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EMERGENCY RESPONSE SERVICE (ERS)

NR556 - APRIL 2023

RULE NOTE

BUREAU VERITAS

BUREAU VERITAS
RULES, RULE NOTES AND GUIDANCE NOTES

NR556 DT R01 April 2023 takes precedence over previous revision.

The PDF electronic version of this document available at the Bureau Veritas Marine & Offshore website https://marine-offshore.bureauveritas.com/ is the official version and shall prevail if there are any inconsistencies between the PDF version and any other available version.

These rules are provided within the scope of the Bureau Veritas Marine & Offshore General Conditions, enclosed at the end of Part A of NR467, Rules for the Classification of Steel Ships. The current version of these General Conditions is available at the Bureau Veritas Marine & Offshore website.

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BUREAU VERITAS

NR556

EMERGENCY RESPONSE SERVICE (ERS)

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Table of Content

Section 1 Emergency Response Service (ERS)

Symbols

BV : Bureau Veritas
ERS : Emergency Response Service
Unit : Ship, barge or buoy
Vessel : Ship or barge
RAO : Response Amplitude Operator
VWBM : Vertical Wave Bending Moment
VWSF : Vertical Wave Shear Force
SWSF : Still Water Shear Force
Hs : Significant wave height
L : Vessel length between perpendiculars
V_{max} : Ship maximum speed.

1 General

1.1 Aim of Service

1.1.1 The aim of the ERS is to provide technical assistance to units in case of a maritime accident at sea, by providing information on their residual strength, stability and/or mooring system capacities in the resulting damaged condition.

This Service, requested as mentioned in [1.3], can be provided by various organizations involved in the maritime sector, including Classification Societies.

The present Rule Note describes the three different types of Services that can be provided by BV:

ERS-S (Strength), **ERS-H** (Hydrodynamic) and **ERS-M** (Mooring).

1.2 Additional class notations

1.2.1 The additional class notations **ERS-S**, **ERS-H** and **ERS-M** can be assigned in the particular case of BV classed units for which the ERS is also contracted with BV.

1.3 International Regulations

1.3.1 **ERS-S** is intended to ensure compliance with the provisions of:

- MARPOL Annex I, Regulation 37.4, regarding the prevention of pollution arising from an oil pollution incident and requiring access to computerized damaged stability and residual structural strength calculation programs for oil tankers above 5000 tons deadweight.
- ISM Code Article 1.3 and Regulation 8.3.
- SOLAS Chapter II-1, Regulation 8-1.3 and IMO Circulars MSC.1/Circ.1400, MSC.1/Circ.1532 rev.1 and MSC.1/Circ.1589, regarding operational information after a flooding casualty for safe return to port of passenger ships.

2 Application

2.1 Type of units concerned

2.1.1 ERS can be contracted for any existing unit, either classed by BV or by another classification society; however the additional class notations can only be assigned to BV classed units.

In general, ERS cannot be contracted for cargo ships less than 65 m in length and non-cargo ships less than 90 m in length. However, ERS may be contracted in other cases provided that longitudinal strength documentation specified in [3.2.2] is available.

ERS-M is solely intended for permanently moored units, such as F(P)SO and buoys; **ERS-S** and **ERS-H** are intended for ships and barges only.

Note 1: For the definition of cargo ships and non-cargo ships, reference is made to NR600, Chapter 1, Section 1.

2.2 Type of Services

2.2.1 As mentioned above, ERS can be contracted for three different types of Services.

2.2.2 ERS-S

ERS-S corresponds to damage longitudinal strength and damage stability analyses. It aims at providing information on the remaining hull strength and stability after the accident.

2.2.3 ERS-H

ERS-H aims at providing limits of navigation, based on VWBM and VWSF direct calculations for the accidental site sea-states, instead of empirical Rules formulae.

ERS-H is only applied in complement to **ERS-S**. It aims at providing maximum environmental conditions (Hs), heading restriction, or speed limit. These limits of navigation are given for hull girder strength only.

2.2.4 ERS-M

ERS-M corresponds to damaged mooring analyses for permanently moored units. It aims at providing information on the remaining capacities of the mooring system after the failure of one or several mooring lines and the potential failure of an additional mooring line.

3 Establishment and maintenance of the Services

3.1 Establishment of the Services

3.1.1 ERS comprises the establishment of the unitspecific technical data. They include computer models of the unit based on information provided by the Client in order to be quickly able to perform calculations of damage stability, damage strength, damage mooring, and/or hydrodynamic behavior of the unit, depending on the Service(s) contracted.

The Client is to supply BV with the documentation listed in [3.2], [3.3] and/or [3.4] depending on the Service(s) contracted.

BV will provide a blank customized “emergency form” (including protocol for the call) to be filled and sent in case of emergency or test by the Client.

The Client will be noticed when the Service(s) become(s) operational and will receive the above “emergency form” together with side documentations.

3.2 Establishment of ERS-S

3.2.1 Models

For **ERS-S**, two different computer models are established by BV:

- A hydrostatic model of the vessel in order to assess the equilibrium (displacement, draught, trim, list), the intact stability, the damage stability and the still water hull girder loads.
- A 2D structural model of the vessel main sections in order to assess the intact and damage strength of longitudinal members of the hull structure.

3.2.2 Documents to be provided

In order to build these two models, the following documents are to be provided by the Client:

- general arrangement drawing
- capacity plan
- print out from the loading computer, if any, showing the naming and numbering convention of the capacities
- hull lines drawing (or off-set tables)
- longitudinal distribution of lightship weight
- loading manual and/or trim and stability manual (with longitudinal strength calculation)
- for ships assigned the **ECFP-2** or **ECFP-3** additional class notation, cargo hold flooding control booklet (with longitudinal strength calculation)
- freeboard report
- coordinates (X, Y, Z) of all openings (doors, air pipes, ventilators, hatches…) located on exposed deck with indication of their means of closing (usually shown on freeboard plan)
- permissible still-water bending moments and shear forces
- midship section drawings
- profile and decks drawings
- shell expansion drawings
- cargo holds structure drawings
- engine room structure drawings
- fore part structure drawings
- aft part structure drawings.

3.2.3 Side documentation

The side documentation provided by BV to the Client when the Service becomes effective includes:

- A capacity table and sketch with BV ERS naming convention. The list of capacities is to be sorted based on the loading computer naming convention under condition that relevant details are provided.
- Stability information regarding heeling lever arm curve with the stability criteria and vessel equilibrium (draught, trim and list) in intact condition at least for two loading conditions (full load and ballast).
- Longitudinal strength information regarding the calculated values of still water bending moments and shear forces and comparison with intact allowable values for the same loading conditions.

3.3 Establishment of ERS-H

3.3.1 Model

Three hydrodynamic models associated to the following loading conditions are to be established:

a) one homogeneous loading condition at maximum draught for the VWBM

b) one homogeneous loading condition at minimum draught for the VWBM

c) one alternate loading condition at intermediate draught for the VWSF.

The RAOs of VWBM and VWSF are calculated as follow:

- for frequencies between 0.1 and 2 rad/s, with a step of 0.05 rad/s
- every 45° headings
- on 9 sections along the vessel length started at 0.1L up to 0.9L, and regularly distributed
- three speeds: 0, 1/3 of V_{max} and 2/3 of V_{max}.

Note 1: The loading condition defined in item c) is normally selected as the loading condition maximising the SWSF among the loading conditions defined in the loading manual or in the Trim and Stability booklet.

3.3.2 Documentation to be provided

The loading manual including the three loading conditions defined in [3.3.1] is to be provided by the Client.

3.3.3 Side documentation

BV will provide the Client with the RAOs of VWBM and VWSF.

3.4 Establishment of ERS-M

3.4.1 Model and scenarios

A computer model and scenarios are established by BV as detailed in App 1.

The documents to be provided by the Client are detailed in App 1.

3.4.2 Side documentation

The side documentation provided by BV is detailed in App 1. It at least includes:

- mooring line naming convention
- detailed environmental loads (not relevant for buoys)
- polar plots of offsets and tensions (not relevant for buoys)
- mooring force, excursion and tug pull (for buoys only).

3.5 Maintenance

3.5.1 When the Service(s) is(are) effective, and in case of modifications or alterations brought to the unit including any data affecting the models prepared by BV, the Client is to inform BV so that the concerned technical data and models are to be updated.

BV will then inform the Client when the updated Service(s) become operational. Updated blank customized “emergency form” and updated side documentation will be sent to the Client.

4 Emergency case

4.1 General

4.1.1 In case of emergency, the Client will initiate the mobilization of the BV ERS team by calling the BV ERS phone number mentioned in the “emergency form”.

The Client will advise BV ERS team about the unit condition by sending the “emergency form” received from BV, duly completed. By fully completing the “emergency form”, the Client will describe the unit condition before damage, the extent of damage and the corrective actions proposed to be taken.

Normally within two hours after the initial phone call from Client (one hour for ships assigned the additional service feature **SRTP**), BV ERS team will acknowledge receipt of the “emergency form” and will confirm their readiness to start the analyses aiming at providing the required information pertinent to the damage sustained by the unit. As soon as possible thereafter, BV ERS team will exchange with the Client in order to confirm the common understanding on the data sent by the Client, on the content of the analyses they will perform and on the results that can be expected from these analyses.

BV ERS team will perform analysis in order to provide information on the described damage, final and intermediate situations given by the Client, taking into account the fact that the crew onboard vessel do not have usually the means to analyze and/or model damaged hull structures and/or mooring to derive the residual strength after damage.

Regular contacts between BV ERS team and Client will be kept until demobilization. The Client will keep BV informed of modifications to the “emergency form” data.

On completion of BV ERS team work, Client will give written notice (by email) of the demobilization of BV ERS team upon receipt of requested information.

4.2 ERS-S

4.2.1 For **ERS-S**, BV ERS team is composed of staff experienced in stability and staff experienced in hull structure.

BV ERS team will provide the Client with at least the following information for initial damage, intermediate and final loading conditions proposed by the Client:

- vessel equilibrium (displacement, draught, trim, list)
- vessel hydrostatic stability
- vessel still water hull girder loads
- allowable damage still water hull girder loads.

BV ERS team will provide opinion on the initial damage situation and the proposed scenarios in terms of hydrostatic stability and strength of the vessel based on the conditions as described by the Client.

In case of stability issue without hull structure failure, BV ERS team will compare the obtained still water hull girder loads of the loading cases under analysis with the allowable still water hull girder loads of the vessel.

In the case the still water hull girder load values exceed allowable still water hull girder loads of the vessel, BV ERS team may check if new allowable still water hull girder loads can be issued taking into account the present and forecasted environmental conditions provided by the Client. Then, BV ERS team will compare the obtained still water hull girder loads of the loading cases analyzed with the new allowable still water hull girder loads of the vessel.

In case of hull structure damage, with or without stability issue, BV ERS team will determine new allowable still water hull girder loads taking into account the hull structure damage (location, extent, loading of adjacent tanks) in conjunction with the present and forecasted environmental conditions provided by the Client. Then, BV ERS team will compare the estimated still water hull girder loads of the loading cases analyzed with the new allowable still water hull girder loads of the vessel.

4.3 ERS-H

4.3.1 For **ERS-H**, the BV ERS team is composed of same staff as for **ERS-S**.

As a complement of the remaining capacity of the hull section calculated in the scope of **ERS-S**, BV will provide limits of navigation based on hull girder strength: maximum environmental conditions (Hs), heading restriction, or speed limit.

4.4 ERS-M

4.4.1 For **ERS-M**, the BV ERS team is composed of staff experienced in mooring analyses.

BV ERS team will provide the Client with information on the remaining capacities of the mooring system to keep the unit in position after the failure of one or several mooring lines, in terms of excursions, tug pull and mooring lines tensions, as detailed in App 1.

5 Test emergency case

5.1

5.1.1 The Client may submit to BV a test emergency case after the receipt of the written notice confirming the Service(s) contracted become operational. The aim of the test emergency case is to validate the communication procedure, technical mutual understanding and speed of response.

The procedure for the test emergency case is the same as for an actual emergency case, as described in [4] above.

Appendix 1 ERS-M (Emergency Response Service - Mooring) Scope of Work

1 General

1.1 Application

1.1.1 This document aims at describing the scope of work for Emergency Response Service for Mooring (**ERS-M**).

1.1.2 **ERS-M** aims at providing information on the remaining capacities of the mooring system after the failure of a given number “n” of mooring lines and the potential failure of an additional mooring line. This will allow the Client to make an informed decision of the likely consequences, in particular on umbilical flow-line and riser system.

1.1.3 In order to speed up Bureau Veritas ERS Service, a number of pre-established mooring scenarios are analyzed before the Service enters into force.

1.1.4 This appendix describes:

- the establishment of pre-established mooring scenarios and the side documentation provided to the Client
- the Service provided in case of an emergency.

2 Definitions

2.1 Mooring line tension

2.1.1 Within this document “mooring line tension” is to be understood as follows:

- In case of calculations with a quasi dynamic approach under a specified set of metocean conditions and system conditions, mooring line tension is calculated as design tension as per NR493 Classification of Mooring Systems for Permanent Offshore Units. This value takes into account the statistical dispersion of results due to random nature of waves.
- In case of static calculations without environmental loads, mooring line tension is the static tension of the mooring line for a given mooring force.

2.1.2 In both cases, tension is to be understood as an actual tension (expressed in kN) at fairlead (including both vertical and horizontal component).

2.2 Usage factor

2.2.1 Usage factor of a mooring line is defined as the following ratio:

$$\text{Usage Factor} = \frac{\text{Mooring Line Tension}}{\text{Mooring Line Breaking Load}}$$

2.2.2 Mooring line breaking load is taken as the minimum breaking load over all line segments (chains, cable, synthetic rope). Usage factor does not take into account the breaking load of other line components.

2.2.3 Usage factors are given when relevant with/without corrosion on mooring lines. In case corrosion on mooring chains is taken into account, default value is 0.4mm/year during the expected Service life of the unit (mooring line segment breaking load is reduced accordingly).

2.3 Mooring force

2.3.1 For the calculations of offloading buoys, mooring force is the horizontal static pulling force applied to the buoy representing all the actions of a shuttle tanker.

2.4 Design mooring force

2.4.1 Design mooring force is the maximum allowable value of mooring force. Its value is project specific and is assumed to be defined at design stage.

2.5 Horizontal excursions

2.5.1 Horizontal excursion under a specified set of metocean conditions and system conditions (F(P)SO) is the maximum horizontal distance during a given sea state between two positions of the reference point:

- its position calculated under these conditions
- its position at rest, without environment, in intact conditions.

2.5.2 For quasi dynamic approach, this excursion is calculated with the same methodology as a design tension as per NR493 Classification of Mooring Systems for Permanent Offshore Units. This value takes into account the statistical dispersion of results due to random nature of waves.

2.5.3 For offloading buoys, with static calculations, horizontal excursion under a specified set of system conditions is the maximum horizontal distance during a given sea state between two positions of buoy center:

- its position calculated under these conditions
- its position at rest, without any mooring force, in intact conditions.

3 Assumptions, units and required documents

3.1

3.1.1 The following assumptions are valid for both the establishment phases and the analyses performed in case of an emergency.

3.2 Assumptions on the unit

3.2.1 Following general assumptions are made during calculations:

- Clearance issues are not considered.
- No offloading is considered on FSO/FPSOs.
- Corrosion on mooring chains is taken into account. By default, this value is 0,4mm/year during the expected Service life of the unit.
- There is no structure in close proximity to the unit under study, except otherwise specified.

3.3 Assumptions on the environmental data

3.3.1 Squalls and wind gusts

Squalls and wind gusts are not considered even if data are available in metocean specifications.

3.3.2 Return periods considered

All analyses on F(P)SOs are based on extreme metocean data from the metocean specification provided by the Client.

Different return periods of the environment and combinations of the elements are considered, as listed below:

a) 100-year return period environment includes 100-year return period for the governing element and associated values (95% quantile values or 1-year return period value) for the others.

b) 1-year return period environment is defined in ERS activities as a combination of 1-year return period of each element (current, wind, swell and wind-sea).

c) 1-year return period for wind and current and two values combined significant wave Hs (below 1-year return period value). This value of Hs is considered omni-directional.

d) 1-year return period for waves and wind with a low current (below 1-year return period value). This value of current is considered omni-directional.

e) 1-year return period for waves and current with a low wind (below 1-year return period value). This value of wind is considered omni-directional.

3.4 Units

3.4.1 Maximum tension

Results in term of mooring line tension will be given under the following format:

- tension in kN
- % of usage of line strength “usage factor” taking into account corrosion
- % of usage of line strength “usage factor” without taking into account corrosion
- polar plots will indicate constraint provided by the Client.

3.4.2 Maximum horizontal excursion

Results in term of horizontal excursion of the unit will be given under the following format:

- excursion in meters of the unit at the reference point
- reference point considered:
  - either at unit center (amidships, at the centerline) for spread moored unit
  - at turret center for single point moored units
  - at buoy center for buoys
- excursion expressed in percentage of water depth
- polar plots will indicate constraint provided by the Client.

3.4.3 Tug pull

The intensity value will be expressed in kN. Its direction will be given from North.

It corresponds to an effective force that may be obtained by several tugs.

3.4.4 Maximum mooring force

The intensity value will be expressed in kN. This value is omni-directional.

3.5 Required documents

3.5.1 Information required for the establishment of the model is as follows:

a) Hull
- lines plan
- general arrangement drawing
- longitudinal distribution of lightship weight (vessels only)
- capacity plan (vessels only)
- loading manual and/or trim and stability manual

b) Unit specific data
- position of fairleads
- wind and current characteristics for the various drafts (vessels only)
- model tests results (if any)
- roll damping characteristics
- position of the unit with reference point
- heading of the unit (Spread moored unit)

c) Anchoring/Mooring system
- identification of all mooring lines
- number and type of connections with the seabed and other structures
- mooring Geometry (number of legs, azimuth of the lines, anchors position)
- length of the mooring legs
- pre-tension (horizontal and/or axial and/or angle at fairlead)
- mooring legs composition
- information on corrosion
- hawser system description for buoys only (from connection of the buoy to the tanker)

d) Site data
- site location
- site environmental conditions
- water depth

e) Survey and maintenance of mooring system
- survey reports
- maintenance reports & information

f) Client assumptions for ERS Services
- design mooring force
- constraint on allowable horizontal excursion
- constraint on line tension (usage factor).

Note 1: The data should be given “as installed” or “as is” if modified since the installation.

4 Establishment of the Services

4.1 General

4.1.1 On pre-established mooring scenarios, the failure of one single line on site is considered.

4.1.2 The system is also checked against the subsequent failure of an additional line.

4.1.3 Results of such mooring analyses will give a basis in case of real incident and in particular will help to speed up the Service in case the incident corresponds to a pre-established scenario.

4.1.4 Such scenarios are very dependent upon the type of unit (buoy or F(P)SO), and the mooring system (spread mooring or single point mooring).

4.1.5 For buoys, calculations are performed with a static approach, tanker being modeled by the mooring force.

4.1.6 Pre-established mooring scenarios encompass a large number of configurations. The combinations of broken lines that will be studied are made to capture properly the maximum of response (horizontal excursions of the unit and tension in mooring lines).

4.1.7 Other configurations specific to each unit given by the Client in the contract may be investigated.

4.2 Configurations considered

4.2.1 Pre-established mooring scenarios are considered with the following configurations:

- intact condition
- 1 broken line cases
- 2 broken line cases
- 2 drafts (full and ballast by default) except on vessels operating with a constant draft, this configuration is not applicable for buoys
- different return periods of the environment defined in [3.3.2].

4.3 Methodology

4.3.1 F(P)SO – spread mooring

For a spread-moored F(P)SO, the methodology to assess the configurations in [4.2.1] follows the steps below:

a) Calculations of environmental loads (intensity, direction) for each element (wave –swell and wind-sea-, current, wind) for all return periods

b) Summation of all environmental loads for each direction for 100-year and 1-year return periods

c) Determination of an envelope of vessel horizontal excursions: maximum excursion vs direction of the excursion for 100-year and 1-year return periods

d) Determination of maximum tension in mooring lines for 100-year and 1-year return periods.

4.3.2 F(P)SO – turret mooring

For a turret-moored F(P)SO, the methodology to assess the configurations in [4.2.1] follows the steps below:

a) Calculations of environmental loads (intensity, direction) for 100-year and 1-year return periods

b) Determination of an envelope of vessel horizontal excursions (maximum excursion vs direction of the excursion) for 100-year and 1-year return periods

c) Determination of maximum mooring lines tension for 100-year and 1-year return periods.

4.3.3 Buoys

For buoys, the maximum tension in mooring lines and maximum buoy excursions will be assessed by applying a “design mooring force” (to be agreed for each unit) with a static approach.

The Client shall provide BV for each buoy with a constraint in excursions and/or a constraint in terms of line usage factor of mooring line strength. Based on this/these constraint(s), BV will provide maximum admissible mooring force to satisfy this/these constraint(s).

BV will calculate the required tug bollard pull to satisfy constraint in excursions and/or a constraint in terms of line usage factor of mooring line strength.

4.4 Side documentation

4.4.1 A report summarizing assumptions and results will be sent to the Client including:

- mooring layout with line numbering conventions
- stiffness of the mooring system for both drafts:
  - in line / bundle direction
  - in between lines / bundles
- results of analyses.

5 Emergency case

5.1 General

5.1.1 In an emergency case, the Client is to provide BV with the emergency form, identifying clearly the broken line(s).

5.1.2 The new configuration with the n broken lines is created to model the new mooring system after the incident

5.1.3 Calculations carried out by BV are based as far as possible on pre-established scenarios.

5.2 F(P)SO – spread mooring

5.2.1 Information provided by BV

BV will provide information on:

a) Maximum horizontal excursion of the vessel and maximum mooring line tension over the remaining lines for the worst draft and for:
   - environment provided by the Client in the emergency form
   - 1-year return periods for the environment
   - 100-year return periods for the environment.

b) Minimum tug pull required to satisfy the Client horizontal excursion and mooring line tension criteria vessel for n broken line mooring system and for environment provided by the Client in the emergency form.

c) Maximum mooring line tension over the remaining lines and maximum horizontal excursion of the vessel for n broken line mooring system and with a tug pull specified by the Client if asked by the Client.

5.2.2 Methodology

Calculations will be based on the most severe vessel loading condition identified in pre-established scenarios.

Results of pre-established scenarios are used as far as possible concerning loads due to environments: for environment given by the Client, a similar environment will be determined from pre-established scenarios.

Depending on the number/nature of mooring lines broken during the incident, offsets and tensions may have to be re-calculated.

In case of a large amount of broken lines resulting in a significant change of vessel behaviour (significant change of mean vessel heading), most results of pre-established scenarios may not be relevant and will be re-computed.

In all cases, methodology used will be as close as possible as the one used for pre-established scenarios

5.3 F(P)SO – turret mooring

5.3.1 Information provided by BV

BV will provide information about:

a) Maximum horizontal excursion of the vessel and maximum mooring line tension over the remaining lines for the worst draft and for:
   - environment provided by the Client in the emergency form
   - 1-year return periods for the environment
   - 100-year return periods for the environment.

b) Minimum tug pull required to satisfy the Client horizontal excursion and mooring line tension criteria vessel for n broken line mooring system and for environment provided by the Client in the emergency form

c) Maximum mooring line tension over the remaining lines and maximum horizontal excursion of the vessel for n broken line mooring system and with a tug pull specified by the Client if asked by the Client.

5.3.2 Methodology

Calculations will be based on the most severe vessel loading condition identified in pre-established scenarios.

Results of pre-established scenarios are used as far as possible concerning loads due to environments: for environment given by the Client, a similar environment will be determined from pre-established scenarios.

Depending on the number/nature of mooring lines broken during the incident, offsets and tensions may have to be re-calculated.

In all cases, methodology used will be as close as possible as the one used for pre-established scenarios.

5.4 Buoys

5.4.1 Information provided by BV

For n broken line mooring systems, BV will provide information about:

- Maximum horizontal excursions and maximum mooring line tension over the remaining lines considering a “design mooring force” without tug
- Maximum mooring force satisfying the Client mooring line tension and /or offset criteria without tug
- Minimum tug pull required to satisfy constraint in tensions and/or excursions without considering mooring force
- At request of the Client and for an available tug bollard pull specified by the Client during the incident, BV will provide maximum horizontal excursions and maximum mooring line tension over the remaining lines.

5.4.2 Methodology

Analyses are based on a static approach with the same methodology as this described in 4 with n broken lines.

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