PERFORMANCE ...................................................................................................................................................... 5

1.5 SAFETY .................................................................................................................................................................... 5

1.6 QUALITY MANAGEMENT SYSTEM CERTIFICATION ...................................................................................... 5

1.7 ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATION ................................................................. 6

2 CUSTOMER SERVICE ............................................................................................................................................... 7

2.1 QUALITY ASSURANCE .......................................................................................................................................... 7

2.2 CUSTOMER SATISFACTION .................................................................................................................................. 7

3 GUIDANCE ON HANDLING, STORING & INSTALLING POWER CABLES ............................................................ 8

3.1 HANDLING ............................................................................................................................................................ 8

3.2 STORAGE ............................................................................................................................................................... 8

3.3 INSTALLATION ....................................................................................................................................................... 9

3.3.1 Minimum Temperature during installation ...................................................................................................... 9

3.3.2 Laying ............................................................................................................................................................... 9

3.3.3 Installation Parameters .................................................................................................................................... 10

3.3.4 Final Placing of cable .................................................................................................................................... 11

3.3.5 Backfilling and Reinstatement ........................................................................................................................ 12

3.3.6 Backfilling ....................................................................................................................................................... 12

4 ELECTRIC CABLE DRUM HANDLING .................................................................................................................... 13

5 CABLE HANDLING AND INSTALLATION INSTRUCTIONS .................................................................................. 14

5.1 COMPLIANCE WITH REGULATIONS ................................................................................................................ 14

5.2 INSTALLATION LOCATIONS ................................................................................................................................ 14

5.3 SPECIAL PRECAUTIONS .................................................................................................................................... 14

5.4 MINIMUM INSTALLATION RADIUS .................................................................................................................. 14

5.5 CABLE SUPPORT SPACING ................................................................................................................................ 15
5.6 PACKING AND HANDLING ................................................................. 15

6 REPAIRS TO PVC OVERSHEATHS .......................................................... 16

6.1 SUPERFICIAL DAMAGE ...................................................................... 16

6.2 HOLES OR SLITS IN PVC OVERSHEATHS ........................................... 16

6.3 REMOVAL OF A COMPLETE RING OF OVERSHEATH ....................... 16

6.4 REPAIRS WITH HEAT-SHRINK SLEEVES ......................................... 17

7 ELECTRICAL CHARACTERISTICS OF SINGLE CORE CABLES .......... 18

7.1 SINGLE CORE CABLES IN PARALLEL ................................................ 18

7.2 ARMoured SINGLE CORE CABLES .................................................... 18

7.3 HEATING EFFECT ON SINGLE CORE (AC) CABLE WHEN SURROUNDED BY STEEL .......... 18

8 SPECIAL PRECAUTIONS FOR HANDLING / INSTALLATION LSF (LOW SMOKE & FUME) SHEATHED CABLES ............................................................................................................ 25
1 COMPANY PROFILE

1.1 ABOUT US
Fast Cables Limited is a leading manufacturer of electrical cables in Pakistan. At Fast Cables quality is our first priority combined with superior customer service and affordability. Our emphasis on quality has made Fast Cables one of the most reliable brands in the Cable Industry of Pakistan and the choice of leading electrical consultants, engineers and architects in the country.

Our manufacturing plant in Lahore is equipped with state of the art technology along with an excellent quality assurance system. Another manufacturing facility is being set up in Raiwand to double production capacity. In addition to our current product portfolio, we also manufacture electrical cables and conductors to cater to the specific needs of our valued customers.

This catalogue provides working instructions on Drum Handling & Installation of Cables. Separate catalogues are available for Fast Cables’ product range including Low Voltage Control & Auxiliary Cables; PVC insulated Wiring Cables; XLPE Cables; LSF Wires and Cables; and Medium Voltage Cables.

1.2 QUALITY OF PRODUCTS
The quality of our products has been tested and certified by the following leading laboratories and institutions in the country and abroad:

- KEMA High Voltage Laboratories, Arnhem, The Netherlands
- Pakistan Council of Scientific & Industrial Research (PCSIR)
- Metal Industry Research & Development Center (MIRDC)
- Central Testing Laboratories (CTL)
- National Physical and Standard Laboratories, Islamabad
- University of Engineering & Technology, Lahore
- University of Engineering and Technology, Taxila

Fast Cables has been awarded the ‘Brand of the Year’ gold medal for 2006-2007 by the Prime Minister of Pakistan.

1.3 RELIABILITY
The key to reliability of a product lies in its manufacturing process. The cable must be free from material and manufacturing defects. Fast Cables constantly monitors its manufacturing processes and operates stringent quality assurance procedures to provide long term reliability. This is of vital significance where cables are to be installed in locations where future access would be difficult. The reliability and reputation of Fast Cables’ products is such that customers can be assured of peace of mind following installation of Fast Cables’ products.
1.4 PERFORMANCE
Optimum cable performance can be provided only by a company such as Fast Cables due to its access to the latest developments in conductor, insulation and protective materials technology. Where required, Fast Cables can incorporate special features such as reduced flame propagation characteristics and damage resistance from chafing/impacts. Fast Cables also produces Low Smoke and Fume (LSF) cables.

Our experienced Technical Staff can provide customized guidance on cable selection and installation in order to ensure that our valued customer gets the right cable for the job.

1.5 SAFETY
Fast Cables maintains a close watch on world developments in cable technology and regulations in order to ensure that its products are designed and constructed to be hazard-free under the prescribed conditions of use. Fast Cables ensures that the strictest standards are adhered to throughout its operations.

Fast Cables uses only tried and tested materials and processes in full compliance with all relevant British and International Standards. Our cables are manufactured for safe use without risk to health on the understanding that users will exercise the same degree of care in their selection and application.

1.6 QUALITY MANAGEMENT SYSTEM CERTIFICATION
Fast Cables’ Quality Management System conforms to the ISO 9001:2008 International Quality System Standard and is certified by the British Standards Institution which is an internationally recognized quality authority accredited in the UK and throughout the world. Fast Cables also holds ISO 9001:2008 certificate.

Certification to the ISO 9001:2008 International standard demonstrates that Fast Cables has drawn up written procedures to ensure full compliance with all requirements of the standard and that these procedures are followed by every department in the company, thus ensuring that the goods leaving Fast Cables’ factory are of the highest quality and meet each customer’s requirements in every respect.

Fast Cables is particularly proud to have achieved certification to the stringent ISO 9001:2008 standard as it is an independent confirmation that Fast Cables designs, manufactures and tests cables consistently to accepted standards.

ISO 9001:2008 is widely used throughout Europe, and is therefore a reassurance to Fast Cables’ customers that the products and service supplied by the company are equal to the best in the world.
1.7 ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATION

Fast Cables’ Environmental Management System conforms to the ISO 14001 International Environmental Management Standard. Certification to the ISO 14001 International standard shows that Fast Cables has a well-defined structure and established working practices aimed at limiting its impact on the environment. Measurement and monitoring of effects, issuing work instructions, training of personnel and taking corrective actions are all essential elements to limiting the impact on the environment. Fast Cables has set improvement targets to reduce any potential environmental impacts associated with its activities.

Fast Cables is proud of its ISO 14001 certification as this certification along with its quality, business success and safety record demonstrates that Fast Cables is a world class organization at par with the global business community.
2 CUSTOMER SERVICE

2.1 QUALITY ASSURANCE
With a pool of highly dedicated and experienced technical staff, Fast Cables is fully equipped to assist customers in overcoming any application problems. It is our priority to ensure that the cables we provide are equipped to carry the exact current at the specified voltage in the prevailing conditions. We also incorporate all preventive features in our cables to resist damage from threats such as vibration, chafing, flexing, impact or pressure. Our cables are also designed to resist oil, solvents or corrosive chemicals.

2.2 CUSTOMER SATISFACTION
For more than two decades, Fast Cables has surpassed the expectations of customers in satisfying their needs in the field of electrical cables and conductors. It is due to this commitment to customer services that we have become the market leader in light cables, power cables and special performance cable technology for all aspects of industrial activities including both public utilities and defense sector.
3 GUIDANCE ON HANDLING, STORING & INSTALLING POWER CABLES

3.1 HANDLING
Damage to cables can occur due to incorrect handling of drums and cables leading to the breakdown of the drum flanges. In exceptional cases, movement of the drum barrel may also take place. Once this breakdown of the drum occurs, the cable is immediately exposed to damage.

For guidance on handling, please refer to the sketches and notes contained in this booklet, which should be followed closely. We have no objection to the use of fork-lift trucks provided that care is exercised not to damage, or remove, the protective battens when pushing the forks under the drum flanges. Unloading can also be safely accomplished by means of ramps and winches (see Figures 1 & 2).

Under no circumstances should a drum be rolled off a vehicle on to a ‘cushion of’ sand, tarpaulin, etc. This action could crumple the flanges and barrel of the drum, driving splinters and/or nails into the cable (see Figure 5).

3.2 STORAGE
If at any time the drums of cables are required to be stored for reasonably long periods, e.g. prior to shipment or installation, the following points should be noted.

1) The site for storage of drums should be well drained, hard packed soil, or preferably a concrete surface, which will not allow the drums to sink and so give rise to damage due to the extreme difficulty in moving drums when they are sunk into the ground.
2) All drums should be stored with the battens intact, and in such a manner as to leave sufficient space between them for air circulation. Check and tighten tie bolts on the drums at regular intervals.
3) Tier stacking of drums is not recommended. Under no circumstances must the drums be stored ‘on the flat’ i.e., with flanges horizontal (see Figure 3).
4) All drums, during installation (i.e. when the battens have been removed), should be ‘scotched’ so that there is no danger of the flanges of drums coming into accidental contact with unprotected cable on other drums. The cables should not be left unprotected. (See Figure 3).
5) Cables should be protected from direct rays of the sun by leaving the battens on or covering the cables with thick black polythene sheet.

IMPORTANT: Cable ends must be sealed with end caps during storage and transportation.
3.3 INSTALLATION

3.3.1 Minimum Temperature during installation

To avoid risk of damage during handling, the cable should be installed only when both the cable and ambient temperature are above 0°C and precautions have been taken to maintain the cable above this temperature. However, cables are suitable for operating at temperature below 0°C and the specified maximum limit, provided that they are not bent or struck when at temperatures below 0°C.

3.3.2 Laying

Normally cables are supplied on wooden or steel drums and great care should be taken during running off to ensure that the cable does not kink. The drum position should be chosen so that the longest length of straight trench is at the pulling end, with any severe bends as close as possible to the drum. It is important that the rolling of the drum to this position should be in accordance with the arrow on the flange – to prevent loose turns from developing during unwinding. The distance of rolling should be kept to a minimum.

Drums should be mounted so that the cable is pulled from the top of the drum, and for very heavy cable, it may be necessary to use a ramp to support the cable during the passage into the trench.

The excavated trench should be carefully examined to ensure that there are no sharp edged stones, foundations, reinforcing metalwork, etc. which could damage the cable, and riddled earth or sand should be used as a bedding.

Preparation of the trench, prior to installing the cable, comprises the installation of skid plates, rollers, etc. and paying out the winch rope, if using power assistance. Cable rollers are necessary to prevent the cable from touching the ground, and should be spaced a maximum of 2m apart for normal size cables. Correct positioning of rollers is important to keep friction to a minimum.

The cable should preferably be drawn to its final position in a continuous manner. During stops, the cable will settle between rollers and may cause high strain on men and machines during restarting. Whether the pulling is manual or with a winch, it is necessary for one man to be stationed at the drum with a plank of wood wedged against the flange of the drum so that over-running of the drum is prevented if the pulling stops. Otherwise, many loose turns can easily develop on the drum.

When pulling by a winch it is advantageous for the cable end to be taken by hand as far as possible before attaching the winch rope. This allows the leading cable rollers, skid plates, etc. to take the load and settle under well-controlled conditions. The winch operator must, at all times, carefully observe the dynamometer to prevent overloading. On long pulls, good communication is essential, preferably by radio.
When pulling a power winch, more attention has to be given to the maximum permissible pulling load which is permissible. For such installations a pulling eye attached to the conductors is necessary, and for copper conductors a pulling tension of 6 kg force per sq.mm of total conductor area can be applied (with the proviso of 2000 kg force maximum). Graphite paste should be used for lubrication when cables are being pulled into ducts.

For open trench and straight installations, a cable ‘stocking’ can be used. It is advisable, however, to protect the oversheath with a layer of bitumen tape applied with 50% overlap. Cables should never be bent to a small radius. As large a radius as space permits should be adopted. Under no circumstances should the bending radius be less than the minimum permissible limits. It is particularly important to have a generous bending radius when cables are to be pulled by a power winch, so as to keep within the maximum permissible pulling tension and to prevent the cable being flattened around bends or in ducts.

3.3.3 Installation Parameters

A. Minimum Bending Radius for LV Cables

<table>
<thead>
<tr>
<th>Type of Cable</th>
<th>Minimum internal radius of bend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Core Unarmoured Cables</td>
<td>6D</td>
</tr>
<tr>
<td>Single core Armoured Cables</td>
<td>6D</td>
</tr>
<tr>
<td>Multicore Armoured Cables with Sector shaped Conductor</td>
<td>8D</td>
</tr>
<tr>
<td>Multicore Unarmoured Cables with Sector Shaped Conductor</td>
<td>8D</td>
</tr>
<tr>
<td>Multicore Armoured Cables with Circular Conductor</td>
<td>6D</td>
</tr>
<tr>
<td>Multicore Unarmoured Cables with Circular Conductor</td>
<td>6D</td>
</tr>
<tr>
<td>Lead Sheathed Cables</td>
<td>12D</td>
</tr>
</tbody>
</table>

D is the tabulated overall diameter of cable

B. Minimum Bending Radius for MV Cables

<table>
<thead>
<tr>
<th>Type of Cable</th>
<th>Installation and Bending Test (without former)</th>
<th>Joints and Terminations (with Former)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Core Unarmoured</td>
<td>6 D</td>
<td>15 D</td>
</tr>
<tr>
<td>Single core Armoured</td>
<td>6 D</td>
<td>12 D</td>
</tr>
</tbody>
</table>
Three Core Armoured 8 D 12 D
Three Core Unarmoured 8 D 10 D

For Lead Sheathed Cables, instead of D, consider (d + D) where
d = Conductor Diameter, and D = Overall Diameter

C. Internal diameter of Duct

<table>
<thead>
<tr>
<th>Cable Diameter (mm)</th>
<th>Internal Diameter of Duct (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 65</td>
<td>100</td>
</tr>
<tr>
<td>65 – 90</td>
<td>125</td>
</tr>
<tr>
<td>90 – 150</td>
<td>200</td>
</tr>
</tbody>
</table>

D. Maximum pulling tension

For Copper Conductor Cables = 6 kgf x number of cores x conductor cross-section = 60 N x number of cores x conductor cross-section

For Aluminium Conductor Cables = 3 kgf x number of cores x conductor cross-section = 30 N x number of cores x conductor cross-section

(Subject to a maximum of 2000kgf or 20,000 N)

E. Side Wall Pressure

\[
= \frac{\text{Maximum Pulling Tension (kgf) x 100}}{\text{Minimum Bending Radius (mm)}}
\]

(Subject to a maximum of 500kgf or 5,000 N/m)

3.3.4 Final Placing of cable

Before disconnecting the pulling rope, the cable is laid off, i.e. starting at one end, it is carefully lifted from the rollers and deposited on the bottom of the trench. About 10m of cable should be lifted at one time, any slack being carried forward. The end position of a cable run may require
double handling because it is not possible to draw cables straight into buildings. In this case the cable is overpulled, then man-handled into the required position. At all times the loops should be kept as large as possible so that the bending radius is always above the minimum permitted.

Similarly, at the drum locations the necessary length of cable may be unwound from the drum and laid out, in a figure of ‘8’ if space is limited, prior to cutting to length and placing into position. Immediately after cutting, the cable ends must be suitably sealed to prevent ingress of moisture. In this respect it is also important to carefully examine the pulling end seal to ensure that it has not been damaged during laying (see Figures 14 & 15).

3.3.5 Backfilling and Reinstatement

Prior to backfilling, it is necessary to carry out a visual inspection, and items which need to be checked are:

1) The cables have suitable bedding, such as sieved sand or soil. Stone chips and other sharp objects in the cable route should be removed.

2) The spacing is correct if there is more than one cable in the trench.

3) Pulling equipment is carefully removed.

4) The cable is free from obvious damage caused during installation. A very high proportion of cable failures in service are due to such damage. It may be necessary to inspect the underside with a mirror. In such cases it is advisable to make a first inspection whilst the cable is still on rollers.

5) It is very important that any damage to the oversheath should be repaired before backfilling is commenced. Strict attention to detail is necessary in making such repairs and only the approved materials specified should be used. Depending upon circumstances, heat shrinkable sleeves, may be used.

3.3.6 Backfilling

The cable should firstly be surrounded and covered with appropriate bedding material, using sand or riddled soil as necessary, to give a compacted cover over the cable. As required, cover tiles or plastic marking tape may then be placed centrally over the cable. The first layer of backfill should be done manually and compacted by hand panning until a thickness of approximately 150mm over the tile is reached. Subsequent material may be placed and compacted with mechanical equipment.
4 ELECTRIC CABLE DRUM HANDLING

A. ROLLING DRUMS

Drums of cable must always be rolled in the direction shown by the arrow painted on the flanges, but such rolling should in any case be kept to a minimum.

B. TURNING DRUMS

The best way to turn a cable drum is to roll it on to two well-greased thin plates or boards about 2 feet square. The plates can then be used as a turntable and the drum rotated to the desired direction. The practice of using an iron bar under the bolt head is regarded as extremely dangerous to the operator and is detrimental to the drum.

C. LOWERING OR LIFTING DRUMS

When drums are moved from one level to another, e.g. lorry to ground, wharf to ship, etc., lifting and lowering gear must always be used. When drums are lifted from the upper layer of a tiered stack, care must be taken to ensure that no movement of the bottom layer occurs so as to cause collapse. Drums, whether loaded or empty, and too heavy to be man-handled, should always be slung; they should never be dropped. (See Figures 1 & 2)

When lifting drums of cable for loading or unloading, spindles must always be used in conjunction with crane slings, chain “brothers” or lifting beams. On no account must any drum be lifted by other means, i.e., by using claw-grabs, wire slings, etc. (See Figure 1)

When lifting drums of cable weighing more than 2 tons, lifting beams or stretchers between the sling or chain brothers must be used to prevent the flanges crushing on to the cable as illustrated. (See Figure 1).

Note: Normally the hooks or slings should be close to the drum flanges.
5 CABLE HANDLING AND INSTALLATION INSTRUCTIONS

5.1 COMPLIANCE WITH REGULATIONS

The use of cables must comply with Environment and Safety regulations of the country where it is being used. Necessary guidance may be obtained from the IEE Wiring Regulations of the UK.

5.2 INSTALLATION LOCATIONS

The cables can be used indoors or outdoors, but certain reservations are necessary concerning cables for direct burial in the ground. For example, it is not recommended that the cables be installed in sustained wet conditions or other aggressive environments. Unprotected open cable ends should not be exposed to moisture prior to final termination or jointing.

The cables shall not be subjected to the deleterious effects of chemical substances on installation or subsequently, for example, the cables should not be installed where there is a risk of sustained contamination due to hydrocarbon or chemical spillage.

Where cables are installed in environments in which ultraviolet radiation may occur, account should be taken of any effect this may have on the material of the cable sheath. It is recommended that the cables be shielded from direct sunlight.

5.3 SPECIAL PRECAUTIONS

For overall cable sheaths containing an anti-terminate masterbatch, the following health warnings are relevant:

Health Warning
Safety precautions must be strictly adhered to when handling cables treated with insect repellent additives. Appropriate warning labels should be attached to the cables which state:

‘The serving or oversheath of this cable contains insect repellent. Wear gloves when handling and wash hands thereafter before eating, drinking or smoking.’

‘Gloves must be worn when handling this cable.’

5.4 MINIMUM INSTALLATION RADIUS

None of the cables should be bent during installation with a minimum internal radius of bend less than that recommended for the cable type by the manufacturer.
5.5 CABLE SUPPORT SPACING

Refer to cable product catalogues regarding recommended spacing for cable supports.

5.6 PACKING AND HANDLING

It will be obvious that in certain circumstances the packaging of cables, e.g., large heavy drums or sharp edges of metal components of cables could constitute a safety hazard and individuals should therefore take due care for their own safety when handling these items. The springing of the steel binding straps or the dangers arising from projecting nails used to retain battens around the drums or containers are particular examples to which we draw your attention.
6 REPAIRS TO PVC OVERSHEATHS

During cable drum unpacking, rewinding or laying, damage to the oversheath may accidentally occur. If the cable underneath appears to be in good condition, repair to localised damage at site may be carried out as suggested in the following alternative methods. The objective is that there is no possibility of moisture ingress through damage to the armour or other parts of the cable when it is in its final installed position.

It is very important that any damage to the oversheath observed after installation should be repaired before backfilling is commenced. Strict attention to detail is necessary in making such repairs and only the approved materials specified should be used. Only a brief outline for PVC sheath repair is given below and in case of doubt, the cable manufacturer’s advice should be sought. Some of the methods quoted are only suitable for use after installation has been completed, when the cable will not be subjected to significant movement in service.

6.1 SUPERFICIAL DAMAGE

The local area of damage is rubbed down with carborundum strip to the depth of the damage and chamfers of 25mm length are formed at the edges. After cleaning with a suitable solvent*, PVC self-ahesive tape of 25mm width is applied under tension with 50% overlap. The taping is continued up the chamfer until the top is reached. Then another four layers are applied over a length extending 75mm beyond the chamfer.

6.2 HOLES OR SLITS IN PVC OVERSHEATHS

The edges of the hole or slit are chamfered for a distance of 30mm and the area around this is abraded over a length of 20mm. The area is then cleaned with a suitable solvent* and, if bitumen is present under the oversheath, care must be taken to remove it from the prepared surface. A patch is then applied to fill the area using an approved grade of special putty e.g., BICASEAL. This is followed by an overlapped layer of 50mm wide PIB self-amalgamating tape extending 50mm from the patch and three overlapped layers of PVC self-adhesive tape extending 100mm from the edge of the PIB tape. In the case of slits, further strengthening by the addition of an epoxy resin bandage should be made if the cable is likely to be moved.

6.3 REMOVAL OF A COMPLETE RING OF OVERSHEATH

After removal of the damaged ring a chamfer is formed. The surface is then thoroughly cleaned with solvent, taking care to remove the graphite layer, if present. Four overlapped layers of 50mm wide PIB self-amalgamating tape are then applied at high tension over a length extending
to 50mm beyond the original cut. PVC self-adhesive tape is then applied at one-third overlap to build up to a level corresponding to the original oversheath diameter; the length should be up to the end of the chamfer.

Five layers of PVC self-adhesive tape are then applied, each one extending 5mm further along the cable. The repair is completed with a resin poultice reinforcement consisting of six layers of ribbon gauze or bandage impregnated and painted with an approved grade of freshly mixed epoxy resin. This requires about 12 hours to cure.

6.4 REPAIRS WITH HEAT-SHRINK SLEEVES

Heat Shrink sleeves can be conveniently used to repair the damaged oversheath of cables. Where possible, a full unshrunk sleeve is slipped along the cable up to the point of sheath damage but if the cable ends are inaccessible, a zipped sleeve is used. Depending upon the nature of damage the location is prepared and cleaned as above and a special putty is applied to cover the opening of the sheath. The heat-shrinkable sleeve is then centrally placed over the point of damage and uniformly heated all round with a gas flame or hot air as recommended by the sleeve supplier. It is important to apply heat evenly and adequately to ensure a water-tight grip.
7 ELECTRICAL CHARACTERISTICS OF SINGLE CORE CABLES

7.1 SINGLE CORE CABLES IN PARALLEL

![Diagram showing correct and incorrect methods of single core cables in parallel](image)

Note: Precise load sharing is difficult with three conductors per phase. The configuration shown represents the most practical compromise.

7.2 ARMOURED SINGLE CORE CABLES

a. If bonded at both ends, the armour carries a circulating current.

b. An insulated adapter used with the cable gland negates the armour circulating current.

c. If not bonded at both ends, the unearthed end of the armours has an induced voltage.

d. In AC systems, single core cables must have non-ferrous armour.

7.3 HEATING EFFECT ON SINGLE CORE (AC) CABLE WHEN SURROUNDED BY STEEL

![Diagram showing magnetic field and heat generation](image)

Magnetic field = Heat generation due to magnetic hysteresis

a. Use - non-ferrous material
   e.g., aluminium or other permissible non-metallic sheet

b. Do not pass single core cable through steel conduit
LIFTING CABLE DRUMS USING CRANE

**Fig. 1**

LIFT DRUMS ON FORK TRUCKS CORRECTLY

**Fig. 2**

I) DO NOT LAY DRUMS FLAT ON THEIR SIDES
II) USE PROPER STOPS TO PREVENT DRUMS ROLLING

**Fig. 3**
AVOID DRIVING NAILS INTO CABLE DRUMS

DO NOT DROP CABLE DRUMS FROM TRUCKS

SECURE DRUMS ADEQUATELY BEFORE TRANSPORTATION
DO NOT DRAG CABLES AGAINST DRUM FLANGES

I) ALIGN DRUMS BEFORE CABLE REWINDING
II) USE STOPPERS TO PREVENT DRUM LATERAL MOVEMENT
III) USE FREE ROTATING ROLLER GUIDES

USE DRUMS WITH SUFFICIENT BARREL DIAMETER
DO NOT PULL CABLE ACROSS LONG UNSUPPORTED SPANS

Fig. 10

DO NOT DRAG CABLE AGAINST SHARP EDGES

Fig. 11

PROVIDE FREELY ROTATING ROLLER SUPPORTS

Fig. 12
PROVIDE FREELY ROTATING ROLLER SUPPORTS

Fig. 13

DO NOT ATTEMPT “COILING” OF CABLE ON THE GROUND

Fig. 14
ON THE GROUND CABLE CAN BE FLAKED IN A FIGURE OF EIGHT FORMATION

Fig. 15

Note: $R$ is Minimum permissible bending radius of cable.
8 SPECIAL PRECAUTIONS FOR HANDLING / INSTALLATION LSF (LOW SMOKE & FUME) SHEATHED CABLES

CABLE SHEATH APPLICATION

<table>
<thead>
<tr>
<th>Material</th>
<th>Key Properties</th>
<th>Recommended for</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>High mechanical strength</td>
<td>Direct burial / Duct installations</td>
</tr>
<tr>
<td>PVC</td>
<td>Flexibility &amp; Flame retardance</td>
<td>General purpose; laying in trench</td>
</tr>
<tr>
<td>LSF</td>
<td>Zero halogen / Low Smoke</td>
<td>Mass Transit Systems; high rise buildings &amp; confined locations.</td>
</tr>
</tbody>
</table>

Cables like LSF sheath need to be handled with care during installation. While special additives are used in the formulation of LSF compound to give the typical flame retardant characteristics of Zero halogen polymers (e.g. high oxygen index, very low smoke density, no acid gas liberation and retardance to flame propagation) some mechanical properties deteriorate. The following basic installation methods are particularly applicable.

a) Cables should not be exposed to sunlight for considerable period before installation i.e., the temperature of the cable sheath should be below 40 degree Celsius.

b) Preferably the installation is done during morning hours when the ambient temp is low.

c) Wire/Rope should not be used directly on cable sheath for pulling.

d) When pulled on cable trays/or any uneven surface, special attention is needed to weldings/or unusually rough terrains.

e) Rollers and bends should not have any sharpness which may damage sheath.

f) Special LSF compatible accessories and fixings are recommended for installations requiring enhanced fire performance.