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Cranston Specification #CS-001

Pulp bale unitizing & unit handling using multiple wire strands

Reprint
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1.0 The purpose of this specification:

Is to define the requirements for the use of the Cranston system of unitizing and handling cellulose pulp bales in units.

2.0 The Cranston system:

An integrated system of unitizing and hoisting equipment optimized for reliability, ease of use and cost of operations. The system was originally developed by Cranston Machinery during the early 1970's and Cranston was instrumental in gaining approval by many of the countries involved in importing & exporting pulp. Over the years changes have been made in types of equipment used and regulations within various countries covering the safe transport of unitized cargo. The system is now the international standard.

The original Cranston system included the automatic Unitizer for the consistent quality application of multiple round steel wires to the pulp bale units, the *Uni-Lift* manually attached hoisting gear and the *Crest-Lift* remotely controlled hoisting gear. Because of advancement of equipment and methods for transporting unitized cargo, few of the original systems are in use today. Cranston machinery still makes the automatic Unitizer, manually attached hooks and grouping frames. However, cargo that has been unitized by a Cranston Unitizer may be used with hoisting gear made by other manufacturers as long as the method and equipment has been approved by the local authorities having jurisdiction for the port of import or export.

3.0 Unitizer requirements:

The multiple round steel wires must be applied to the pulp bale unit by a Cranston Unitizer or similar machine in accordance with the following specifications:

3.1 The wire must be certified by the manufacturer as suitable for unitizing and in compliance with applicable local and industry standards.

3.2 Each strand of wire applied around the unit must have its own joint or closure at the bottom of the unit and must be independent of the others.

3.3 The joint or closure must be of the twisted type and must have a minimum breaking strength equal to 90% of the minimum wire strength.

3.4 The minimum breaking strength of the combined wires applied to the unit must conform to Schedule 4.5.

3.5 Each pulp bale unit must be marked according to the regulations of the governing authority.

3.6 A wire sample and a twisted joint sample shall be checked a minimum of once every eight hour operating span and at every change of machine wire supply to insure the standards required to comply with Article 3.3 and Article 4 are met.

3.7 The proper safety factor for the wire strapping is selected on the basis of the hoisting method to be used by the shipper and the requirements of the countries from and to which the units are shipped. **The most rigid safety factor must apply.** A guide to the requirements of a few selected countries is listed in Table 3.8. The safety factor requirement for any country not listed may generally be obtained from the shipper. The proper wire requirements can then be determined by reference to Schedule 4.5.

Table 3.8 Safety Factor for Selected Countries

Australia	4
Canada	3.5 & 4*
Germany	4
Netherlands	4
Sweden	4
United Kingdom	3.5
United States	3.5

*Safety factor of 4 required for units to be exposed to more than one lift. Always check with local authorities regarding required strapping safety factor.

4.0 Wire Specifications:

The multiple round steel wires applied must conform to the following specifications: (This is a simplified specification and does not relate to actual metallurgy or chemistry of the wire - see actual specifications from wire manufacturer.)

4.1 Wire must be galvanized or zinc coated to resist corrosion. (Coatings may be used in the manufacture and coiling of the wire. Excessive slippery coatings cannot be used in unitizing as they result in inefficient joint strength.)

4.2 Wire must have a minimum of 7% elongation in 10 inch (250mm) gauge length.

4.3 Wire tensile strength must be between 140,000 and 170,000 psi (100 to 120 Kg/mm^2). (Generally considered hi-tensile steel wire.)

4.4 The wire to be used must actually be tested in the unitizing machine to assure that the proper joint can be consistently developed by the machine.

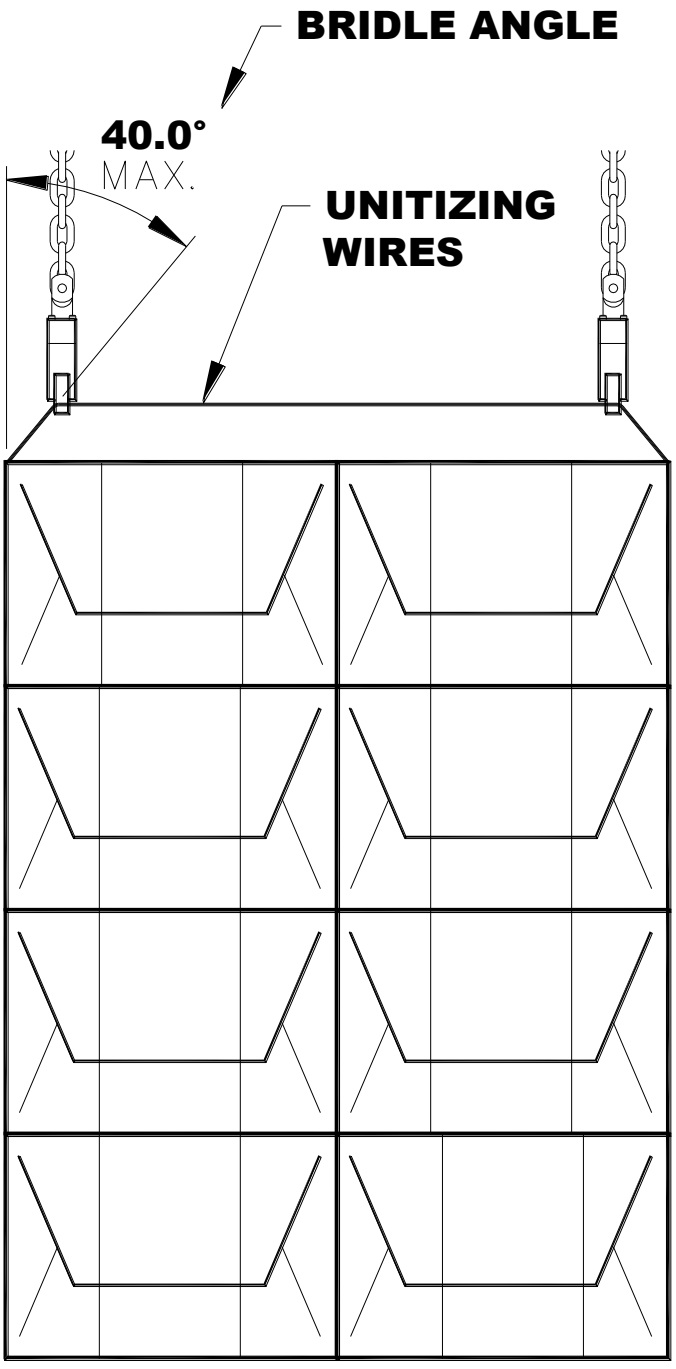
4.5 The number, size and minimum breaking strength of the wires applied to the pulp bale unit must conform to the requirements of Table 3.8 and Schedule 4.5.

Schedule 4.5 Combined Wire Strength Requirement

Safety factor	Minimum combined wire breaking strength
4	Unit Weight x 2.611
3.5	Unit Weight x 2.284
3	Unit Weight x 1.958

Notes to Schedule 4.5

1. Strength determined by F = (Unit Weight ÷ 2) x Secant of maximum bridle angle x safety factor.
2. Factors based on maximum bridle angle of 40°.
3. Secant maximum bridle angle taken as 1.305.
4. See figure on next page for illustration of bridle angle.


BRIDLE ANGLE
40.0°
MAX.
UNITIZING
WIRES

4.6 Allowable individual wire breaking strength should be based on the values listed in Table 4.6A or 4.6B.

Table 4.6A - Breaking Strength of Individual Wire in Pounds (#'s)
(Wire gauge below refers to American Steel & Wire Co. gauge system or same as Washburn & Moen)

Gauge	Size (Inch)	Area ($Inch^2$)	Minimum Tensile Strength (1000 psi)				
			140	145	150	155	160
12	.1055	.0087	1224	1268	1311	1355	1399
11-3/4	.109	.0093	1306	1353	1400	1446	1493
11-1/2	.113	.0100	1404	1454	1504	1554	1605
11-1/4	.117	.0108	1505	1559	1613	1666	1720
11	.1205	.0114	1597	1654	1711	1768	1825
10-3/4	.124	.0121	1691	1751	1811	1872	1932
10-1/2	.128	.0129	1802	1866	1930	1995	2059

Table 4.6B - Breaking Strength of Individual Wire in Kilograms

	Size (mm)	Area (mm^2)	Minimum Tensile Strength (Kg/mm^2))				
			100	105	110	115	
	2.6	5.31	531	557	584	611	
	2.7	5.73	573	601	630	658	
	2.8	6.16	616	647	677	708	
	2.9	6.61	661	694	727	760	
	3.0	7.07	707	742	778	813	
	3.1	7.55	755	793	830	868	
	3.2	8.04	804	844	885	925	

4.7 Application and Example of CS.001 Requirements

The key wire requirement of CS.001 is embodied in Sections 3.4, 4.5, & Schedule 4.5. The minimum combined breaking strength of all the wires applied to the unit for lifting must equal or exceed a value based on the weight of the unit to be lifted.

Given the weight of the pulp unit produced and the required Safety Factor, the number and size of wire straps can then be selected based on the availability of local wire supply and unitizing equipment. With reference to Section 4.3 and Tables 4.6A and 4.6B, it must be noted that the wire size and number of wires must be based on the minimum breaking strength and tensile strength to be encountered. It is unreasonable to assume that a wire drawing mill will always be able to supply product at the nominal point in the tensile strength range, and it is also unreasonable to determine the wire application parameters based on the actual values of each individual coil of wire. Therefore, the selection must be made on the minimum value guaranteed by the wire supplier.

Based on the minimum breaking strength of the wire determined from Table 4.6 and the number of wires used, a minimum acceptable knot strength is determined according to Section 3.3. A common error in interpretation of CS-001 is that the knot strength determined by Section 3.3 somehow refers to the actual wire strength. It does not. The value determined is a fixed value based on the minimum breaking strength of the wire. The value remains as a constant reference value for checking the knot strength year in and year out.

The following example should help to clarify the statements above: Given a unit weight of 2000 Kg and a required Safety Factor of 3.5, the minimum combined strength of the lifting wires must equal or exceed (2000 x 2.284) 4568 Kg. (ref. Schedule 4.5)

Assuming quality wire meeting the specifications of CS-001, Sections 4.0, 4.1, 4.2, and 4.3 is available with a nominal tensile strength of 115 Kg/mm^2 and a guaranteed minimum tensile strength of 110 Kg/mm^2, then the number of wires required can be determined from Table 4.6B. Selecting 6 wires for the application yields a minimum single wire knot strength of ((4568/6) / .9) 846 Kg. Reading down the column headed 110 in Table 4.6B indicates a wire diameter of 3.2 mm. An alternative selection of 7 wires yields a minimum knot strength of ((4568/7) / .9) 725 Kg and a wire diameter of 2.9 mm.

If 6 wires are used, the minimum allowable knot strength of each wire must be 846 Kg. If 7 wires are used the minimum allowable knot strength of each wire must be 725 Kg. These are the values that are used for knot testing to verify adequate lifting capacity

5.0 Suggested Instructions for Stevedores and Longshoremen:

5.1 When using the Cranston System, it is forbidden to stand under or near a hanging unit, and those individuals not directly involved with the handling are restricted from the area in which the load will pass.

5.2 When using the Cranston System, all hook fitters must be clear of the load before lifting of the unit commences. Likewise, all individuals must stand clear until the load is relieved from the hooks and is completely at rest. (Crane or load may swing or shift without warning).

5.3 When loading or unloading, only one crew is to work in a cargo space unless work areas are properly guarded to confine multiple crews to their own work area.

5.4 When using the Cranston System, any unit with missing or damaged lifting wires must be lifted with extreme caution and can be lifted out with a wire rope sling.

5.5 Sudden acceleration and braking must absolutely be avoided when lifting or lowering with the Cranston System. Cranes which permit “free-running” lowering of the load are not permitted to be used.

5.6 All clamp or fork trucks used for transporting the pulp bale units must have the clamp or fork devices prepared so that damage to the unit lifting wires does not occur.

5.7 When lift trucks are used, the truck must not be set in motion until the unit has been lifted clear of the quay or floor. Likewise, the unit must not be lowered until truck motion has been entirely stopped. The bottom of the unit must not be rubbed or scuffed since this may result in damage to the lifting wires and their joints.

5.8 Transporting the unit by inserting fork truck forks under the lifting wires is forbidden.

5.9 Cranston Machinery has no responsibility for the tools or crews used or activities of individuals involved in attaching or releasing units to or from a crane, truck, dock or warehouse. Local regulations and safety precautions must be followed.

6.0 Quality Control:

In most cases, a test certificate shall be prepared by the person responsible for the unitizing of the cargo and a copy of the certificate shall accompany the units. Various carriers, ports or countries may have different formats for the certificate as well as the information it must contain. Typical information required is:

- Name and address of unitizing facility.
- The identifying mark that is stamped on each unit which provides a means of identifying the company, the mill, the Unitizer, the wire manufacturer and date of wire production.
- Maximum weight of each unit.
- General description, i.e., eight bale unit, pulp, unitized for bridle lift.
- Number of wires on each unit and minimum breaking strength of the individual wire.
- The safety factor developed by the applied unit wire group.

This publication is a general guideline and is not intended nor published as a safety specification. Refer to local regulations and authorities.