AS 2035—1983

Australian Standard®

DETERMINATION OF SHORT-CIRCUIT CURRENTS IN MARINE ALTERNATING CURRENT INSTALLATIONS

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- American Bureau of Shipping
- Australian Chamber of Shipping
- Australian Shipbuilders Association
- Bureau Veritas
- Department of Industry and Commerce
- Department of Transport
- Det norske Veritas
- Institute of Marine Engineers
- Lloyds Register of Shipping
- Royal Institution of Naval Architects

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METHOD FOR DETERMINATION OF SHORT-CIRCUIT CURRENTS IN MARINE ALTERNATING CURRENT INSTALLATIONS

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PREFACE

This edition of this standard was prepared by the Association's Committee on Shipbuilding, to supersede AS 2035—1977. Some minor corrections and additions have been incorporated into this edition as follows:

(a) Correction to typographical errors in formula (3).

(b) An expanded formula has been included in Fig. 1 to allow calculation of the decrement factor *K*.

(c) Correction to Table 2, first column, Nominal cross-section ('mm' deleted and 'mm^2' substituted).

The method given in this standard provides sufficient accuracy for most purposes, and could be applied by the average shipyard. It would be suitable for most installations, except those which were large and complicated, and the tables should provide a reasonable coverage of most machine characteristics. This method was accordingly adopted subject to provision being made for the situation where the actual machine characteristics differed from those given in the tables.

For large and complicated installations it was agreed that the IEC method (IEC 363, Short-circuit Current Evaluation with regard to Rated Short-circuit Capacity of Circuit-breakers in Installations in Ships) should be considered as an alternative to this standard.

Users of this standard should note that while observing the requirements of the standard, they should also ensure compliance with such statutory and classification society requirements, rules and regulations as are applicable to the individual ship concerned.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHOD FOR DETERMINATION OF SHORT-CIRCUIT CURRENTS IN MARINE ALTERNATING CURRENT INSTALLATIONS

1 SCOPE. This standard sets out a method for the determination of short-circuit currents in marine alternating current installations with special regard to rated short-circuit capacity of protection devices.

2 REFERENCED DOCUMENTS. The following standard is referred to in this standard:

IEC 363 Short-circuit Current Evaluation with regard to Rated Short-circuit Capacity of Circuit-breakers in Installations in Ships

3 APPLICATION. The method is applicable to the majority of installations. For the larger and more complicated installations, consideration should be given to the use of the IEC method (see IEC 363).

The tables and graphs are intended to apply to normal installations where the circuit-breaker making capacity is at least 10 percent greater than the asymmetrical short-circuit current. In other cases, the actual machine and cable characteristics shall be obtained from the manufacturers. The actual characteristics should be checked against those given in the tables and graphs as soon as they are known.

4 ASSUMPTIONS. Short-circuit currents may only be determined in a practical manner by the use of assumptions and simplifications. The main assumptions used in this standard are as follows:

(a) The calculation of short-circuit currents takes into account the total number of generators that can be arranged to operate in parallel.

(b) The contribution from the motors is taken as that of one motor directly connected to the main busbars, and having rated power equal to the sum of the rated powers of all the motors which may be running when the fault occurs to the network.

(c) The impedance of the fault itself has been excluded from the calculations.

(d) The formulas give maximum values of short-circuit currents corresponding in general to short-circuit current characteristics half a period after the fault has started.

5 NUMERICAL DATA. Where specific indications are not available, the impedances of the various parts of the network may be obtained from Tables 1, 2, 3, 4 and 5. The values given in the tables apply to both 50 Hz and 60 Hz alternating current.

6 METHOD OF CALCULATION.

6.1 Determination of Short-circuit Currents. In three-phase a.c. installations, the short-circuit currents which must be known to determine the type of each protective device and its setting are—

(a) the maximum asymmetrical short-circuit current;

(b) the maximum symmetrical short-circuit current; and

(c) the minimum symmetrical short-circuit current.

For protective circuit-breakers of generators, the following should be known, in addition, for each generator:

(d) The maximum asymmetrical short-circuit current.

(e) The steady short-circuit current.

The values of these various short-circuit currents for three-phase faults may be determined from the formulas given in Clauses 5.2 to 5.6. Such faults generally produce the largest short-circuit currents in normal installations, particularly those with an insulated neutral.

6.2 Maximum Symmetrical Short-circuit Current.

6.2.1 *Fault located on the main busbars.* The maximum r.m.s. value of the symmetrical short-circuit current I_{ccs} in amperes, for a fault on the main busbars is determined by—

I_{ccs} = 3[illegible] $\frac{V_g}{X''_{dt}} = \frac{V_g}{X''_d}$ . . . . (1)

where

V_g = phase-to-neutral voltage at generator terminals, in volts. If precise information is not available the following formula should be used:

$$V_g = \frac{U_n \times 1.05}{\sqrt{3}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

U_n being the rated phase-to-phase voltage of the network concerned ($\sqrt{3}\,V_n$)

X''_d = total equivalent reactance, in ohms

$$= \frac{X''_{dt} \times X'_{dm}}{X''_{dt} + X'_{dm}}$$

X''_{dt} = equivalent direct axis subtransient reactance of the generators arranged to run in parallel (including reactances of cables and protective devices between the generators and the main busbars), in ohms

$$\frac{1}{X''_{dt}} = \sum_{n=1}^{n=m} \frac{1}{X''_{dn} + X_{cn} + X_{an}} \quad \ldots\ldots\ldots\ldots (3)$$

X''_{dn} = direct axis subtransient reactance of generator n, in ohms

$$= \frac{X''_{dn}}{100} \times \frac{U_n^2}{S_n} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

S_n being the rated output of generator n, in volt amperes and X''_{dn} its subtransient reactance, in percent

X_{cn} = reactance of the cable connecting generator n to the main busbars (see Table 2), in ohms

X_{an} = reactance of the protective device of generator n (see Table 3), in ohms