

# DIN EN 13155:2022-03 (E)

## Crane - Safety - Non-fixed load lifting attachments

---

<b>Contents</b>		<b>Page</b>
European foreword.....		8
Introduction .....		9
<b>1</b> Scope.....		<b>10</b>
<b>2</b> Normative references.....		<b>11</b>
<b>3</b> Terms and definitions .....		<b>12</b>
<b>4</b> List of significant hazards .....		<b>21</b>
<b>5</b> Safety requirements and/or protective measures .....		<b>46</b>
<b>5.1</b> General requirements .....		<b>46</b>
<b>5.1.1</b> General.....		<b>46</b>
<b>5.1.2</b> Mechanical load bearing parts .....		<b>46</b>
<b>5.1.3</b> Controls.....		<b>47</b>
<b>5.1.4</b> Handles .....		<b>47</b>
<b>5.1.5</b> Requirements for slings which are integrated.....		<b>47</b>
<b>5.1.6</b> Stability during storage .....		<b>48</b>
<b>5.1.7</b> Quality of welding.....		<b>48</b>
<b>5.2</b> Specific requirements for each category of attachment .....		<b>48</b>
<b>5.2.1</b> Plate clamps .....		<b>48</b>
<b>5.2.2</b> Vacuum lifters .....		<b>49</b>
<b>5.2.3</b> Lifting magnets.....		<b>50</b>
<b>5.2.4</b> C-hooks .....		<b>52</b>
<b>5.2.5</b> Lifting forks .....		<b>52</b>
<b>5.2.6</b> Lifting beams .....		<b>53</b>
<b>5.2.7</b> Clamps.....		<b>54</b>
<b>5.2.8</b> Lifting insert systems.....		<b>55</b>
<b>6</b> Verification of the safety requirements and/or protective measures.....		<b>56</b>
<b>7</b> Information for use .....		<b>62</b>
<b>7.1</b> Instruction handbook.....		<b>62</b>
<b>7.1.1</b> General information.....		<b>62</b>
<b>7.1.2</b> Specific information .....		<b>63</b>
<b>7.1.3</b> Guidance for maintenance .....		<b>66</b>
<b>7.1.4</b> Verifications and inspections .....		<b>67</b>
<b>7.2</b> Marking.....		<b>67</b>
<b>7.2.1</b> Minimum marking .....		<b>67</b>
<b>7.2.2</b> Additional marking .....		<b>67</b>
<b>7.2.3</b> Additional safety plates .....		<b>68</b>
<b>Annex A</b> (normative) General verification methods .....		<b>69</b>
<b>A.1</b> Verification of mechanical strength by calculation .....		<b>69</b>
<b>A.2</b> Verification of mechanical strength on the type by a static test .....		<b>69</b>
<b>A.2.1</b> Conditions.....		<b>69</b>
<b>A.2.2</b> Procedure.....		<b>69</b>
<b>A.2.3</b> Acceptance criteria.....		<b>69</b>
<b>A.3</b> Verification of mechanical strength on each individual attachment by a static test.....		<b>70</b>

<b>A.3.1</b>	<b>Conditions</b> .....	<b>70</b>
<b>A.3.2</b>	<b>Procedure</b> .....	<b>70</b>
<b>A.3.3</b>	<b>Acceptance criteria</b> .....	<b>70</b>
<b>A.4</b>	<b>Verification by inspection</b> .....	<b>70</b>
<b>A.4.1</b>	<b>Procedure</b> .....	<b>70</b>
<b>A.4.2</b>	<b>Acceptance criteria</b> .....	<b>70</b>
<b>Annex B (normative)</b>	<b>Verification methods for plate clamps</b> .....	<b>71</b>
<b>B.1</b>	<b>No detachment when the load is brought down and in case of impact</b> .....	<b>71</b>
<b>B.1.1</b>	<b>Conditions</b> .....	<b>71</b>
<b>B.1.2</b>	<b>Procedure</b> .....	<b>71</b>
<b>B.1.3</b>	<b>Acceptance criteria</b> .....	<b>71</b>
<b>B.2</b>	<b>Determination of the friction coefficient</b> .....	<b>71</b>
<b>B.2.1</b>	<b>Conditions</b> .....	<b>71</b>
<b>B.2.2</b>	<b>Procedure</b> .....	<b>72</b>
<b>B.2.3</b>	<b>Acceptance criteria</b> .....	<b>73</b>
<b>B.3</b>	<b>No slipping of the load - clamping by friction or penetration</b> .....	<b>73</b>
<b>B.3.1</b>	<b>Procedure</b> .....	<b>73</b>
<b>B.3.2</b>	<b>Acceptance criteria</b> .....	<b>74</b>
<b>B.4</b>	<b>Range of thickness of clamps</b> .....	<b>74</b>
<b>B.4.1</b>	<b>Conditions</b> .....	<b>74</b>
<b>B.4.2</b>	<b>Procedure</b> .....	<b>74</b>
<b>B.4.3</b>	<b>Acceptance criteria</b> .....	<b>74</b>
<b>B.5</b>	<b>Minimum working load</b> .....	<b>74</b>
<b>B.5.1</b>	<b>Conditions</b> .....	<b>74</b>
<b>B.5.2</b>	<b>Procedure</b> .....	<b>74</b>
<b>B.5.3</b>	<b>Acceptance criteria</b> .....	<b>74</b>
<b>Annex C (normative)</b>	<b>Verification methods for vacuum lifters</b> .....	<b>75</b>
<b>C.1</b>	<b>Verification of pressure measuring device</b> .....	<b>75</b>
<b>C.1.1</b>	<b>Conditions</b> .....	<b>75</b>
<b>C.1.2</b>	<b>Procedure</b> .....	<b>75</b>
<b>C.1.3</b>	<b>Acceptance criteria</b> .....	<b>75</b>
<b>C.2</b>	<b>Verification of leakage indicator</b> .....	<b>75</b>
<b>C.2.1</b>	<b>Conditions</b> .....	<b>75</b>
<b>C.2.2</b>	<b>Procedure</b> .....	<b>75</b>
<b>C.2.3</b>	<b>Acceptance criteria</b> .....	<b>75</b>
<b>C.3</b>	<b>Verification of visibility of measuring device or indicator</b> .....	<b>75</b>

C.3.1	Conditions.....	75
C.3.2	Procedure.....	75
C.3.3	Acceptance criteria.....	75
C.4	Verification of devices to compensate for vacuum losses.....	76
C.4.1	Conditions.....	76
C.4.2	Procedure.....	76
C.4.3	Acceptance criteria.....	76
C.5	Verification of warning device.....	76
C.5.1	Conditions.....	76
C.5.2	Procedure.....	76
C.5.3	Acceptance criteria.....	76
C.6	Verification of the non-return valve.....	76
C.6.1	Conditions.....	76
C.6.2	Procedure.....	76
C.6.3	Acceptance criteria.....	76
C.7	Verification of controls.....	77
C.7.1	Conditions.....	77
C.7.2	Procedure.....	77
C.7.3	Acceptance criteria.....	77
C.8	Verification of energy source failure warning system.....	77
C.8.1	Conditions.....	77
C.8.2	Procedure.....	77
C.8.3	Acceptance criteria.....	77
C.9	Verification of the position of the load.....	77
C.9.1	Conditions.....	77
C.9.2	Procedure.....	77
C.9.3	Acceptance criteria.....	77
C.10	Verification of adhesion force by calculation or testing.....	77
C.10.1	General.....	77
C.10.2	Verification by calculation.....	78
C.10.2.1	Procedure.....	78
C.10.2.2	Acceptance criteria.....	78
C.10.3	Verification by testing.....	79
C.10.3.1	Procedure.....	79
C.10.3.2	Acceptance criteria.....	79
C.11	Determination of the friction coefficient.....	79

C.11.1	Conditions .....	79
C.11.2	Procedure .....	80
C.11.3	Acceptance criteria .....	80
<b>Annex D (normative) Verification methods for lifting magnets .....</b>		<b>81</b>
D.1	Verification of tear-off force .....	81
D.1.1	Verification by pull test .....	81
D.1.1.1	Conditions (see Figure D.1): .....	81
D.1.1.2	Procedure .....	82
D.1.1.3	Acceptance criteria .....	82
D.1.2	Verification by flux measurement and calculation .....	82
D.1.2.1	Conditions .....	82
D.1.2.2	Procedure .....	83
D.1.2.3	Acceptance criteria .....	83
D.2	Verification of controls .....	83
D.2.1	Conditions .....	83
D.2.2	Procedure .....	83
D.2.3	Acceptance criteria .....	83
D.3	Verification of back-up and warning devices .....	83
D.3.1	Conditions .....	83
D.3.2	Procedure .....	83
D.3.3	Acceptance criteria .....	83
D.4	Verification of the discharge time of batteries .....	83
D.4.1	Conditions .....	83
D.4.2	Procedure .....	84
D.4.3	Acceptance criteria .....	84
D.5	Verification of indicating devices .....	84
D.5.1	Conditions .....	84
D.5.2	Procedure .....	84
D.5.3	Acceptance criteria .....	84
D.6	Verification of alternative mechanical back-up devices .....	84
D.6.1	Conditions .....	84
D.6.2	Procedure .....	84
D.6.3	Acceptance criteria .....	84
D.7	Verification that the magnet is matched to the intended load(s) .....	85
D.7.1	Procedure .....	85
D.7.2	Acceptance criteria .....	85

<b>Annex E (normative) Verification methods for lifting beams</b> .....	<b>86</b>
<b>E.1 Verification of mechanical strength of each individual lifting beam by static test or live load test</b> .....	<b>86</b>
<b>E.1.1 Conditions</b> .....	<b>86</b>
<b>E.1.2 Procedure</b> .....	<b>86</b>
<b>E.1.3 Acceptance criteria</b> .....	<b>86</b>
<b>E.2 Verification of mechanical strength on the type by a static test</b> .....	<b>86</b>
<b>E.2.1 Conditions</b> .....	<b>86</b>
<b>E.2.2 Procedure</b> .....	<b>86</b>
<b>E.2.3 Acceptance criteria</b> .....	<b>87</b>
<b>E.3 Verification of locking or holding devices by testing</b> .....	<b>87</b>
<b>E.3.1 Conditions</b> .....	<b>87</b>
<b>E.3.2 Procedure</b> .....	<b>87</b>
<b>E.3.3 Acceptance criteria</b> .....	<b>87</b>
<b>E.4 Verification of the locking or holding by calculation</b> .....	<b>88</b>
<b>Annex F (normative) Verification methods for lifting forks</b> .....	<b>89</b>
<b>F.1 Verification of mechanical strength of the secondary positive holding device for lifting forks in horizontal direction</b> .....	<b>89</b>
<b>F.1.1 Conditions</b> .....	<b>89</b>
<b>F.1.2 Procedure</b> .....	<b>89</b>
<b>F.1.3 Acceptance criteria</b> .....	<b>89</b>
<b>F.2 Verification of mechanical strength of the secondary positive holding device for lifting forks in vertical direction</b> .....	<b>89</b>
<b>F.2.1 Conditions</b> .....	<b>89</b>
<b>F.2.2 Procedure</b> .....	<b>89</b>
<b>F.2.3 Acceptance criteria</b> .....	<b>89</b>
<b>Annex G (normative) Verification methods for clamps</b> .....	<b>90</b>
<b>G.1 Determination of the friction coefficient</b> .....	<b>90</b>
<b>G.1.1 Conditions</b> .....	<b>90</b>
<b>G.1.2 Procedure</b> .....	<b>90</b>
<b>G.1.3 Acceptance criteria</b> .....	<b>91</b>
<b>G.2 No slipping of the load – clamping by friction or penetration</b> .....	<b>91</b>
<b>G.2.1 Conditions</b> .....	<b>91</b>
<b>G.2.2 Acceptance criteria</b> .....	<b>92</b>
<b>G.3 Verification of mechanical strength of the secondary positive holding device for clamps in horizontal direction</b> .....	<b>92</b>
<b>G.3.1 Conditions</b> .....	<b>92</b>
<b>G.3.2 Procedure</b> .....	<b>92</b>

G.3.3	Acceptance criteria .....	92
G.4	Verification of mechanical strength of the secondary positive holding device for clamps in vertical direction .....	92
G.4.1	Conditions .....	92
G.4.2	Procedure .....	92
G.4.3	Acceptance criteria .....	92
G.5	Range of thickness of clamps.....	93
G.5.1	Conditions .....	93
G.5.2	Procedure .....	93
G.5.3	Acceptance criteria .....	93
Annex H (normative)	Verification methods for lifting insert systems .....	94
H.1	Verification of the embedment in concrete.....	94
H.1.1	Conditions .....	94
H.1.2	Procedure .....	94
H.1.2.1	General .....	94
H.1.2.2	Failure modes .....	99
H.1.3	Acceptance criteria .....	101
H.1.3.1	General .....	101
H.1.3.2	Normalization of ultimate loads.....	102
H.1.3.3	Concrete failure.....	102
H.1.3.4	Pull-out .....	102
H.1.3.5	Steel failure .....	102
H.1.3.6	Evaluation criteria.....	102
H.2	Individual verifications .....	103
H.2.1	Conditions .....	103
H.2.1.1	General .....	103
H.2.1.2	Factory Production Control (FPC) .....	103
H.2.2	Procedure .....	104
H.2.3	Acceptance criteria .....	104
Annex I (informative)	Selection of a suitable set of crane standards for a given application.....	105
Annex ZA (informative)	Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC aimed to be covered.....	107
Bibliography	.....	112