Engineering Standard

SAES-T-928 1 October 2020

Telecommunications Outside Plant (OSP) Buried Cable

Document Responsibility: Communications Standards Committee

Contents

Summary of Changes

Paragraph Number		Change Type (Addition, Modification, Deletion)	Technical Change(s)
Previous Revision (7 May 2019)	Current Revision (1 October 2020)		
Scope	Scope	Modification	- Define acronyms of OSP to outside palnt - [delete] In the events of conflicting requirements. - Update reference standard, TIA-758 to version B
3.1	3.1	Modification	- [deleted] Non-active standard: SAES-T-634 - [Replaced] AE 036412 with DE-950235 (Library Drawing) & TIA-758 A with TIA-758-B (latest revision) - [updatet] NEMA TC 6 & 8 to 2020 version - [add] 01-SAMSS-051 & SAES-B-062
3.2	3.2	Modification	Random Separation definition, alignment with Table 2
5.1	5.1	Addition	Sub-section was added (5.1.1, 5.1.2, 5.1.3)
5.2	5.2	Modification	[add] …a valid certified the RCDD during the detailed design phase before the package can be issued for Construction (IFC).
5.3	5.3	Modification	Referencing the section to SAES-T-632 standard
5.5	5.5	Modification	The word “that were” was added, as follows: …Any subsurface utilities or structures *that were* not identified during the engineering/design stage, but identified during the excavation.
5.5.3	5.5.3	Modification	The the words “chemical or other industrial” was added to aligned with SAES-068 standard.
None	5.5.4	Addition	A new sub-section was added which address the design consideration of cable types utilization.
6.1	6.1	Modification	Rephrase the section to align with SAES-L-450 standard
6.1.1	6.1.1	Modification	Replaced the SAES-M-100 standard with SAES-L-450 standard as a reference.
6.1.2 (b)	6.1.2 (b)	Modification	Alignment with SA standard drawing (AA-036748).
6.1.3	6.1.3	Modification	Detectable marker tape is required.
6.1.4	6.1.4	Modification	The requirement of 152 m (BICSI standard) is mandated in lieu to the standard drawing AB-036897.
6.1.4 (2)	6.1.4 (2)	Modification	Replaced SA standard drawing with a Library drawing AE-036412
6.1.5	6.1.5	Modification	- Update reference standard to 2020 version - Rereference to SAES-T-911 standard (Commentary Notes) - Bullet (C) was added (Commebntary Notes)
6.1.6	6.1.6	Modification	Concrete encase is mandatory requirement on the identified locations
6.2.5	6.2.5	Modification	Clearly defined the used of HDPE pipes types and its specification in alignment with 01-SAMSS-051
6.3.2 Table 2	6.3.2 Table 2	Addition	[add] - Requirements of buried communication cable parallel with Pipeline using Thrust bore method, refer to section 6.7 - Requirements of buried communication cable crossing with Pipeline. [add] - Requirements of buried communication cable parallel with Roads (paved, unpaved, asphalt). - Requirements of buried communication cable crossing with Roads (paved, unpaved, asphalt). [add] - Requirements of buried communication cable parallel with Existing FO cable (separate trench at the pipeline corridors)

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			- Requirements of buried communication cable crossing with Existing FO cable (separate trench at the pipeline corridors) [add] - Requirements of buried communication cable parallel at Camel roads. - Requirements of buried communication cable crossing at Camel roads. - Requirements of buried communication cable when crossing and paralleling with waterways or water canals.
6.4	6.4	Modification	Reference to section 6.3.2 of Table 2 for the requirements to comply
6.5	6.5	Modification	- [clarification] Referencing the section to Saudi Aramco Standard Drawing AA-036748 instead of SAES-B-100. - [add] Commentary note to aligned with SAES-O standards.
6.6. (a) & (b)	6.6. (a) & (b)	Modification	(a) No mechanical protection is required (concrete encasement). (b) Concrete encasment is mandatory
6.6. (c)	6.6 (c)	Addition	(c) Define the requirements for Insdustrial Security application
6.7.1 (c)	6.7.1 (c)	Modification	(c) Detectable marker is mandatory and alignment to SASD-03678
None	6.7.3 (c)	Addition	Added a sub-section
6.7.6 (c) & (d)	6.7.6 (c) & (d)	Modification	(c) Detectable marker is mandatory (d) Cover requirement, alignement with SAES-L-450 standard
6.7.7 (d)	6.7.7 (c)	Modification	Change to bullet C from bullet D
None	6.7.7 (d) & (e) & Figure 1	Addition	(d) Special installation requirement (separation) of FO cable within the piplien corridor. (e) Special installation requirement (separation) of FO cable crossing highways utilizing Thrust bore method. (Figure 1) FOC installation drawing inside the Pipeline Casing
None	6.7.8 Commentary Bullet 2 & 3	Addition	Clearly defined the requirement for used of a permanent direct buried splice closure for FO cable, applicable only if the fiber cable is in a separate trench with pipeline.
6.7.9	6.7.9	Modification	Modified paragraph for better understanding of the protection methods
None	6.7.10	Addition	Isntallation requirements of FO Cables at Camel Crossing
6.9.3	None	Deletion	Standard requirement was move to SAES-T-795 standard which address grounding and bonding.
6.9.4	None	Deletion	Standard requirement was moved to SAES-T-795 standard, which address grounding and bonding.
7	7	Modification	Replaced the non-active standard (SAES-T-6290 with SAES-T-928
8	8	Modification	Replaced the non-active standard (SAES-T-634) with SAES-T-624 for Fiber and SAES-T-928 for copper.
8.2	8.2	Addition	New sub-section to address inspection requirements
None	9.2	Addition	New sub-section to address the as-built drawings deliverables
9	9-	Mofification	Alignment to GI-2.710 (Mechanical Completion and performance Acceptance of Facilities).

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1 Scope

This standard is in conjunction with the international standards listed below define the mandatory requirements governing the engineering design, construction, and installation of telecommunications outside plant (OSP) buried cables. Additional requirements and/or exceptions to the below documents are outlined in this standard.

(1) TIA-758-B: Customer-Owned Outside Plant (OSP) Telecommunications Infrastructure Standard

(2) BICSI Outside Plant (OSP) Design Reference Manual (OSPDRM)

(3) BICSI Telecommunications Distribution Method Manual (TDMM)

2 Conflicts and Deviations

Any conflict between this document and other applicable Mandatory Saudi Aramco Engineering Requirements (MSAERs) shall be addressed in writing to the EK&RD Coordinator. Any deviation from the requirements herein shall follow internal company procedure SAEP-302.

3 References

All referenced specifications, standards and codes, forms, drawings and similar material shall be of the latest issue (including all revisions, addenda and supplements) unless stated otherwise. Listed below are applicable standards.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

SAEP-302	*Waiver of a Mandatory Saudi Aramco Engineering Requirement*

Saudi Aramco Construction Safety Manual

SMG-06-002-2008	*Saudi Aramco Construction Safety Manual*

Saudi Aramco Engineering Standards

SAES-A-114	*Excavation and Backfill*
SAES-A-115	*Groundwater Monitoring Well Design, Installation, and Decommissioning*
SAES-B-008	*Restrictions to Use of Cellars, Pits, and Trenches*
SAES-B-062	*Onshore Wellsite Safety*
SAES-B-064	*Onshore and Nearshore Pipeline Safety*

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SAES-B-068	*Electrical Area Classification*
SAES-L-450	*Construction of On-land and Near-shore Pipelines*
SAES-L-460	*Pipeline Crossings under Roads and Railroads*
SAES-M-100	*Saudi Aramco Building Code*
SAES-Q-006	*Asphalt and Sulfur Extended Asphalt Concrete Paving*
SAES-T-018	*Telecommunications - Symbols, Abbreviations, and Definitions*
SAES-T-624	*Telecommunications: Fiber Optic Cables for Outside Plant (OSP) and Inter/Intra Building Applications*
SAES-T-629	*Communications – Outside Plant Copper Cable*
SAES-T-632	*Telecommunications: Splicing Copper Cables, Fiber Optics Cables, and Types of Splice Closure*
SAES-T-795	*Grounding, Bonding, and Electrical Protection for Telecommunications Facilities*
SAES-T-911	*Telecommunication Conduit System Design*
SAES-T-920	*Telecommunications Copper Cable Information*

Saudi Aramco Material Specification

01-SAMSS-051	*High Density Polyethylene (HDPE) Pipe and Fittings*
18-SAMSS-625	*Outside Plant - Fiber Optic Cable Specifications (Single-mode and Multi-mode)*

Saudi Aramco Standards Drawings

AA-036748	*Buried Telephone Cables/Distribution Wires - Installation Details*
AB-036897	*Buried/Underground Cable Route Marker Post and Signs*
AA-036373	*Polyvinyl Chloride (PVC) Plastic Direct Buried/Encased Conduit in Concrete*
DE-950235	*Library drawing: Guard Post and Guard Rail Details*

Saudi Aramco General Instructions

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GI-0002.100	*Work Permit System*
GI-0002.710	*Mechanical Completion and performance Acceptance of Facilities.*
GI-0002.716	*Land Use Permit Procedure*
GI-0887.000	*Coordination of Saudi Aramco Projects with Non-Saudi Aramco Agencies*
GI-1021.000	*Street and Road Closure: Excavations, Reinstatement, and Traffic Controls*

3.2 Industry Codes and Standards

American National Standards Institute

ANSI C2	*National Electrical Safety Code (NESC)*

National Fire Protection Association

NFPA 70	*National Electrical Code (NEC)*

National Electrical Manufacturers Association

NEMA TC 6 & 8-2020	*Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations*

Building Industry Consulting Service International (BICSI Standards)

OSP DRM	*Outside Plant Design Reference Manual – 6th edition*
TDMM	*Telecommunications Distribution Method Manual – 14th edition*

Telecommunications Industry Association

TIA-758-B	*Customer-Owned Outside Plant (OSP) Telecommunications Infrastructure Standard – 2012 edition*

4 Definitions

Directional Drilling Method: Installing conduits for telecommunication systems by using surface operated drilling device. The device is angled into the ground from the surface and directed to its destination by remote control. The directional drilling method is using the HDPE (High Density Poly-Ethylene) pipes and allows for steering around existing obstacles (utilities in the vicinity of the crossing location) where the other method only allows straight paths.

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Flush-Type Construction: Flush-type construction involves out of sight installation of all cables, closures, splices, service wires, and loading coil cases.

Fixed Separations: Separation requirements established by the National Electrical Safety Code.

Outside Plant (OSP): Telecommunications infrastructure that is designed and installed externally to buildings and typically routed into an entrance facility (EF), see BICSI OSPDRM for more details.

Random Separation: In random separation, there is no planned separation between telecommunication cables and other utilities (refer to table 2 e.g. power cables).

5 General Requirements

5.1 Outside Plant (OSP) Designer Reference

5.1.1 The BICSI TDMM, OSPDRM, and TIA-758-B standards (latest version) are hereby recognized as the engineering design references. Design drawings shall use conventional symbols as specified in SAES-T-018 Telecommunications – Symbols, Abbreviations, and Definitions and BICSI.

5.1.2 Saudi Aramco standard drawings (SASD) and library drawings shall be used to complement to this standard.

5.1.3 The industry standards listed in Section 3 of this standard shall be used for additional information such as definitions, abbreviations and explanation for further clarifications.

5.2 Outside Plant (OSP) Designer Certification Requirements

All OSP telecommunications system designs by non-Saudi Aramco design offices (such as GES Contractor, LSTK) must be done under the design authority of a valid/current BICSI Outside Plant (OSP) Designer/BICSI Registered Communications Distribution Design (BICSI RCDD). For external design contractors, the RCDD and/or OSP shall be a direct employee of that company.

All related design drawings shall be reviewed and stamped by a valid certified RCDD during the detailed design phase before the package can be issued for Construction (IFC).

5.3 All cable splicing operation must be performed by a certified cable splicer, as per SAES-T-632 standard.

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5.4 The random separation in joint buried trench method with power facilities is not permitted within Saudi Aramco; Table 2 highlights the required separation distance between the communications cable and other infrastructure components.

5.5 All other known or proposed subsurface utilities or structures shall be identified (By review of Saudi Aramco Drawings and Coordination with Utilities, proponents such as, Utilities, Pipelines Operations Engineering Division, and Cathodic Protection Unit, and etc.) and shown on the construction drawings during the engineering/design stage. Any subsurface utilities or structures that were not identified during the engineering/design stage, but identified during the excavation/construction stage shall be added to the as-built drawings. All telecommunication facilities shall be properly identified using Saudi Aramco SAES-T-018, Telecommunications - Symbols, Abbreviations and definitions.

5.5.1 Prior to the use of any land or right of way for the placement of buried cable, a Saudi Aramco Land Use Permit shall be processed in accordance with General Instruction GI-0002.716, "Land Use Permit Procedure. Prior to starting any work, all required work permits shall be obtained in accordance with GI-0002.100, "Work Permit System. Coordination with non-Saudi Aramco agencies shall be handled in accordance with GI-0887.000, "Coordination of Saudi Aramco Projects with non-Saudi Aramco Agencies".

5.5.2 The expected thermal, chemical, electrical, mechanical, and other environmental conditions or hazards at the location shall be identified and action be taken to protect all telecommunication facilities from damage.

5.5.3 Design and engineering of any communications facilities/OSP infrastructure within the perimeter of a hydrocarbon / chemical or other industrial handling/processing plant shall comply with electrical area of classification maps/drawings. Refer to SAES-B-068 for more details.

5.5.4 Variable things to be looked at when designing underground or direct-buried communications cable route. Some of which may be related to safety, costs (existing underground infrastructure such as utilities and waterways), environmental areas (soil conditions), right of way (R/W), and other foreign obstacles.

5.6 All excavations and reinstatements in paved areas shall comply with SAES-Q-006 "Asphalt Concrete Paving" and with GI-1021.000, "Street and Road Closure: Excavations, Reinstatement and Traffic Controls". The trench detail area designated "Zone B" in this Saudi Aramco General Instruction shall be back filled with "clean sand" or "select fill material".

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5.7 To ensure safety of workmen, excavation work shall, at all times, be under the immediate supervision of someone with authority to modify shoring or other work methods and situations, as necessary, to maintain safe working conditions as outlined in the Saudi Aramco Construction Manual, SAES-A-114, Safety Management Guide SMG-06-002-2008, Saudi Aramco Construction Safety Manual, SAES-A-115 Shoring and Materials and other applicable safety practices.

5.8 All direct buried fiber optic and copper cables and buried service wires shall be of the filled core type. Fiber optic cables shall comply with 18-SAMSS-625; and copper cables shall comply with SAES-T-920. Air core cables shall not be used for direct burial purposes or sections installed in conduit.

5.9 Only appropriate material shall be used when preparing the cable for splicing. Petrochemical materials used as fuel (such as Kerosene or Gasoline) shall not be used for cleaning the cables. Refer to SAES-T-632 for more details.

6 Design

6.1 Buried Cable

Providing the procedures outlined in this standard are adhered to, it shall not be necessary to berm and stabilize buried cable trench routes. However, should the prevailing conditions at a particular location (i.e., active sand areas) indicate that the buried cable trench should be berm or stabilized with marl at minimum depth for retention of cover and the back-fill shall be stabilized. Other stable material, or approved environmentally friendly stabilization materials with a minimum penetration or weathered crude oil use shall comply as outlined in SAES-L-450, "Construction of On-land and Near-Shore Pipelines".

In pipeline areas, stabilized pipeline berms could be used as an indication of where it may be necessary to consider stabilizing cable trench cover.

6.1.1 When rock is encountered, the excavation in rock shall be made to provide the minimum earth cover in accordance with paragraphs 6.5 and 6.6. For this purpose, rock is described as a material that requires special equipment, such as rock breakers, rock saws, etc., to do the excavation work. Refer to SAES-L-450 standard.

6.1.2 The trench bottom shall be:

a) Bottom of the excavation trenches and backfill material shall be free of rock and debris or a rock protrusions and other items that could damage the cable,

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b) Uniformly graded and a minimum of 50 mm depth bed of clean sand (such as pure sand, sweet sand, fine sand or soft sand) shall be placed in all open (non-plowed) trench bottoms, refer to Standard Drawing (AA-036748) in details, buried communications cables installation details.

Commentary Notes:

Backfilling of trench shall be compacted in 150 mm lift (200 mm maximum) to the applicable Saudi Aramco standard requirement.

6.1.3 Orange colored marker/identification (detectable) marker tape shall be placed in the trench above the cable and the specification shall be in accordance with Standard Drawing (AA-036748), "Buried Telephone Cable/Distribution Wire - Installation Details". The following black legend shall be printed on the tape in both Arabic and English: "CAUTION! - TELECOMMUNICATION CABLE BELOW)".

6.1.4 Marker posts and signs shall be placed in accordance with Standard Drawing (AB-036897), "Buried/Underground Cable Route Marker Posts and Signs". On long straight runs of buried cable, marker posts shall be placed no further than 152 meters apart in lieu of the standard drawing AB-036897. This is to clearly indicate the route and to warn the public and other workmen of the presence of the buried cable.

Marker posts shall be placed at the ends of conduits used at roads, railroad, pipeline, and utility crossings, and at changes of direction and at 30 meters spacing within plant areas.

Commentary Notes:

1) In areas where curves or hills exist, marker post shall be placed in the line of sight.

2) In areas where guard post is required, SA library drawing AE-036412 shall be comply.

6.1.5 Four inch (4 in) PVC conduit (NEMA TC 8, type DB or EB) in concrete encasement as specified by SAES-T-911 shall be placed at all road or street crossings, and at railroad crossings. Each end of the conduit shall extend a minimum distance of one meter beyond the edge of pavement and must be sealed/plugged in accordance with SAES-T-629.
A minimum of one spare conduit (for maintenance and repair purposes) shall be placed at each crossing.

Commentary Notes:

1) Roads means all paved roads and maintained dirt roads.

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2) Sharing of conduit with non-telecommunication cables, refer to SAES-T-911.

3) Communications copper and Fiber Optic-FOC cables shall be placed in separate conduits.

6.1.6 Direct buried cable shall be placed in a concrete encased four-inch (4 in) PVC conduit (NEMA TC 8, Type DB) in the identified areas listed, which is underneath;

1) On a concreted area,
2) On an asphalted area,
3) On an area as mandatory such as, in the driveways, alleyways, pedestrian traffic ways,
4) On a soil stabilized location (banks and trenches),
5) On the paved parking areas,
6) On the material lay down areas, and
7) Inside the plant facilities areas.

A spare conduit shall be placed adjacent to the initial conduit and to be specified in the design drawings. In addition, the conduit shall extend one (1) meter beyond the edge of the pavement or concrete at each end.

This conduit shall be placed as specified by SAES-T-911, and other related Saudi Aramco Standard Drawing (SASD AA-036373), also all conduit ends must be sealed and plugged. In addition, it shall be identified with Electronic Marking System (EMS) in accordance with SAES-T-624 requirements.

Commentary Notes:

In a situation when the OSP cable is exposed to sunlight, in the transition or change over sections from below ground (conduit) to above. The OSP cable shall be protected using non-metallic flexible conduit with UV rated and it shall extend at least 1000 mm (1m) both ends.

6.1.7 Buried feeder cables, if used, shall be sized in accordance with BICSI and TIA-759-B standards.

6.1.8 Buried distribution cables shall be sized to meet the ultimate or maximum expected requirements in accordance with BICSI and TIA-759-B standards.

6.1.9 Loops in excess of 5.5 km shall be loaded. The H-88 cable loading system is used on Saudi Aramco standard exchange cables.
The following standard spacing accuracy applies:

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a) The average load coil spacing shall be within 2% of the standard spacing 1830 m for H-88.

b) Each individual deviation shall be less than 2% of the average spacing.

c) The average of the individual deviations from the average spacing shall be less than 0.5% of the average spacing.

A transmission data sheet showing transmission calculations shall be included with all designs involving loaded cables.

6.1.10 Bonding, grounding and protection of buried telecommunication cable facilities shall be in accordance with SAES-T-795.

6.1.11 Bonding and grounding requirements and all other construction details necessary to meet transmission and protection (Electrical Stress Exposure, etc.) requirements shall be specified on the construction drawings.

6.1.12 Direct buried cable is subjected to different harsh environment moisture, rodent damage, lightning, sand movement. Therefore, the FO cable design type is suitable for Saudi Arabia environments and suitable for direct buried use.

6.2 Roadways and Railroad Crossing

Where it is not possible to provide an open trench, when constructing a conduit system, such as at crossings of railroads and major highways or freeways, etc., thrust bore method or directional drilling method shall be used.

6.2.1 Thrust Bore Method

Four four-inch (4 in) PVC conduits (NEMA TC 8, Type DB) shall be placed in a steel casing (pipe) pushed through the ground to facilitate the cable at the crossing (refer to Table 1 below).
Upon completion of the conduit installation, the casing must:

a) Be filled with fine sand, blown in under air pressure,

b) Have the inside of both casing ends sealed with a minimum of 75 mm wall of concrete.

6.2.2 Casing Wall Thickness

The minimum wall thickness of the casing shall be as required by the highway or railroad proponent but never less than three-sixteenths inch.

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6.2.3 Number of Conduits per Casing

Table 1 provides an indication of the number of conduits that can be installed inside different casing sizes. The minimum cover over the casing in railroad crossings shall be 1.4 m as specified in SAES-L-460, "Pipeline Crossings under Roads and Railroads", unless greater cover is required by the high or railroad proponent.

Table 1 - Casing Size Requirements, when 4-inch Conduits are Used

Number of Conduits to be placed	Casing Size Required Inside Diameter (In Inches)
4	13
6	16
7	16
8	20
9	20
10	22
11	22
12	22
13	24
14	26
15	26
16	26
17	26
18	26
20	30

6.2.4 Concrete Encasement with Other Utilities

When sections of direct buried telecommunication cables need to be placed in concrete encased conduits, they shall not be placed inside the same concrete encasement with power facilities or other underground utilities.

6.2.5 Horizontal Directional Drilling Method

6.2.5.1 Directional drilling shall be using the HDPE (High Density Poly-Ethylene) pipes with 110 mm outside diameter, refer to 01-SAMSS-051 for materials selection.

6.2.5.2 The HDPE pipes at the crossing will not be connected to other underground communications conduit system.

6.2.5.3 The HDPE pipes shall undergo mandrel testing in both directions before, during, and after installation.

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6.2.5.4 The HDPE pipes at the crossing shall be placed with a minimum cover of 1200 mm unless greater cover is required by the proponent.

6.3 Separation from Power Lines

6.3.1 Buried cable installations shall be designed in all cases so that power induced voltages in the metallic member telecommunication cable do not exceed recognized safety and operation margins. For design information refer toSAES-T-795.

6.3.1.1 Where buried metallic member telecommunication cables run parallel or cross under aerial power lines, the same induced voltage limitation as in paragraph 6.3.1 shall apply.

6.3.1.2 In addition, when metallic member buried cables cross under aerial power lines (as near as possible to 90-degree angle) which exceed 15 kV (phase to phase) the design shall be such that the cable shall be protected for the worst-case power fault condition. Refer to SAES-T-795.

6.3.2 Telecommunication cables (containing metallic or none) and power cables shall not be directly buried together in the same trench by the "Random Separation" method. Fixed separation as specified in Table 2 and outlined below is required.

6.3.2.1 Separations between buried power facilities (power cable, power pedestals etc.) and metallic member telecommunication cables shall not be less than 300 mm of well tamped earth. In areas where this is not possible, 75 mm of concrete or 100 mm of masonry is required. Concrete and masonry separation shall have a width of 400 mm and extended 500 mm beyond each side of the cable trench line. The cable should cross as near as possible to 90-degree angle.

6.3.2.2 Where the power exposure at the crossing is greater than 15 kV phase to phase, buried metallic member telecommunication cables shall be placed inside a buried (4 in) NEMA TC 8, DB conduit. Each end of the conduit shall extend a minimum distance of 1500 mm (1.5m) from the power cable.

6.3.2.3 When a metallic member telecommunications cable is buried under aerial power lines having a phase to phase voltage of more than 15 kV, the cable must be placed in a buried 4 in. NEMA TC 8, conduit under the aerial power line.

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The conduit shall extend for a distance of 2-times the power line height on each end of the crossing.

6.3.2.4 Telecommunication cables shall not be in the same trench with a power cable having a phase-to-ground voltage of more than 20 kV.

Table 2 - Minimum Separation Chart

	Buried Telecommunication Cables	
Between	**Parallel**	**Crossing**
Buried Power Cable	300 mm of well-tamped soil, 75 mm of concrete, or 100 mm of masonry	300 mm of well-tamped, 75 mm of concrete, or 100 mm of masonry
Water and Sewer Lines; CATV & Instrumentation Cables, waterways or water canals, etc.	300 mm	150 mm
Oil/Gas Field Pipelines	Fiber optic cables installation in a joint pipeline trench shall follow SAES-L-450 and this standard.	1000 mm (1m) below in concrete encased conduit Or 10000 mm (1m) below the pipeline with HDPE pipes, solid wall type
	Telecommunications service point (maintenance hole and pedestal.) shall not be closer than 25 m to any pipeline in the corridor as per SAES-B-064	
	Telecommunications cables shall not be closer than 5 m to any pipeline when crossing roads, streets, wadi and railroads. See *exception in section 6.7.7 (e)*, *if it's used a thrust bore method on highway crossings.*	
Onshore Wellsite	15 m	Not permitted
Roads (paved, unpaved, asphalt)	5000 mm (5m)	1200 mm (1.2m) below surface with concrete encase conduit Or 1200 mm (1.2m) below surface with HDPE pipes, solid wall type
Existing FO cable (separate trench at the pipeline corridors)	4000 mm (4m)	
Camel Crossing	5000 mm (5m)	

6.4 Separation from Other Subsurface Utilities

Commentary Note:

Refer to Table 2 - Minimum Separation Chart of this standard, see section 6.3.2.

6.5 Minimum Cover Requirements for Copper Buried Cables

All direct buried telecommunication copper cables shall be placed not less than 600 mm of earth cover from the top of the cable. In the latter situation, it is required that a minimum of 50 mm bed of "clean sand" be placed in the bottom of the trench. The cable shall be placed on the sand bed and covered with either 150 mm of additional "clean sand" or with "select fill material" as defined in Saudi Aramco Standard Drawing AA-036748 (Earth separation and Concrete separation). The top 100 mm of the trench shall then be filled with 3000 psi

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concrete for "Trench in rock area, Non-roadway areas, and Trenches for Saudi Aramco road/street paved areas", refer to Saudi Aramco Standard Drawing AA-036748 for further details.

Commentary Note:

Communications copper cables installed around the plant fence (inside/outside) for industrial security applications such as surveillance cameras may be installed in direct buried with the specified depth and design as required in SAES-O standards.

6.6 Minimum Cover Requirements for Fiber Optic Cables

Direct buried for fiber optic cables shall be placed with a minimum cover of:

a) 1,200 mm, when placed without mechanical protection (concrete encasement).

b) 250 mm, in rock areas, when placed inside concrete encased conduit is mandatory, refer to SAES-T-911, SAES-T-624, and Standard Drawing AA-036748. The minimum cover measured from top of concrete encasement.

c) Industrial Security Applications

Communications fiber optic cables installed around the plant fence (inside/outside) for industrial security applications such as surveillance cameras may be installed in direct buried with the specified depth and design as required in SAES-O standards.

6.7 Separation from Oil/Gas Field Pipelines

Pipelines as referenced in this section means hydrocarbon pipelines and other oil field pipelines (pipelines located outside plant area fences) used in the operation of the oil business.

6.7.1 Crossing Pipeline Corridors

All telecommunication cables that are installed across pipeline corridors shall be placed below the pipes inside concrete encased conduits, which have been installed in accordance with SAES-B-064, SAES-T-911, and this standard:

a) The minimum vertical distance between the bottom of any pipe and the top of the concrete encased conduit bank shall be 1.0 m.

b) The concrete encased conduits shall be continuous and at the same elevation with respect to the natural grade across the entire width of

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the pipeline corridor. Also, a spare of one (1) duct for future use shall be provided.

c) The conduit system shall be identified by placing an orange marker tape directly on the top of the conduit concrete encasement surface. Additional detectable marker tape is to be located 300 mm minimum below surface ground grade. This is providing early warning during excavation, refer to SASD-03678.

d) The directional drilling method may be used to place communications HDPE (solid wall type) conduit system for installation of cables under pipelines corridors.

The minimum vertical distance between the bottom of any pipeline in the corridor and the top of the HDPE pipes shall be 1.2 m. The proposed design shall be submitted to Saudi Aramco Pipelines and Saudi Aramco IT Engineering Department for review as a requirement.

6.7.2 New Pipelines Crossing on Existing Cables

When new pipelines crossing existing telecommunication cables or conduits, the telecommunications cable(s)/conduits shall be provided the same mechanical protections and separations as outlined above (Crossing Pipeline Corridors). Inform Saudi Aramco, Information Technology Engineering Department of IT prior and during construction to avoid any fiber optic cable cut or service interruption.

6.7.3 Cables Crossing Over Pipelines

In situations where it is impractical to place telecommunication cables below pipelines as required above, telecommunication cables may be installed in concrete encased conduit on top of the pipeline provided:

a) One-meter separation [may be reduced to no less than 300 mm if approved per item c) below] is maintained between the top of all subsurface pipelines and the bottom of the buried concrete encased telecommunications conduit structure.

b) The standard ground cover can be maintained above the buried concrete encased telecommunication conduit structure.

c) This design variation shall be reviewed by the Saudi Aramco proponent(s).

6.7.4 Coordination

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When a buried cable design involves the installation of a telecommunication cable across or inside a Saudi Aramco pipeline corridor, the design and installation of the cable shall be coordinated with Saudi Aramco, Pipelines Operations Engineering Division, and Cathodic Protection Unit. Construction in other areas, which have cathodic protection systems, shall also be coordinated with the proponent of the cathodic protection system.

6.7.5 Where it is necessary to install sections of conduit, they shall be installed in accordance with the standard, SAES-T-911.

6.7.6 New Telecommunication FO Cable Paralleling to New Pipeline

When a new fiber optic cable is installed parallel to a new pipeline, it shall be installed in the pipeline trench.

a) The design requirement shall follow this standard and SAES-L-450.

b) Fiber optic cables shall be dielectric materials.

c) Marker posts and detectable marker tape installation is required and it shall be in accordance with the SAES-T standard.

d) The minimum cover for the fiber optic cable shall be 800 mm. The 800 mm cover shall be maintained from the outside diameter surface of the cable to the outside surface of the berm at all angles.

e) If the proponents for the FOC and the pipeline are different, then a Service Level Agreement (SLA) with roles and responsibilities together with the maintenance procedure shall be established between the two proponents.

Commentary Note:

1) Additional requirements for "Marking and Identification" shall comply with SAES-T-911 standard.

2) Additional requirements for "Marker Tape" shall comply with SAES-T-624 standard.

3) Direct buried splicing is not permitted on the same trench, an Optiped (5m clearance) or MH (25 m clearance) is required.

6.7.7 Fiber Optic Cable Installation in a Separate Trench Paralleling to Pipeline

a) A separate trench is applicable only when the pipeline or the fiber optic cable is already existing.

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b) Service point (maintenance hole and pedestal) shall not be closer than 25 m to any pipeline in the corridor (refer to SAES-B-064). When locating service points, the engineer must be sure to take into consideration the location of proposed or future pipelines as determined by coordination with the pipeline's proponent.

c) Telecommunications cables shall not be closer than 5 m to any pipeline when crossing roads, streets, and railroads.

Exception:

Where pipeline corridors have not been established, telecommunication cables shall be placed a minimum distance of 3 meter from the pipeline.

d) In the pipeline corridor, when a communication cable installation parallels to a pipeline, and if not planned to install in the same trench with the pipeline, then it shall maintain a minimum of 5 m clearance from the pipeline. In addition, coordination with the Pipeline proponents shall be considered and they shall be informed of the design for review.

e) If the use Thrust bore method under highways for pipeline installations, then FOC can be installed inside the casing according to the figure below. There shall be two (2) HDPE pipes, solid wall, 110 mm outside diameter hanged to the top of the casing above the pipeline. The HDPE pipes shall be extended at least 10 meters from the edge of the casing.

Figure 1: FOC can be installation Inside the Pipeline Casing

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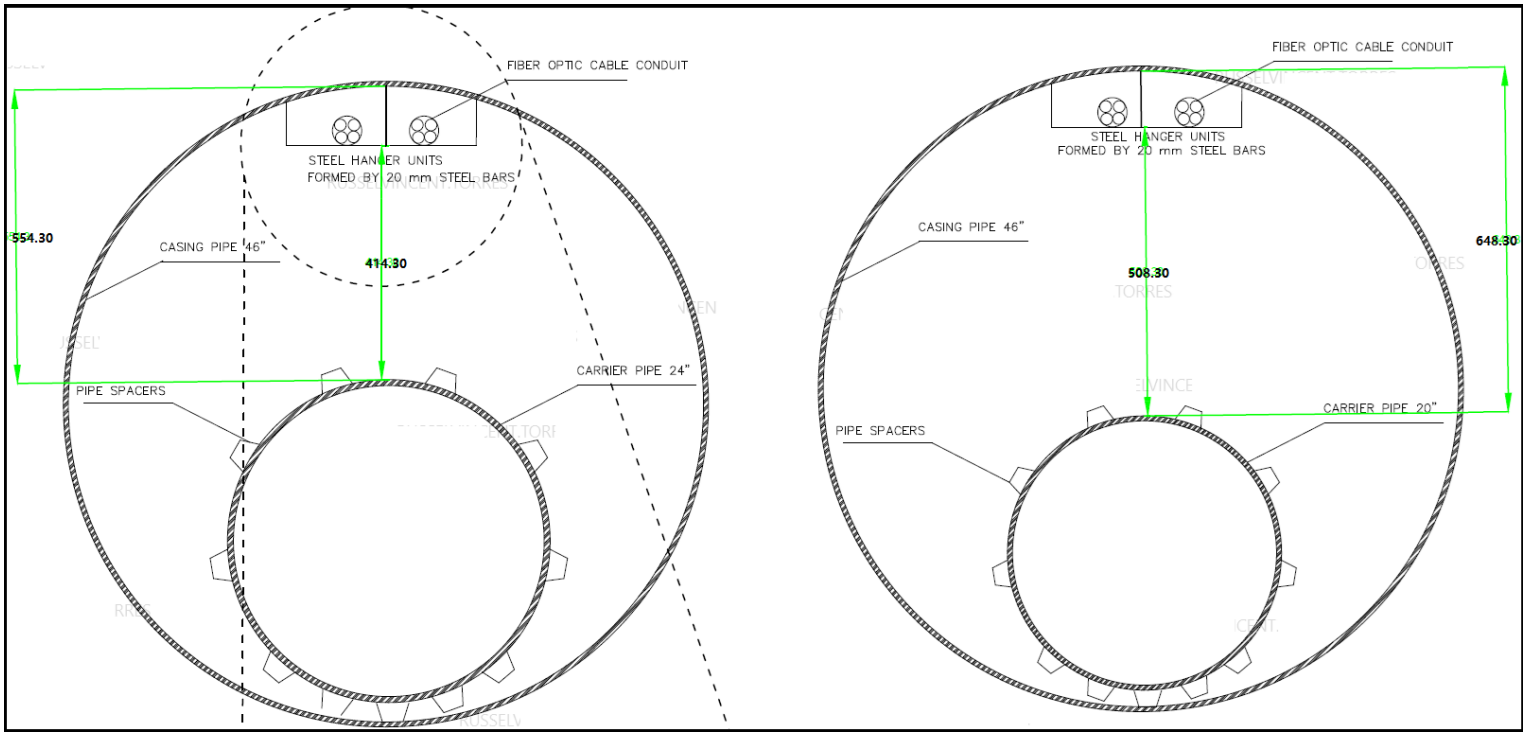

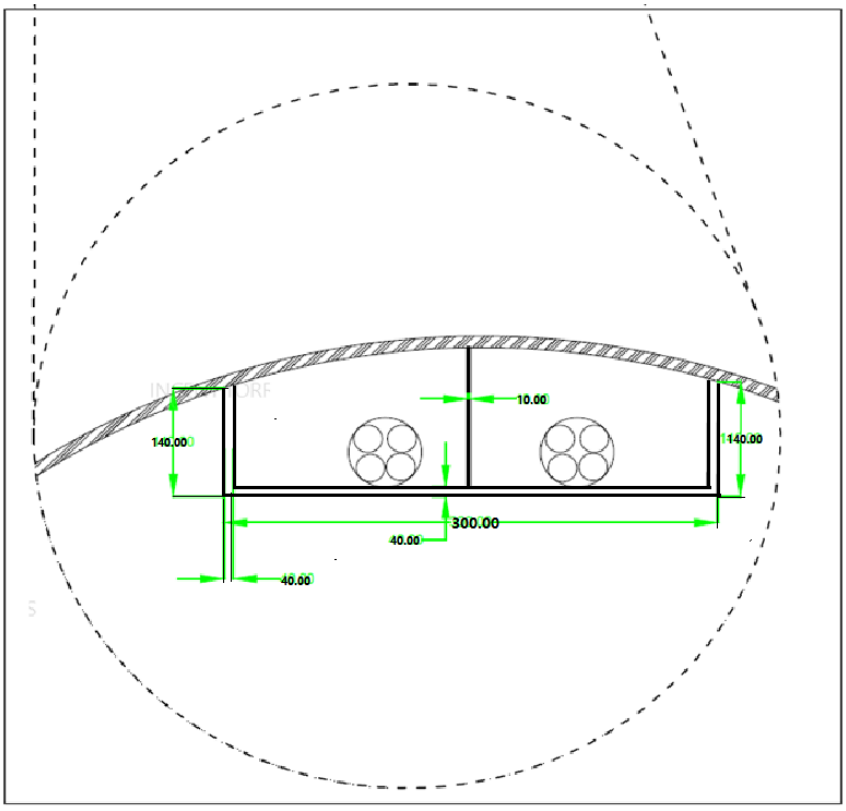

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6.7.8 Service point (maintenance hole and pedestal) shall not be closer than 25 m to any pipeline in the corridor (refer to SAES-B-064).
When locating service points, the engineer must be sure to take into consideration the location of proposed or future pipelines as determined by coordination with the pipeline's proponent.

Commentary Note:

1) The use of direct buried fiber optic cable permanent splice closure that can never be opened is permitted, and shall be placed on main FO cable route and level.

2) This only applies if there is no future expansion (add and drop), and if the fiber cable is in a separate trench with pipeline, and it is not applicable on a joint trench method.

3) The use of direct buried splice closure, Optiped, refer to SAES-T-632 standard.

6.7.9 Cables Crossing Wadi

A Telecommunication cable (e.g., copper twisted pair, fiber optic, coaxial) route shall be designed and constructed such that the cable will be protected from disturbances (e.g., washout, displacement, damage) as a result of the Wadi becoming active due to the flow of water and debris. Consideration shall be given to the design and construction of Wadi(s) cable route crossing to avoid disturbances to other structures that support soil erosion and flood control systems.

The following protection methods shall be, as follows:

Method 1:
- Consider additional depth
- Concrete encased for conduit is required
- Additional cover is required by having a grid wire and large aggregates.

Method 2:
- Using Directional Drilling Method to the cable route.

Commentary Note:

a. It shall be designed and constructed on a case-by-case basis to ensure that each cable route crossing is protected for the life of the cable.
.
b. The cable route crossing shall be designed in such a manner as not to create a hindrance to the natural water shed of the Wadi and the surrounding area.

6.7.10 Cables at Camel Crossing

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For Pipeline Trench with Fiber Optic Cable, the fiber optic cables shall be installed in separate trench.

Commentary Note:

Fiber optic cable may be installed in the same pipeline trench at camel crossings if the cable is installed inside HDPE pipes, refer to table 2 - Minimum Separation Chart, in alignment with SAES-L-450.

6.8 Exchange Buried Facilities - Flush Construction

In cases where flush construction method is needed, the cable installation shall also be in accordance with the other portions of this SAES as well as the rest of the SAES-T Series.

6.9 Exchange Buried Facilities - Terminal/Pedestal Installation

6.9.1 Bonding Terminal Housings

Where a terminal housing/pedestal is located within 3 m of an electrical supply terminal or transformer housing, a minimum of No. 6 AWG tinned solid copper wire shall be used to bond the telecommunication terminal housing to the equipment ground. The connection to the equipment ground shall be made by the Power Distribution Department personnel. Refer to Saudi Aramco Standard Drawing AA-036748.

6.9.2 When metallic telecommunication cables are buried parallel to buried power facilities (in a joint or separate trench) with fixed separation (one meter or less), and, where there is no requirement for a telecommunications pedestal/terminal, a telecommunication cable may be buried passing the distribution power transformers/terminals etc., without placing a telecommunications pedestal/terminal solely for the purpose of bonding the cable shield to the power ground.
However, ensure that the ground potential rise (GPR) exposure does not exceed 50% of the cable core-to-sheath dielectric rating and no point on the cable is more than 150 m from a bond to the power ground.

7 Installation

Buried telecommunication cables shall be installed in accordance with the requirements of this standard, SAES-T-928 and other applicable codes and standards as referenced in Section 3 above. Construction in or near Hazardous or Classified areas shall comply with SAES-B-008, SAES-B-068, SAES-B-062, ANSI C2 (NESC), NFPA 70 (NEC), and other applicable codes and standards. The Saudi Aramco Construction Safety Manual, the SAES-B and O-Series and, in general all safety and security requirements

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shall be complied with. In addition, the installation of all cables shall comply with general requirements related to land use, clearances, road or pipeline crossings, etc.

8 Testing and Inspection

8.1 The testing and acceptance of buried telecommunication cables shall be done in accordance with SAES-T-624 for fiber optic cable and SAES-T-928 for copper cable. Quality assurance inspections shall be performed during all phases of construction by Saudi Aramco Inspection Department Inspector.

8.2 As pre-requisites, a test inspection for direct buried cables and trench layout/details shall be conducted by the Inspection Department. An inspection report is required and it shall be readily available if needed.

8.3 Inspection Department Notification: The Saudi Aramco Inspection Department shall be notified two working days prior to beginning any construction or testing so that all necessary inspections can be scheduled. The Inspection Department shall be notified two working days prior to backfilling any trenches or starting any acceptance testing.

9 As-Built Drawings

As-Built drawings and acceptance test results shall be provided to the Saudi Aramco Information Technology Engineering Department or Area-IT before the Mechanical Completion Certificate (MCC) is approved. As-built deliverables are required such as, cable schematic, layout drawings, splicing details trench and conduit layout, rack face elevation drawings, cable schedule list includes building name, room number, rack number, MH ID, PED ID, patch panel ID, panel location on rack and identification of the cable & type.

Commentary Note:

All Redlined as-built drawings shall comply with the requirements as per GI-0002.710 (Mechanical Completion and performance Acceptance of Facilities).

Revision Summary

11 June 2017	Major revision as FOC and Pipeline shared trench is permitted.
1 January 2018	Editorial revision to modify and/or delete paragraphs 6.7.3 (c), 6.7.7 (b), and Section 9.
7 May 2019	Editorial revision as part of content confirmation assessment
1 October 2020	Major revision (see summary of changes above)

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