

# ISO 20474-1:2017-07 (E)

## Earth-moving machinery - Safety - Part 1: General requirements

---

| <b>Contents</b>    |                                                                             | <b>Page</b> |
|--------------------|-----------------------------------------------------------------------------|-------------|
| Foreword .....     |                                                                             | vi          |
| Introduction ..... |                                                                             | vii         |
| <b>1</b>           | <b>Scope .....</b>                                                          | <b>1</b>    |
| <b>2</b>           | <b>Normative references .....</b>                                           | <b>1</b>    |
| <b>3</b>           | <b>Terms and definitions .....</b>                                          | <b>4</b>    |
| <b>4</b>           | <b>Safety requirements and protective measures .....</b>                    | <b>6</b>    |
| 4.1                | General .....                                                               | 6           |
| 4.2                | Access systems .....                                                        | 7           |
| 4.2.1              | General requirements .....                                                  | 7           |
| 4.2.2              | Access to articulated machines .....                                        | 7           |
| 4.3                | Operator's station .....                                                    | 7           |
| 4.3.1              | General requirements .....                                                  | 7           |
| 4.3.2              | Operator's station equipped with a cab .....                                | 8           |
| 4.3.3              | Operator-protective structures .....                                        | 9           |
| 4.3.4              | Falling-object protective structures (FOPS) .....                           | 10          |
| 4.3.5              | Elevating operator's station .....                                          | 10          |
| 4.3.6              | Replacement of operator protective structure .....                          | 10          |
| 4.4                | Seats .....                                                                 | 10          |
| 4.4.1              | Operator's seat .....                                                       | 10          |
| 4.4.2              | Additional seat .....                                                       | 10          |
| 4.5                | Operator's controls and indicators .....                                    | 11          |
| 4.5.1              | General .....                                                               | 11          |
| 4.5.2              | Starting and stopping system .....                                          | 11          |
| 4.5.3              | Inadvertent activation .....                                                | 11          |
| 4.5.4              | Pedals .....                                                                | 11          |
| 4.5.5              | Emergency attachment lowering .....                                         | 11          |
| 4.5.6              | Uncontrolled motion .....                                                   | 12          |
| 4.5.7              | Remote control .....                                                        | 12          |
| 4.5.8              | Visual displays/control panels, indicators and symbols .....                | 12          |
| 4.5.9              | Ride-on machine controls accessible from ground level .....                 | 12          |
| 4.5.10             | Non-riding machine controls .....                                           | 12          |
| 4.6                | Steering systems .....                                                      | 12          |
| 4.6.1              | General .....                                                               | 12          |
| 4.6.2              | Wheeled machines .....                                                      | 12          |
| 4.6.3              | Crawler machines .....                                                      | 13          |
| 4.7                | Brake systems .....                                                         | 13          |
| 4.8                | Visibility .....                                                            | 13          |
| 4.8.1              | Operator's field of view .....                                              | 13          |
| 4.8.2              | Lighting, signalling and marking lights, and reflex-reflector devices ..... | 13          |
| 4.9                | Warning devices and safety signs .....                                      | 13          |
| 4.10               | Tyres and rims .....                                                        | 14          |
| 4.11               | Stability .....                                                             | 14          |
| 4.12               | Object handling .....                                                       | 14          |
| 4.12.1             | Lifting devices for object handling .....                                   | 14          |
| 4.12.2             | Lowering control device .....                                               | 14          |
| 4.13               | Noise .....                                                                 | 14          |
| 4.13.1             | Requirements for noise reduction .....                                      | 14          |

|        |                                                                       |    |
|--------|-----------------------------------------------------------------------|----|
| 4.13.2 | Noise emission measurement .....                                      | 14 |
| 4.14   | Protective measures and devices .....                                 | 15 |
| 4.14.1 | Contaminated area .....                                               | 15 |
| 4.14.2 | Hot parts .....                                                       | 15 |
| 4.14.3 | Moving parts .....                                                    | 15 |
| 4.14.4 | Guards .....                                                          | 15 |
| 4.14.5 | Articulated frame lock .....                                          | 15 |
| 4.14.6 | Sharp edges and acute angles .....                                    | 15 |
| 4.14.7 | Fenders .....                                                         | 15 |
| 4.15   | Retrieval, transportation, lifting and towing .....                   | 16 |
| 4.15.1 | Common use .....                                                      | 16 |
| 4.15.2 | Retrieval .....                                                       | 16 |
| 4.15.3 | Tying-down .....                                                      | 16 |
| 4.15.4 | Lifting .....                                                         | 16 |
| 4.15.5 | Off-road towing .....                                                 | 16 |
| 4.15.6 | Transportation .....                                                  | 16 |
| 4.16   | Electrical and electronic systems .....                               | 16 |
| 4.16.1 | General .....                                                         | 16 |
| 4.16.2 | Degree of protection .....                                            | 17 |
| 4.16.3 | Electrical connections .....                                          | 17 |
| 4.16.4 | Over-current protective devices .....                                 | 17 |
| 4.16.5 | Batteries .....                                                       | 17 |
| 4.16.6 | Battery disconnection .....                                           | 17 |
| 4.16.7 | Electrical connectors for auxiliary starting aids .....               | 17 |
| 4.16.8 | Electric sockets for lighting .....                                   | 17 |
| 4.17   | Pressurized systems .....                                             | 18 |
| 4.17.1 | General requirements .....                                            | 18 |
| 4.17.2 | Hydraulic lines .....                                                 | 18 |
| 4.17.3 | Hydraulic hose assemblies .....                                       | 18 |
| 4.17.4 | Air pressure vessels .....                                            | 18 |
| 4.18   | Fuel tanks, diesel emission fluid tanks and hydraulic oil tanks ..... | 18 |
| 4.18.1 | General requirements .....                                            | 18 |
| 4.18.2 | Filler openings .....                                                 | 18 |
| 4.18.3 | Fuel tanks .....                                                      | 19 |
| 4.19   | Fire protection .....                                                 | 19 |
| 4.19.1 | Fire resistance .....                                                 | 19 |
| 4.19.2 | Fire extinguisher .....                                               | 19 |
| 4.20   | Attachments .....                                                     | 19 |
| 4.20.1 | General .....                                                         | 19 |
| 4.20.2 | Identification .....                                                  | 19 |
| 4.20.3 | Instructions .....                                                    | 19 |
| 4.20.4 | Quick couplers .....                                                  | 19 |
| 4.20.5 | Lifting devices .....                                                 | 19 |
| 4.21   | Maintenance .....                                                     | 20 |
| 4.21.1 | General .....                                                         | 20 |
| 4.21.2 | Routine maintenance .....                                             | 20 |
| 4.21.3 | Support devices .....                                                 | 20 |
| 4.21.4 | Access to the engine compartment .....                                | 20 |
| 4.21.5 | Tiltable cab support device .....                                     | 20 |
| 4.22   | Underground operation in non-explosive atmosphere .....               | 20 |
| 4.23   | Rear-mounted winch .....                                              | 21 |
| 4.23.1 | Mounting .....                                                        | 21 |
| 4.23.2 | Controls .....                                                        | 21 |
| 4.23.3 | Protection .....                                                      | 21 |
| 4.24   | Speed limit for non-riding machines .....                             | 21 |
| 5      | Verification of safety requirements .....                             | 21 |
| 6      | Information for use .....                                             | 22 |
| 6.1    | Safety labels .....                                                   | 22 |
| 6.2    | Operator's manual .....                                               | 22 |

**6.3 Machine marking ..... 22**

**Annex A (informative) List of significant hazards ..... 23**

**Annex B (normative) Requirements for elevating operator's stations ..... 27**

**Annex C (normative) Requirements for lifting devices used in object handling ..... 29**

**Annex D (normative) Requirements for earth-moving machinery used underground in non-explosive atmospheres ..... 35**

**Bibliography ..... 37**