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ASSESSMENT OF GENERAL ALARM AND PUBLIC ADDRESS SYSTEMS ON OFFSHORE INSTALLATIONS.

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INTRODUCTION

Effective general alarm and public address systems are essential on offshore installations. U.K. legislation applying to these systems is of a general nature; no specific design or testing criteria are stated. This paper summarises existing requirements, reviews published research on this subject and describes tests carried out by AVT to investigate the coverage and effectiveness of alarm and P.A. systems on several offshore installations.

STATUTORY REQUIREMENTS & RELEVANT STANDARDS

Statutory requirements for such systems are stated in SI 486 (1); additional recommendations of a general nature are given in DEn Guidance Notes (2), (3). The principal recommendations are summarised below:

- the purpose of the general alarm system is to raise the alarm in every part of the installation by means of aural and, where necessary, visual signals distinct from other signals and alarms on the installation.

- the purpose of the public address system is to transmit clear verbal instructions to all parts of the installation.

- in areas where aural communication is not practicable conspicuous visual warning signals should be provided to inform personnel of the transmission of important and urgent orders on the public address system.

More specific guidance on warning signals and system acceptability is given in BS 5839 (4) and DIN 33,404 (5); BS CP 327 (6) gives advice on P.A. system design.

ASSESSMENT CRITERIA

Rating schemes were developed for both alarm audibility and P.A. intelligibility. Alarm audibility ratings were largely based on work by Wilkins (7) (8) (9), while P.A. intelligibility ratings were derived from procedures put forward by Kryter and Broadbent (10)(11). Classifications were as follows:

Rating	Alarm Signal Level Minus Masked Threshold Level (In optimum ⅓ octave band)	P.A. Articulation Index
Not Acceptable	< 7 dB	< 0.2
Just Acceptable	7 - 12 dB	0.2 - 0.29
Acceptable	13 - 15 dB	0.3 - 0.39
Good	16 - 20 dB	0.4 - 0.49
Excellent	> 20 dB	> 0.5

TEST PROCEDURE

Alarm System

Alarms were sounded for periods of 5 - 10 minutes, with an interval of similar duration between each sounding, so that measurements of both alarm signal noise level and background noise level could be made. These levels were measured in ⅓ octave frequency bands corresponding to the fundamental frequency of the alarm sounder, and to the most significant higher harmonic frequency. Details of four different types of sounders in use offshore are given below:

Sounder Unit	Fundamental	Harmonic
Yodalarm	1000 or 1250 Hz	3150 or 4000 Hz
Banshee	2500 or 3150 Hz	-
Bell	2500 or 3150 Hz	5000 Hz
Klaxon	315 Hz	2500 Hz

Measurements were made at representative locations within each module and in external platform areas. Normal survey procedure was to commence measurements at locations closest to the alarm sounders and to progressively move away from the sounders. In very high noise areas, measurements could thus be concluded when the alarm signal became imperceptible.

Alarm signal noise levels were found to vary by as much as 10 - 12 dB from point to point within the modules, owing to the directional sound output from the sounder, the formation of standing waves and reflections off walls and other large surfaces. The measurement practice adopted therefore was to move the microphone about, at each measurement position, to locate and define using the r.m.s. 'fast' meter response the maximum level detectable at that location. It is assumed that the response by individuals to an alarm sounding will be determined by the maximum alarm signal level. The r.m.s. 'slow' meter response was used for all background noise level measurements.

Overall 'A' weighted background noise levels were also measured to determine the correction to the ⅓ octave background noise levels to define masking threshold criterion levels.

Public Address System

The systems were tested by the insertion of a tape-recorded test signal containing octaves of band-limited white noise over the frequency range 200 Hz - 5600 Hz, corresponding to the combined bandwidth of the five octave bands of interest. The signal tape-recording was shaped to approximate to the spectrum shape of a typical male speaker, and was fed directly from the output of a precision tape recorder, at low signal level, into the microphone input to the P.A. system amplifier.

Calibration of the test signals against the typical peak speech levels of a male speaker was made using the sound output from one or more loudspeakers situated in low noise level areas. Typical test messages and passages of speech were relayed over the system, and the maximum r.m.s. speech levels were determined using a sound level meter connected to a chart recorder. The tape recorder signal was then substituted at the microphone, and its output level was adjusted so that the signal corresponded to the maximum r.m.s. speech levels at each frequency. Where public address amplication equipment incorporated an output voltmeter, this meter reading was used as a secondary means of initial calibration, and subsequently as a more convenient means of checking the correct operation of the system.

Test signal noise levels were measured at representative locations throughout the installation. Measurements were made using the r.m.s. slow meter response of the sound level meter to determine the test signal noise levels in five octave bands (250, 500, 1000, 2000 and 4000 Hz). Background noise levels at these frequencies were measured during the intervals between the test signals. The measured signal to noise ratios were then converted into a basic Articulation Index. A subjective appraisal of typical spoken messages was made at intervals during the survey programme to confirm the validity of the survey results.

CONCLUSIONS

The tests provide an effective means of assessing the perf··rmance of the platform alarm and P.A. systems. They enable specific problem areas in P.A. and alarm coverage to be identified, and effects of possible alternative measures to be evaluated. Improvements to the systems may involve repair of defective equipment, uprating of existing sounders/loudspeakers, provision of additional units, increase in P.A. amplifier output levels or installation of visual signalling devices. Providing and maintaining an audible, intelligible P.A. and alarm system is vital to ensure the safety of personnel on an offshore installation ; we believe the test methods described to be an efficient, practicable means of achieving this objective.

REFERENCES

(1) Statutory Instrument No. 486: 1977 'Offshore Installations (Life Saving Appliances) Regulations, 1977.

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