



Engineering Standard

SAES-T-481

23 April 2012

In-Plant Voice Paging System

Document Responsibility: Communications Standards Committee

Saudi Aramco DeskTop Standards

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Previous Issue: 12 June 2011 Next Planned Update: 6 November 2015

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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 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 deviations, providing less than the mandatory requirements of this standard require written waiver approval as per Saudi Aramco Engineering 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 Procedure

SAEP-302	<i>Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement</i>
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Saudi Aramco Engineering Standards

SAES-A-105	<i>Noise Control</i>
SAES-B-008	<i>Restrictions to Use of Cellars, Pits and Trenches</i>
SAES-B-055	<i>Plant Layout</i>
SAES-B-068	<i>Electrical Area Classifications</i>
SAES-P-100	<i>Basic Power System Design Criteria</i>
SAES-P-103	<i>Direct Current and UPS Systems</i>
SAES-P-104	<i>Wiring Methods and Materials</i>
SAES-T-795	<i>Communications Facility Grounding Systems</i>
SAES-T-887	<i>Telecommunications: Electrical Coordination - Protection</i>

<u>SAES-T-903</u>	<i>Communications Electrical Protection - Outside Plant</i>
<u>SAES-T-911</u>	<i>Telecommunication Conduit System Design</i>
<u>SAES-T-916</u>	<i>Telecommunications Building Cable Systems</i>
<u>SAES-T-920</u>	<i>Telecommunications Cable Information</i>
<u>SAES-T-928</u>	<i>Telecommunications - OSP Buried Plant</i>

3.2 Industry Codes and Standards

National Fire Protection Association

<u>NFPA 70</u>	<i>National Electrical Code</i>
<u>NFPA 72</u>	<i>National Fire Alarm Code</i>

American National Standards Institute

<u>ANSI C2</u>	<i>National Electric Safety Code (NESC)</i>
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Factory Mutual Engineering & Research Corporation

<i>FM</i>	<i>Factory Mutual</i>
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Building Industry Consulting Service International

<i>BICSI TDMM</i>	<i>Telecommunications Distribution Methods Manual</i>
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National Electrical Manufacturers Association

<u>NEMA 250</u>	<i>Enclosures for Electrical Equipment</i>
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Underwriters Laboratory, Inc.

<u>UL 1480</u>	<i>Standard for Safety Speakers for Fire Protective Signaling Systems</i>
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4 Design Requirements

4.1 The design of the “party paging communications systems” shall comply with [NFPA 70](#) National Electrical Code (NEC) and the guidelines outlined in [SAES-B-068](#) (Electrical Area Classifications).

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 120 Volts AC, 60 Hz.
 - 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 exceeds 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.
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- 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 120 Volts AC, 60 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 180 cm.

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.

5.3 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 - for indoor, non hazardous locations

NEMA type 4X - for outdoor non hazardous location

For hazardous locations (Class I Division 1 & 2), the enclosures shall comply with 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, (Class I - Div. 1) or (Class I - Div. 2) as per the requirements of [SAES-P-100](#) paragraph 4.2.

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 800-51.

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 shall not be installed in Class I Division 1 areas unless the equipment and all associated components are either [UL](#) (Underwriters Laboratory) listed or certified by [FM](#) (Factory Mutual) for use in Class I Division 1 area and the enclosures 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 mm²).
- 6.4 All buried metallic conduits and cables with metallic members or sheath shall be grounded in accordance with [SAES-T-903](#). 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-887](#) Sections 4.1 & 4.2).
- 6.5 All interbuilding 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-903](#) Section 4).
- 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-903](#), NEC articles 725-54(c) and 800-30 (a)] shall be provided;
- On each circuit of the interbuilding aerial cable runs and
 - On each circuit of interbuilding 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 725-54 (b)(5)].
- 6.9 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.
- 6.10 Only filled cables shall be used in all buried or underground installations to prevent moisture intrusion (refer to [SAES-T-920](#) section 3.2).
- 6.11 Cable pulling tension and bending radius shall not exceed the limitations recommended by the cable manufacturer.
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- 6.12 Bending radius of conduits shall not be less than ten times the internal diameter of the conduit (refer to BICSI-TDM Manual, Ch. 4, Page 130).
- 6.13 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.
- 6.14 As many loudspeakers, as required, shall be installed at strategic locations around the plant, to ensure that the plant personnel receive an intelligible message from any location within the plant.
- 6.15 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.
- 6.16 The location of party paging stations in plant areas shall be distinctly marked with durable paint, of yellow stripes on a black background.
- 6.17 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](#) (NEC), [NFPA 70](#) (NEC), and the Saudi Aramco Construction Safety Manual.

7 Testing and Inspection

- 7.1 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.
- 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.

Revision Summary

6 November 2010	Revised the "Next Planned Update." Editorial revision to clarify full-duplex system requirements.
12 June 2011	Editorial revision change the document's Primary Contact Person.
23 April 2012	Editorial revision to change the primary contact.