Engineering Standard

SAES-T-481 05 May 2019

In-Plant Voice Paging System

Document Responsibility: Plants Networks Standards Committee

Contents

Previous Issue: 29 February 2016 Next Planned Update: 9 April 2022

Contact: Almadi, Soliman Musa (almadism) on +966-13-8801357

1 Scope

This standard defines the minimum mandatory requirements governing the design and installation of AC powered, in-plant party paging communication systems for use in Saudi Aramco industrial facilities such as Petroleum Refineries, Gas Oil Separation Plants (GOSPs), Natural Gas Liquid (NGL) Plants, Terminals, Bulk Plants, and Water Injection Plants (WIPs).

This entire standard may be attached to and be made a part of purchase orders.

2 Conflicts and Deviations

Any conflicts between this document and other applicable Mandatory Saudi Aramco Engineering Requirements (MSAERs) shall be addressed to the EK&RD Coordinator.

Any deviation from the requirements herein shall follow internal company procedure SAEP-302.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedures

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

Saudi Aramco Engineering Standards

SAES-A-105	*Noise Control*
SAES-B-008	*Restrictions to Use of Cellars, Pits and Trenches*
SAES-B-055	*Plant Layout*
SAES-B-067	*Safety Identification and Safety Colors*
SAES-B-068	*Electrical Area Classification*
SAES-P-100	*Basic Power System Design Criteria*
SAES-P-103	*UPS and DC Systems*
SAES-P-104	*Wiring Methods and Materials*

SAES-T-624	*Fiber Optic Cables for Outside Plant (OSP) and Inter/Intra Building Applications*
SAES-T-629	*Telecommunications Outside Plant - Copper Cable*
SAES-T-795	*Grounding, Bonding, and Electrical Protection for Telecommunications Facilities*
SAES-T-911	*Telecommunication Conduit System Design*
SAES-T-916	*Telecommunications: Building Cable Systems, Pathways and Spaces*
SAES-T-920	*Telecommunications Cable Information*
SAES-T-928	*Telecommunications - OSP Buried Cable*

Saudi Aramco Typical Inspection Plan

SATIP-P-104-01	*Low Voltage (up to 1 kV) Power Cable and Building Wire*

3.2 Industry Codes and Standards

National Fire Protection Association

NFPA 70	*National Electrical Code*
NFPA 72	*National Fire Alarm Code*

American National Standards Institute

ANSI C2	*National Electric Safety Code (NESC)*

Factory Mutual Engineering & Research Corporation

FM	*Factory Mutual*

ANSI /Telecommunications Industry Association

ANSI/TIA-606-C	*Administration Standard for Telecommunications Infrastructure*

Building Industry Consulting Service International

BICSI TDMM	*Telecommunications Distribution Methods Manual*

National Electrical Manufacturers Association

NEMA 250	*Enclosures for Electrical Equipment*

Underwriters Laboratory, Inc.

UL 1480 *Standard for Safety Speakers for Fire Protective Signaling Systems*

4 Design Requirements

4.1 The design of the "In-Plant party paging communications systems" shall comply with NFPA 70 National Electrical Code (NEC) and the guidelines outlined in SAES-B-068 (Electrical Area Classification).

4.2 Power Supply Sources

4.2.1 The "in-plant party paging communications system" shall be powered by Uninterruptible Power Supply (UPS) system.

4.2.2 The UPS system could be dedicated to the in-plant party paging communication system or shared with other system. UPS system back up capacity should comply with 4.2.6.

4.2.3 The UPS system shall comply with SAES-P-103 and SAES-P-104.

4.2.4 The operating voltage of "in-plant party paging stations" shall be 220/230 Volts AC, 60/50Hz.

4.2.5 The UPS system shall have adequate load capacity (KVA) for the entire system.

4.2.6 During commercial power failure, the UPS system shall be capable of providing one of the following:

4.2.6.1 Back up power for a minimum of four-hour battery capacity system provided that a secondary engine driven power generator system is used in conjunction with the UPS and arranged in accordance with NFPA 72, National Fire Alarm Code, 2007, Section 4.4.1.9.3, Secondary Power Supply.

4.2.6.2 Back up power for a minimum of eight-hour battery capacity system without the use of a secondary engine driven power generator system.

4.3 The paging stations, amplifiers, junction enclosures, plugs and loudspeakers installed in hazardous (classified) areas as defined by the approved area classification drawing shall meet the NEC requirements for installation in such location.

4.4 Acoustical booths shall be furnished for the party paging stations in areas where ambient noise levels exceed 80 dBA. The ambient noise level measured inside the acoustical booths shall not exceed 80 dBA.

4.5 Loudspeakers shall be installed in areas where ambient noise levels exceed 90 dBA (refer to SAES-A-105).

4.6 The in-plant party paging communications system shall include a multi-tone generator capable of generating a minimum of six different types of tones for different emergency conditions, such as; yelp, warble, siren, and steady tone.

4.7 The multi-tone generator shall be equipped with priority-override capability, allowing the most critical tones to override the less critical tones in the event of simultaneous or multiple emergency conditions. The control for the multi-tone generator shall be located in central control room.

4.8 The interpretation of each alarm tone shall be established by the personnel in charge of the plant operations.

5 Design

5.1 Line Balance Assembly

A line balance assembly shall be installed in the in-plant party paging communications system to reduce side tone, feedback, hum and distortion in the system. Wherever feasible, line balance assembly shall be installed at the central location of the serving area.

5.2 Party Paging Systems

5.2.1 Only multi-channel in-plant party paging systems shall be installed. The system shall be capable of conducting a minimum of five (5) simultaneous and full-duplex conversations. Each station of the party paging system shall be equipped with paging capability and shall be capable of selecting other stations.

5.2.2 The operating voltage of “in-plant party paging stations” shall be 220/230VAC, 60/50 Hz.

5.2.3 All party paging stations shall include speaker amplifier and termination points for powering external speakers.

5.2.4 All station handsets shall be designed to be disconnected from the communications network whenever the handset is on-hook (not in use).

5.2.5 Handset microphone of party paging stations shall be equipped with noise cancellation device to minimize noise interference.

5.2.6 Handset cable of party paging stations shall be retractile and extendible to at least 1800 mm.

5.2.7 The handset shall be equipped with gain amplifier with adjustable range.

5.2.8 The volume level of speaker amplifier shall be internally adjustable.

5.2.9 The input and the output of the speaker amplifier shall be transformer coupled. The output side shall have two taps for both 8-ohms and 16-ohms output impedance.

5.2.10 Line Extender shall be used in pairs (at each end) to provide extension or expansion of Paging System. Line extender shall be connected by fiber optic cable including fiber optic modem (converter) and CAT 6 cable at each end. The Line Extender shall be supported by a power source that is equivalent to the Paging System to ensure end to end system reliability.

5.3 Speakers

5.3.1 Loudspeakers used for the in-plant party paging communications shall meet the requirements of UL 1480 (UL Standard for Safety Speakers for Fire Protective Signaling Systems) recommendations.

5.3.2 The loudspeaker driver-coil (voice coil) impedance shall be either 8 ohms or 16 ohms.

5.3.3 All speaker components, including driver, horn and mounting hardware shall be made of corrosion and impact resistant material.

5.4 Enclosures

The enclosures for “in-plant party paging communications equipment” shall comply with:

NEMA type 12 (IP52) - for indoor, non-hazardous locations

NEMA type 4X (IP56) - for NEMA type 4X - for outdoor non-hazardous location and in installations located in severe corrosive environments

For hazardous locations, the enclosures shall comply with area classification requirement; NEMA type 7 in addition to NEMA type 4X.

The equipment along with the enclosures shall be rated and labeled for use in classified locations, as per the requirements of SAES-P-100, Section 8.

Enclosures and junction boxes having an internal volume exceeding 2,000 cm^3 shall be provided with Type 300 Series stainless steel breather and drain fittings, or a combination of breather and drain fitting. Enclosures shall be provided with tamper-resistance factory assembled breather/drainer (or provision for future breather/drainer) system where required.

5.5 Station Interconnection Cables

5.5.1 Cables shall be UL listed for indoor and outdoor applications. Cables installed within a building shall be listed as being resistant to the spread of fire in accordance with NFPA 70 National Electrical Code (NEC) Article 800-50 and Article 800.26.

5.5.2 Outer jacket of the cables shall be made of hard service, flame retardant and moisture and ultraviolet resistant material to provide protection from oil, chemical, mechanical and other environmental abuse.

6 Installation

6.1 Enclosures, plugs or loudspeakers and all associated components to be installed in classified areas shall be UL (Underwriters Laboratory) listed or certified by FM (Factory Mutual) for use per area classification and the enclosures shall comply with NEMA type 4X and type 7.

6.2 All electrical equipment installed, shall comply with the NFPA 70 National Electrical Code (NEC), and shall meet the criteria set forth in SAES-B-055 and SAES-B-068 for classified areas.

6.3 All equipment shall be grounded in accordance with the grounding specifications of the NFPA 70 National Electrical Code (NEC) Article 200, Article 250, and SAES-T-795. The size of the equipment grounding conductors shall be in accordance with NEC Article 250-95.

All metal enclosures for the party paging communications systems shall be grounded to the plant or building grounding system with a green insulated copper conductor of minimum No. 6 AWG (16 mm^2).

6.4 All buried metallic conduits and cables with metallic members or sheath shall be grounded in accordance with SAES-T-795. Buried cable installations shall be designed in all cases so that power induced voltages in the telecommunication cable do not exceed recognized safety and operation margins (refer to SAES-T-795 Sections 4.3 and 4.4).

6.5 All inter-building cable runs, directly buried or in underground conduit, where a continuous metallic shield or a continuous metallic conduit containing the cable shall be bonded to each building grounding electrode system (refer to SAES-T-795 Section 5.3.3).

6.6 Installations of communications cables, conduits and splice chambers shall comply with SAES-B-008, SAES-T-911 and SAES-T-928. The building cables, conduits, raceways and distribution systems shall comply with the latest version of BICSI-TDM Manual and SAES-T-916.

6.7 A listed primary protector [refer to SAES-T-795, NEC articles NEC article 725.52 and 800-90 (a)] shall be provided;

- On each circuit of the inter-building aerial cable runs and
- On each circuit of inter-building underground cable runs exceeding 42.7 m.

6.8 In-plant party paging communications system cables may be installed in tray, underground ducts or above ground in galvanized rigid steel conduits provided they do not occupy the same enclosure, cable trays, conduit or duct for conductors of lighting or power systems [refer to NEC article 725.136 (a)].

6.9 PVC coated rigid conduit shall be factory PVC coated (minimum thickness of PVC: 40 mils (1 mm) per NEMA RN 1.

6.10 PVC coated rigid conduit shall be used in corrosive environments or within 1 km from the shoreline. Flexible conduits shall not be used unless to employ flexible connections at loudspeaker terminals.

6.11 Only filled cables shall be used in all buried or underground installations to prevent moisture intrusion (refer to SAES-T-920, Section 4.0).

6.12 Cable pulling tension and bending radius shall not exceed the limitations recommended by the cable manufacturer.

6.13 Bending radius of conduits shall not be less than ten times the internal diameter of the conduit (refer to BICSI-TDM Manual latest edition).

6.14 Consistent conductor identity shall be maintained throughout the system when terminating cables in the stations or enclosures. Wire pairs providing power, shall be identified with wire markers and shall be showing the voltage and the type of service.

6.15 The loudspeaker for the party paging system shall be mounted to a minimum height of 2.5 meters. The loudspeaker cone shall not point upwards in a vertical direction.

6.16 Paging call stations should be installed 1.65 meters above finish floor or ground level measured up to the center of the call station or according to manufacturer recommendation.

6.17 Additional loudspeakers shall be installed, as required, at strategic locations around the plant, to ensure that the plant personnel receive an intelligible message from any location within the plant.

6.18 The installed loudspeaker shall not be facing the direction of the noise source. The amplifier/volume control of the loudspeaker shall be adjusted to a level that produces a clear audible message.

6.19 Ensure all horns are facing the same direction, rather than toward each other. Whenever possible, it is recommended to stagger the horns.

6.20 The location of party paging stations in plant areas (inside and outside buildings) shall be distinctly marked with durable paint, of yellow stripes on a black background. Refer to SAES-B-067 on the color requirements.

6.21 Construction and installation of all the system cables in or near Hazardous or Classified areas shall comply with SAES-B-008, SAES-B-068, ANSI C2 (NESC), NFPA 70 (NEC), and the Saudi Aramco Construction Safety Manual.

6.22 All cables, System Components, and stations shall be labeled based on EIA/TIA-606-C: Administration Standard for Telecommunications Infrastructure.

7 Testing and Inspection

7.1 Acceptance testing requirements for fiber optic and copper cables are covered in SAES-T-624 and SAES-T-629. SATIP-P-104-01 for Low Voltage Cable.

7.2 Each component of the party paging system shall be tested individually and as a complete system for transmit and receive of all tones and proper functioning of all operational features.

Test results of the party paging system shall be recorded with authorized signatories of witnesses.

Revision Summary

29 February 2016 Revised the Next Planned Update, reaffirmed and re-organized the content of the document, and reissued as major revision.

9 April 2019 Revised the Next Planned Update, reaffirmed and re-organized the content of the document, comply with the standard's revision cycle, and reissued as major revision.

08 May 2019 Editorial revision to comply with references requirements

Summary of Change Form

No.	Paragraph No.	Change Type (New, Modification,..)	Technical Change
1	1 Scope	Modification	Explicitly included in the scope both Terminals and Bulk Plants.
2	3.1 Saudi Aramco References	Modification	Updated Saudi Aramco References (standard committee name, number and title) based on the latest standards realignment and revisions.
	3.2 Industry Codes and Standards	Modification	Added relevant standard related more to the discipline.
3	4.2.4 Design Requirements	Modification	Modification to reflect Power requirements (220/230VAC, 60/50 Hz) to be inline with Saudi Arabia Government directive.
	5.2.2 Party Paging Systems	Modification	Modification to reflect Power requirements 220/230VAC, 60/50 Hz to be inline with Saudi Arabia Government directive.
4	5.2.6 Party Paging Systems	Modification	Converted the unit from Centimeter to Millimeter.
5	5.2.10 Party Paging Systems	Modification	Add the word "Convertor" to further explain Modem.
6	6.1 Installation	Modification	Mapped installations to be based on classification areas.
7	6.7 Installation	Modification	Reflected the relevant NEC articles; NEC article 725.52.
8	6.7 Installation	Modification	Reflected the relevant NEC articles; NEC article NEC article 725.136.
9	6.13 Installation	Modification	Reflected the relevant "BICSI-TDM Manual latest edition."
10	6.20 Installation	Modification	Further defined what "In plant areas" to include both inside and outside buildings.
11	6.22 Installation	Added	Cable label requirements
12	7.1 Testing and Inspection	Remove	Duplicate