

# ISO 14990-2:2016-11 (E)

## Earth-moving machinery - Electrical safety of machines utilizing electric drives and related components and systems - Part 2: Particular requirements for externally-powered machines

---

| <b>Contents</b>    |  | <b>Page</b> |
|--------------------|--|-------------|
| Foreword .....     |  | iv          |
| Introduction ..... |  | v           |
| <b>1</b>           | <b>Scope .....</b>   | <b>1</b>    |
| <b>2</b>           | <b>Normative references .....</b>  | <b>1</b>    |
| <b>3</b>           | <b>Terms, definitions and abbreviated terms .....</b>  | <b>1</b>    |
| <b>4</b>           | <b>General requirements .....</b>  | <b>2</b>    |
| 4.1                | General .....  | 2           |
| 4.2                | Special conditions .....   | 2           |
| 4.3                | Supplies .....   | 2           |
| 4.3.1              | AC supplies .....  | 2           |
| 4.3.2              | DC supplies .....  | 2           |
| <b>5</b>           | <b>Protection against electric shock hazards .....</b>   | <b>3</b>    |
| 5.1                | General .....  | 3           |
| 5.2                | Guidance for type of neutral earthing system .....   | 3           |
| <b>6</b>           | <b>Protection against electrical fire hazards .....</b>  | <b>4</b>    |
| <b>7</b>           | <b>Protection against thermal hazards .....</b>  | <b>4</b>    |
| <b>8</b>           | <b>Protection against mechanical hazards .....</b>   | <b>4</b>    |
| <b>9</b>           | <b>Protection against abnormal operation hazards .....</b>   | <b>5</b>    |
| 9.1                | General .....  | 5           |
| 9.2                | Supply conductors .....  | 5           |
| 9.3                | Socket outlets .....   | 5           |
| 9.4                | Protection against supply interruption or voltage reduction and subsequent restoration.<br>5 9.5 Phase sequence protection ..... | 5           |
| 9.6                | Protection against overvoltages due to lightning and to switching surges .....   | 5           |
| <b>10</b>          | <b>Electric power source .....</b>   | <b>6</b>    |
| 10.1               | Incoming supply conductor terminations .....   | 6           |
| 10.2               | Terminal for connection to the external protective earthing system .....   | 6           |
| 10.3               | Protection against unauthorized, inadvertent and/or mistaken connection .....  | 7           |
| <b>11</b>          | <b>Wiring .....</b>  | <b>7</b>    |
| 11.1               | Flexible cables .....  | 7           |
| 11.2               | Conductor wires, conductor bars, and slip-ring assemblies -- Clearances .....  | 7           |
| 11.3               | Connections and routing -- Conductor and cable runs .....  | 8           |
| 11.4               | Connection to moving elements of the EMM .....   | 8           |
| <b>12</b>          | <b>Electric motors .....</b>   | <b>9</b>    |
| 12.1               | Criteria for motor selection or design .....   | 9           |

|             |   |           |
|-------------|---|-----------|
| <b>13</b>   | <b>Non-motor loads .....</b>  | <b>9</b>  |
| <b>14</b>   | <b>Controls .....</b>   | <b>9</b>  |
| <b>14.1</b> | <b>Control circuit supply .....</b>   | <b>9</b>  |
| <b>15</b>   | <b>Manuals and documentation .....</b>  | <b>10</b> |
| <b>15.1</b> | <b>Information to be provided .....</b>   | <b>10</b> |
| <b>15.2</b> | <b>Installation documents .....</b>   | <b>10</b> |
| <b>16</b>   | <b>Marking .....</b>  | <b>11</b> |
| <b>16.1</b> | <b>Marking of equipment .....</b>   | <b>11</b> |
| <b>17</b>   | <b>Tests .....</b>  | <b>11</b> |
|             | <b>Annex A (informative) Enquiry form for electrical equipment of externally-powered machines .....</b> | <b>12</b> |
|             | <b>Bibliography .....</b>   | <b>15</b> |