

Wire rope inspection sheet: CSA Z150:26

One rope per sheet. How to fill it in: page 4. Mark ✓ nothing found, X found (write where and what), N/A does not apply. **Free analysis:** send us a photo of the completed sheet for a same-day response (page 2).

Date	Inspection type (codes: page 4)	Hours (machine or rope)	Inspector (print)	Trolley distance (m) or boom angle (°)	Hook height (m) and hook load
Customer / owner	Site / location	Crane make	Crane model	Serial number	Unit number
Winch number	Winch duty (main hoist, aux, boom hoist, trolley)	Rope length (m / ft)	Nominal diameter d (mm)	Construction (e.g. 6x36 WS)	Core (IWRC, WSC)
Lay (ordinary / regular or Lang, direction)	Grade / finish	OEM specified breaking force (crane manual, not the mill cert)	Minimum breaking force (mill cert)	Date installed	Certificate number
Rope manufacturer / supplier	Drum: single or multi-layer	Sheaves: steel or synthetic	Load-bearing wires in outer strands (n)	Rotation-resistant category	

Your limits for this rope (how to work them out: page 6; tables: page 8)

Broken wires: sections of rope working in steel sheaves and/or spooling on a single-layer drum	Broken-wire limit (reached or exceeded: removal): over 6d _____ over 30d _____	Tables 2 / 3
Broken wires: sections of rope spooling on a multiple-layer drum (crossover zones and wrap interference)	Broken-wire limit (reached or exceeded: removal): over 6d _____ over 30d _____ (N/A if single-layer)	Tables 2 and 3, footnote ‡
Diameter loss limit (Table 4, % of nominal d below dref): tick your rope	☐ IWRC, 6 strands or less, 19 class: more than 5.0% ☐ IWRC, over 6 strands, 36 class: more than 2.5% ☐ IWRC, 6 strands or less, 36 class: more than 4.0% ☐ Rotation-resistant (all): more than 3.5% ☐ IWRC, over 6 strands, 19 class: more than 3.5%	5.5.4.2 d)
Your minimum diameter = dref - (% x nominal d)	_____ mm	Table 4
Sheave grooves	Rope nominal Ø (d): _____ mm Manufacturer's groove limit (if none: rope manufacturer's or applicable standards): _____ mm (5.5.6.1.2) Design range d x 1.06 = _____ to d x 1.10 = _____ mm (4.7.5.1) Pitch Ø at least 15 d boom hoist / 18 d load hoist / 16 d load block (4.7.6)	

Reference diameter dref (measured after break-in, on rope not subjected to bending or wear; copy it from the logbook, do not re-measure):

_____ mm, measured at _____ m from the _____ end on (date) _____. D1 _____ mm, D2 _____ mm, averaged (CRS practice).

1. Diameter: D1 and D2 at right angles, average (D1 + D2) / 2 (averaging: CRS practice)

#	Measured at	D1 (mm)	D2 (mm)	Average (mm)
1.1	_____ m from the _____ end			
1.2	_____ m from the _____ end			
1.3	_____ m from the _____ end			
1.4	_____ m from the _____ end			
1.5	_____ m from the _____ end			
1.6	_____ m from the _____ end			

3. Other measurements

	Check	Reading	Where (m from which end)
3.1	Lay length (mm), same place each time (CRS practice)		

Notes



2. Broken wires: one line for every broken wire or group you find

	Where (m from which end)	Zone SH or ML	Ø at this spot D1 / D2 (mm)	Broken wires in 6d	Broken wires in 30d	Breaks within 6d of an end connection	Outer wires broken at the core	Notes
2.1	___ m from the ___ end		/					
2.2	___ m from the ___ end		/					
2.3	___ m from the ___ end		/					
2.4	___ m from the ___ end		/					
2.5	___ m from the ___ end		/					
2.6	___ m from the ___ end		/					

Zone SH: rope working in steel sheaves and/or spooling on a single-layer drum. Zone ML: multiple-layer drum, for deterioration at the cross-over zones and interference between wraps due to fleet angle effects, not sections of rope which only work in sheaves and do not spool onto the drum (Tables 2 and 3, footnote ‡). Outer wires broken at the core: outer wires broken where they touch the core, seen as a wire or loop sticking out (5.5.4.2 c)). Ø at this spot: D1 and D2 measured where the breaks are, so the diameter and the breaks at the same spot are judged together (CRS practice). Broken-wire limits: page 1.

	Check	✓ / X / N/A	If X: where and what
4. Rope condition			
4.1	Broken wires very close together (local grouping)		
4.2	Rotation-resistant rope: local core deterioration		
4.3	Waviness		
4.4	Strand extrusion or wire extrusion		
4.5	Kinks or tightened loops		
4.6	Crushing		
4.7	Birdcaging		
4.8	Bends or other distortion (unstranding, main-strand displacement, core protrusion)		
4.9	Heat damage		
4.10	Electric arcing		
4.11	Contact with high-voltage lines		
4.12	Rope length on the drum		
4.13	Local increase in diameter		
4.14	Unevenness of outer strands		
4.15	General corrosion		
4.16	Broken or cut strands		
4.17	Wear		
4.18	Reeving as the crane and rope makers recommend		
4.19	Ambient temperature above 82 °C (180 °F)		
4.20	Lubrication condition		

	Check	✓ / X / N/A	If X: where and what
4.21	Rope test (magnetic rope test or other non-destructive test), if one was done: date and result (CRS practice)		
5. Rope ends and drum and block			
5.1	Corroded or broken wires at or near terminal ends		
5.2	Rope at the wedge socket		
5.3	Rope spooled in the lower drum layers		
5.4	Drum flange points, crossover points, repetitive pickup points		
5.5	Drum cracked, worn or deformed		
5.6	Hook and dead-end lug: magnetic particle inspection		
5.7	Hook: cracks, throat opening, twist		
5.8	Hook: corrosion, gouging, deformation		
5.9	Hook nut: corrosion, deterioration, loose set screws		
5.10	Dead-end attachment lug: cracks, wear, damage		
5.11	Block sheaves: alignment (bearing clearance), free movement, nicks, cracks		
5.12	All bolts tight and undamaged; safety latch works		
5.13	Weight and rated load capacity posted on a plate or permanent marking		

6. Sheaves: one line per sheave (groove gauges: page 9; groove limits: page 1)

	Sheave (which one)	Groove Ø (mm) or gauge OK / not OK (5.5.6.1.2)	Groove wear: general or uneven wear, flat spots (5.5.6.1.1); negative impressions (CRS practice): ✓ / X	Flange: chips or damage (5.5.6.1.4); broken, deformed or cracked (5.5.6.3): ✓ / X	Bearing: freewheeling, no excessive play (5.5.6.1.5): ✓ / X	If X: where and what
6.1						
6.2						
6.3						
6.4						
6.5						

Location of defects, repairs, reinspection findings (5.3.5.2.2 a))	Next periodic / next annual due (annual: end of the same month next year, 5.3.5.1 c))	Competent person: name and signature (5.3.5.2.2 e))	Date
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Wire rope inspection: CSA Z150:26

A free inspection sheet and guide from Crane Rope Solutions. It shows what CSA Z150:26 asks you to check and record, and how to record it. One rope per inspection sheet.

How to use this guide

1. Work out your limits for this rope once (page 6) and write them at the top of page 1.
2. Inspect the rope and fill in the inspection sheet, pages 1 and 2. How to fill it in: page 4. A filled-in example is on pages 10 and 11.
3. Send us a photo of the completed sheet for a free analysis (below).

WHO

Periodic and annual rope inspections: a competent person (5.5.3.2, 5.5.3.3, 5.3.5.2.1).

WHEN

Daily: rope reeving shall be inspected daily and observed during operation (5.3.3.1 a)); ropes in use watched every working day, especially attachments and end fittings (5.5.2.1, should). Periodic rope inspection: should be at least monthly (5.5.3.1). Crane periodic: as the manufacturer specifies or every 500 h, at least every 6 months (5.3.2.2 b)). Annual: by the end of the same month the next year (5.3.5.1 c)). Also: rope idle over a month, after an incident that might have damaged the rope or its termination, first use of a newly acquired crane (5.5.3.6, 5.3.2.1).

HOW MUCH ROPE

Periodic: the accessible length of rope (5.5.3.2). Annual: the entire length (5.5.3.3).

Have on hand

- The reference diameter and rope length recorded in the logbook when the rope was installed (5.5.1, shall).
- Rope details from the certificate: nominal diameter, construction, core, lay, and the load-bearing outer wires for Table 2 or Table 3 on page 8.
- The crane logbook, showing the periodic inspections since the last annual (5.3.5.2.1 e)).

Look closely at these areas (5.5.3.4)

- Sections at saddles, equalizer sheaves or other sheaves where rope travel is limited
- At or near terminal ends where corroded or broken wires might protrude
- Near the wedge socket: if damage is suspected, the wedge socket shall be taken apart to inspect the hidden rope, then put back together by a competent person (5.5.3.4 c))
- Sections subject to reverse bends
- Sections normally hidden: over sheaves and in the lower drum layers



Send it to us: free analysis, same-day response

When you finish the sheet, take a clear photo of both pages and text it to **604-813-WIRE (9473)** (scan the code), or email it to **dean@craneropesolutions.com**. Add photos of anything you marked X, with a tape or ruler in the frame. We send back our analysis the same day.

A photo review is advice only. It does not replace the inspection the standard requires; the decision stays with the competent person.

CSA Z150:26, Safety code on mobile cranes. Clause numbers in brackets point to the standard. Text marked Crane Rope Solutions (CRS) practice is our method, not the standard.



How to fill in the inspection sheet

1 Top of page 1: the inspection, crane and rope

- Date, inspection type (codes below), hours, your name, and the crane set-up at the time: Z150 covers mobile cranes: write the boom angle (trolley distance only if the crane has a trolley). Hook height and hook load (none, block only, or tonnes). Set the crane up the same way each time if you can, so the same part of the rope sits at your points (CRS practice).
- Rope details from the mill certificate (size, construction, core, lay, grade, minimum breaking force) and the crane manual (OEM specified breaking force).

2 Your limits (page 1)

- Work them out once for this rope with page 6 and copy them onto each new sheet.

3 Section 1: diameter

- The rope shall be replaced where the loss of diameter is greater than Table 4 at any location (5.5.4.2 d)). Take two readings at right angles and average them, using calipers with jaws wide enough to span at least two strands (CRS practice).
- Measure across the tops of the strands, not into the gaps (CRS practice).
- Choose points you can find again (areas to look at: page 3), including the place with the smallest diameter you can find.
- For each point, write how far along the rope it is from the drum end or from the dead end (picture on page 5). Measure the distance with a tape measure, or read it from a rope counter, and mark the spot on the rope with a paint pen so the next inspection measures the same place (CRS practice).
- Reference diameter dref: measured on a section of rope that has not been subjected to bending, wear or other significant cross-sectional deformation or degradation, taken after break-in (Table 4 Note). Record dref and the rope length in the logbook at installation (5.5.1, shall).

4 Section 2: broken wires

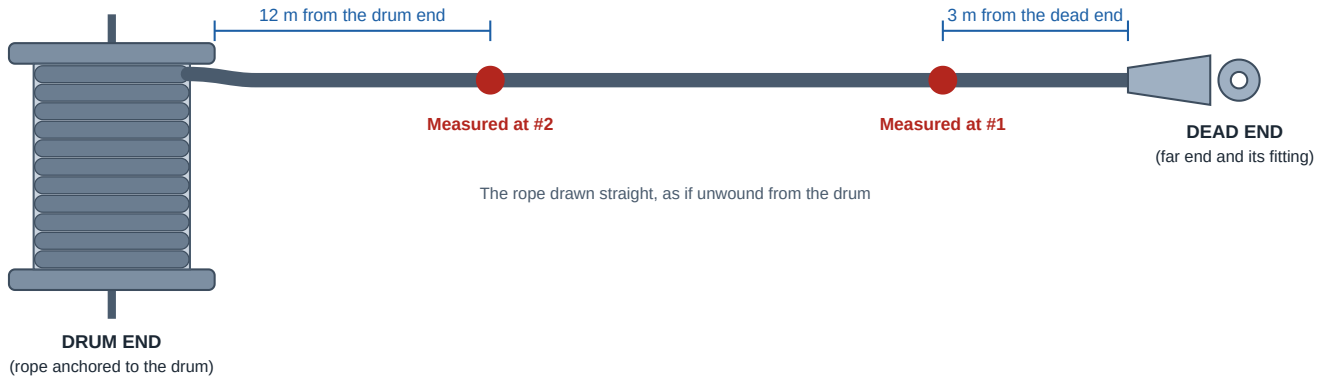
- Look along the rope this inspection covers (page 3). Write one line for every broken wire, or group of broken wires, that you find, and mark each spot on the rope with a paint pen (CRS practice).
- For each line, write how far along the rope it is from the drum end or the dead end. In each count column, write the most broken wires in any 6d length, and in any 30d length, that includes this spot. 6d and 30d mean 6 or 30 times the nominal diameter d: for a 28 mm rope, 168 mm and 840 mm.
- Zone SH: rope working in steel sheaves and/or spooling on a single-layer drum. Zone ML: multiple-layer drum, for deterioration at the cross-over zones and interference between wraps due to fleet angle effects, not sections of rope which only work in sheaves and do not spool onto the drum (Tables 2 and 3, footnote ‡). Outer wires broken at the core: outer wires broken where they touch the core, seen as a wire or loop sticking out (5.5.4.2 c)).
- On every line, also measure D1 and D2 at that spot, the same way as section 1, and write them in the Ø column, so the diameter and the breaks at the same spot are judged together (CRS practice).
- Write ML only for breaks at a crossover zone or where wraps interfere; otherwise write SH. Breaks grouped in one or two neighbouring strands: also mark row 4.1.

Inspection type codes

D daily (5.3.3) P periodic: rope at least monthly (should, 5.5.3.1); crane as the manufacturer specifies or every 500 h, but at least every 6 months (5.3.2.2 b)) A annual (5.3.5) O other: idle over a month, after an incident that might have damaged the rope, first use (5.5.3.6, 5.3.2.1)



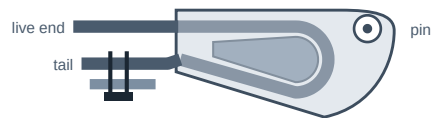
Finding your points again



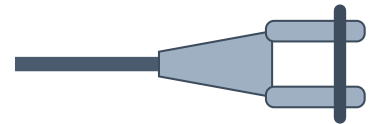
Common dead-end fittings (Crane Rope Solutions illustration)



Button (swaged or poured)



Wedge socket



Open spelter socket (pin through the jaws)

5 Sections 3 to 6: everything else

- Measurements: write the reading and where. Checks: mark ✓ nothing found, X found, N/A does not apply. For every X, write where it is (m from which end, or which part) and what you found in the same row.
- Corrosion (row 4.15): write where it is and what you see, for example light surface rust, rough to touch, pitted wires, or rust coming from between the strands (CRS practice).
- Sheaves (section 6): one line per sheave, named so you can find it again (for example "Boom tip 2"). Groove: write the groove diameter in mm, or OK / not OK from a go / no-go gauge (page 9). Then mark ✓ or X for groove wear, flange and bearing as the column headings say, and for every X write what and where in the last column. Negative impressions: the pattern of the rope's strands pressed or worn into the groove.

6 Sign and send

- Sign or initial, write the next inspection due, and send us a photo of both pages for a free analysis and a same-day response.



Your limits from CSA Z150:26

Work these out once for each rope and write them on page 1. Then the rules below tell you what each finding means. **FAIL** the standard says (shall) the rope or that part comes out of service, or the item must be put right. **SHOULD** the standard recommends (should) it; the competent person decides (Crane Rope Solutions practice). **EVALUATE** no fixed limit; the competent person judges it; for rotation-resistant rope diameter loss, a qualified person reviews it (5.5.4.2 e)). Rows not listed are for the record only.

A. Broken-wire limits

- Round strand ropes use Table 2; rotation-resistant and non-rotating ropes (ASTM A1023 Category I and II) use Table 3 (page 8). Both apply to rope on steel sheaves and drums (5.5.4.2).
- Find your construction in the "Example constructions" column, or count n: the load-bearing wires in the outer strands, leaving out filler wires.
- Table 2: pick regular or Lang lay. Write the broken-wire limits over 6d and over 30d for rope working in steel sheaves and/or spooling on a single-layer drum. Multiple-layer drum: also write the broken-wire limits from the multiple-layer drum columns. Those apply only at the cross-over zones and where wraps interfere due to fleet angle effects (Tables 2 and 3 footnote).
- Example: 6x36WS, regular lay, single-layer drum (row 201 to 220): 9 broken wires over 6d and 18 over 30d.

B. Minimum diameter

- Tick your rope type on page 1 (Table 4). The % is of the nominal diameter d.
- Minimum diameter = dref - (% x nominal d). The rope fails when the loss is greater than the table value (5.5.4.2 d)).
- Example: 20 mm IWRC rope, 6 strands, 36 class: more than 4.0%. dref 20.8 mm. 4.0% of the nominal 20 mm = 0.8 mm. Minimum = 20.8 - 0.8 = 20.0 mm. A reading below 20.0 mm fails.
- Rotation-resistant rope: any loss of diameter also goes to a qualified person (5.5.4.2 e)). It can deteriorate from the inside out (5.5.2.2 Note).

C. Other limits

- Other Z150 numbers: more than 1 broken wire within 6d, or more than 2 beyond 6d, of an end connection (should: remake the termination or replace the rope); 2 or more outer wires broken at the core contact point (shall replace); the 6% to 10% groove radius design range (4.7.5.1; in service use the manufacturer's limits, 5.5.6.1.2); the 15 d / 18 d / 16 d sheave sizes. Any waviness, kink, birdcage, crushing or other distortion fails (5.5.4.2 f)).
- Tables 2 and 3 apply to rope on steel sheaves and drums. For other sheave materials, get the broken-wire limits from a qualified person and the sheave, drum or crane manufacturer (5.5.4.2, should); synthetic sheaves can hide internal breaks (5.5.4.2 Note).

D. Rules for the sheet rows

Row	Check	Rule	Clause
1.1 to 1.6	Each average diameter	FAIL Below your minimum diameter (page 1): loss greater than Table 4	5.5.4.2 d)
1	Rotation-resistant rope: any loss of diameter (likely with a lengthened lay, Note)	EVALUATE Could mean core failure: a qualified person shall review it	5.5.4.2 e)
2	Most broken wires in any 6d. Sections of rope working in steel sheaves and/or spooling on a single-layer drum (wire breaks randomly distributed)	FAIL Reaches or exceeds the broken-wire limit over 6d (page 1)	Tables 2, 3
2	Most broken wires in any 30d. Sections of rope working in steel sheaves and/or spooling on a single-layer drum (wire breaks randomly distributed)	FAIL Reaches or exceeds the broken-wire limit over 30d (page 1)	Tables 2, 3
2	Most broken wires in any 6d. Sections of rope spooling on a multiple-layer drum (at the crossover zones and where wraps interfere due to fleet angle effects)	FAIL Reaches or exceeds the multi-layer drum broken-wire limit over 6d (page 1)	Tables 2 and 3, footnote
2	Most broken wires in any 30d. Sections of rope spooling on a multiple-layer drum (at the crossover zones and where wraps interfere due to fleet angle effects)	FAIL Reaches or exceeds the multi-layer drum broken-wire limit over 30d (page 1)	Tables 2 and 3, footnote
2	Broken wires within 6d of an end connection	SHOULD More than 1: remake the termination where possible, or replace the rope	5.5.4.2 b)
2	Broken wires in sections beyond 6d of an end connection	SHOULD More than 2: remake the termination where possible, or replace the rope	5.5.4.2 b)
2	Outer wires broken at the core contact point (protruding wire or loop)	FAIL 2 or more	5.5.4.2 c)
4.1	Broken wires very close together (local grouping)	SHOULD Discard; also when in a length under 6d or in one strand, even below the table numbers	5.5.4.2 a)
4.2	Rotation-resistant rope: local core deterioration	EVALUATE Immediate-hazard item: evaluate against 5.5.4	5.3.3.1 a) vii)
4.3	Waviness	FAIL Any (Figure 1)	5.5.4.2 f)
4.4	Strand extrusion or wire extrusion	FAIL Any	5.5.4.2 f)
4.5	Kinks or tightened loops	FAIL Any	5.5.4.2 f)
4.6	Crushing	FAIL Any	5.5.4.2 f)



Row	Check	Rule	Clause
4.7	Birdcaging	FAIL Any	5.5.4.2 f)
4.8	Bends or other distortion (unstranding, main-strand displacement, core protrusion)	FAIL Any distortion	5.5.4.2 f), 5.3.3.1 a) i)
4.9	Heat damage	FAIL Any evidence of heat damage, from any cause	5.5.4.2 g)
4.10	Electric arcing	EVALUATE Immediate-hazard item: evaluate against 5.5.4; from contact with high-voltage lines, see the next row	5.3.3.1 a) ix)
4.11	Contact with high-voltage lines	SHOULD Any contact that can pass current through the rope: replace	5.5.4.2 h)
4.12	Rope length on the drum	FAIL Below the crane manufacturer's minimum for that drum	5.5.4.2 i)
4.13	Local increase in diameter	EVALUATE Immediate-hazard item: evaluate against 5.5.4	5.3.3.1 a) ii)
4.14	Unevenness of outer strands	EVALUATE Immediate-hazard item: evaluate against 5.5.4	5.3.3.1 a) iii)
4.15	General corrosion	EVALUATE Immediate-hazard item: evaluate against 5.5.4	5.3.3.1 a) iv)
4.16	Broken or cut strands	EVALUATE Immediate-hazard item: evaluate against 5.5.4	5.3.3.1 a) v)
4.17	Wear	EVALUATE Immediate-hazard item; loss beyond Table 4 fails on the diameter pages	5.3.3.1 a) viii)
4.18	Reeving as the crane and rope makers recommend	EVALUATE Competent person decides	5.3.3.1
4.19	Ambient temperature above 82 °C (180 °F)	EVALUATE Rope maker shall be consulted	4.7.2.6
4.20	Lubrication condition	SHOULD Wire rope should be maintained in a well-lubricated condition	5.5.5.5
5.1	Corroded or broken wires at or near terminal ends	EVALUATE Evaluate against 5.5.4 (end-connection rows in section 2 of the sheet, rules: page 6)	5.5.3.4 b)
5.2	Rope at the wedge socket	EVALUATE Damage suspected: the socket shall be taken apart, the hidden rope inspected, and put back together by a competent person	5.5.3.4 c)
5.3	Rope spooled in the lower drum layers	EVALUATE Evaluate against 5.5.4	5.5.3.4 e)
5.4	Drum flange points, crossover points, repetitive pickup points	EVALUATE Evaluate against 5.5.4	5.5.2.2
5.5	Drum cracked, worn or deformed	EVALUATE Competent person decides	5.3.4.1 c)
5.7	Hook: cracks, throat opening, twist	FAIL Any crack, more than the normal throat opening, or any twist out of the plane of the unbent hook: remove from service and destroy	5.3.3.3
5.8	Hook: corrosion, gouging, deformation	EVALUATE Competent person decides	5.3.5.2.3 a) i)
5.9	Hook nut: corrosion, deterioration, loose set screws	EVALUATE Competent person decides	5.3.5.2.3 a) ii)
5.10	Dead-end attachment lug: cracks, wear, damage	EVALUATE Competent person decides	5.3.5.2.3 a) iii)
5.11	Block sheaves: alignment (bearing clearance), free movement, nicks, cracks	EVALUATE Any crack in a sheave: FAIL, remove it (5.5.6.3)	5.3.5.2.3 b)
5.12	All bolts tight and undamaged; safety latch works	EVALUATE A hazard is fixed before use	5.3.5.2.3 c), d)
5.13	Weight and rated load capacity posted on a plate or permanent marking	EVALUATE Not conspicuously posted on a plate or other permanent marking: put right	5.3.5.2.3 e)

E. Sheaves (section 6)

FAIL Broken or deformed flange, or a crack anywhere in the sheave: remove the sheave from service (5.5.6.3).

EVALUATE Groove outside the manufacturer's limits (or, if none, the rope manufacturer's or applicable standards') (5.5.6.1.2). A worn or damaged groove may be restored only if the sheave manufacturer approves (5.5.6.2). Design reference: groove radius 6% to 10% over the nominal rope radius (4.7.5.1).

EVALUATE General wear, uneven wear, groove radius, flat spots (5.5.6.1.1); flange chips or damage (5.5.6.1.4); bearings freewheeling, no excessive play (5.5.6.1.5); sheave compatible with the rope (5.5.6.1.3).

FAIL Aluminum sheave used with steel wire rope (4.7.5.3).

When: Inspect sheaves before a new rope goes on, when the rope wears early, and whenever damaged or broken wires are found (5.5.6.1.1).

F. After the inspection

Limit reached: Remove the rope from service when a replacement criterion is met (5.5.3.7, 5.5.4.2, shall); the crane should stay out of service until it is replaced (5.5.4.1). Note any deterioration causing appreciable strength loss and determine whether further use is a hazard (5.5.3.2).

Corrective actions: Every deficiency is examined; a hazard is repaired before the crane returns to service (5.3.3.2, shall). Unsafe conditions found by inspection are corrected before operation resumes (5.4.3.1, shall). Cutting back at the drum end needs a logbook entry (5.5.5.6 d)); wedge socket shortening should be logged (5.5.5.7).

Records: A dated report of rope condition covering the 5.5.3.4 points, kept on file (5.5.3.8). The annual mechanical report states the rope was inspected per 5.5.3 (5.3.5.2.2 c)). Keep a copy of every inspection report in the crane logbook (5.3.5.1 d)). Periodic results should go in the operator's crane log (5.5.3.1). When rope is cut off, the length removed should be recorded in the logbook (5.5.1). A long-term inspection program should include records of examination of ropes removed from service (5.5.4.1). New rope: dref and rope length in the logbook (5.5.1).



How many broken wires reach the limit?

1) Find your construction in the example column, or count n: the load-bearing wires in the outer strands, leaving out filler wires. 2) Read the broken-wire limit for your lay and the length counted over (6d or 30d). Multi-layer columns are only for crossover zones and where wraps interfere due to fleet angle effects. Reaching or exceeding that limit is a removal criterion: the rope shall be removed from service (5.5.4.2, 5.5.3.7). d = nominal rope diameter. A broken wire has two ends and counts once.

Table 2: round strand ropes working in steel sheaves

Load-bearing outer wires (n)	Example constructions	Steel sheaves and/or single-layer drum				Multi-layer drum	
		Regular lay		Lang lay		Regular and Lang	
		6d	30d	6d	30d	6d	30d
Under 50	6x7, 7x7	2	4	1	2	4	8
51 to 75	6x19S	3	6	2	3	6	12
76 to 100	6x21F	4	8	2	4	8	16
101 to 120	6x25F, 8x19S	5	10	2	5	10	20
121 to 140	9x19S	6	11	3	6	12	22
141 to 160	8x25F, 6x26WS, 10x19S	6	13	3	6	12	26
161 to 180	9x25F	7	14	4	7	14	28
181 to 200	10x25F, 6x31WS	8	16	4	8	16	32
201 to 220	6x36WS, 8xK26WS	9	18	4	9	18	36
221 to 240		10	19	5	10	20	38
241 to 260	6x41WS, 8x31WS	10	21	5	10	21	42
261 to 280		11	22	6	11	22	45
281 to 300	8x36WS	12	24	6	12	24	48
300 and over		0.04n	0.08n	0.02n	0.04n	0.08n	0.16n

Table 3: rotation-resistant and non-rotating rope (Category I and II, ASTM A1023) in steel sheaves

Load-bearing outer wires (n)	Example constructions	Steel sheaves and/or single-layer drum		Multi-layer drum (all classes)	
		6d	30d	6d	30d
4 strands ≤ 100	4x29F	2	4	2	4
3 or 4 strands ≥ 100	4x26WS, K3x40, K3x48, K4x48	2	4	2	8
11+ outer strands: 71 to 100	17x7, 18x7, 19x7	2	4	4	8
101 to 120	35x7, 34(W)x7	3	5	5	10
121 to 140	39x7	3	5	6	11
141 to 160		3	6	6	13
161 to 180		4	7	7	14
181 to 200	18x19S, 19x19S	4	8	8	16
201 to 220		4	9	9	18
221 to 240	35x17S	5	10	10	19
241 to 260		5	10	10	21
261 to 280	34(W)xK19	6	11	11	22
281 to 300		6	12	12	24

Seale outer strands with 19 wires or fewer per strand (e.g. 6x19 Seale): use the row two rows above where n would place it. Multi-layer columns apply to deterioration at crossover zones and interference between wraps due to fleet angle effects, not to sections of rope which only work in sheaves and do not spool onto the drum. These counts apply to rope on steel sheaves and drums (5.5.4.2). Also see the grouping, end-connection and core-break criteria in 5.5.4.2. Summarized from CSA Z150:26 Table 2 and Table 3 for field reference.

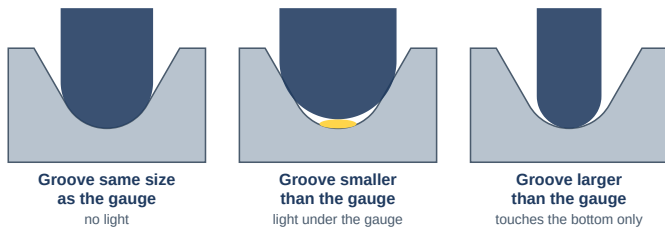


Checking sheave grooves with groove gauges

There are two types of groove gauge: **go / no-go gauges** and **actual size gauges**. How to use them, and what to do about a groove outside the limits, is Crane Rope Solutions practice unless a clause is given. The groove sizes come from CSA Z150:26 (box at the bottom).

1. Go / no-go gauges

1. Clean the groove so the gauge sits on bare metal, not grease or dirt.
2. A go / no-go gauge is made to a groove size, not to the rope size: check the size marked on it. For a 28 mm rope use a **minimum gauge of 29.68 mm** (Z150 4.7.5.1 design minimum, $d \times 1.06$) and a **maximum gauge of 30.80 mm** (Z150 4.7.5.1 design maximum, $d \times 1.10$). CSA Z150 4.7.5.1 is a design requirement; in service the groove is checked against the manufacturer's limits (5.5.6.1.2).
3. Place it into the groove, square to the sheave. **Plastic gauges: do not push down hard.** They flex, and pressing down can easily give a wrong reading, so plastic gauges are not the best choice. Crane-specific steel groove gauges are available at craneropesolutions.com.
4. Shine a flashlight behind the gauge.
5. **Minimum gauge, any light under it** (middle picture): the groove is smaller than the Z150 design minimum. Check it against the manufacturer's limit (5.5.6.1.2). Restore it only if the sheave manufacturer approves (5.5.6.2), or replace the sheave (Crane Rope Solutions practice).
6. **Maximum gauge touches only the bottom, with gaps at both sides** (right picture): the groove is more than 10% larger than the rope: oversized. Check it against the manufacturer's limit (5.5.6.1.2); if it is outside that limit, replace the sheave (Crane Rope Solutions practice).
7. Check several places around each sheave and write the result in section 6 of the sheet.



2. Actual size gauges

Crane Rope Solutions offers actual size gauges in 0.25 mm steps. Try gauges until you find the one that best fills the groove without letting light underneath it. That gauge is your true groove size. Write the size in section 6 of the sheet.

Check it against the minimum. CSA Z150 4.7.5.1 design minimum: the groove radius shall exceed the nominal rope radius by at least 6% (in service: the manufacturer's limits or, if none, the rope manufacturer's or applicable standards'). For a 28 mm rope: $28 \times 1.06 = 29.68$ mm, so the closest 0.25 mm step at or above it is the **29.75 mm** gauge.

Check it is not oversized. CSA Z150 4.7.5.1 design maximum: not more than 10%. For a 28 mm rope: $28 \times 1.10 = 30.80$ mm; a groove reading more than this is oversized.

Why we prefer actual size gauges

A go / no-go gauge only tells you pass or fail. An actual size gauge shows how much wear is left, so your maintenance plan can move from pass, pass, pass, fail to 100% life remaining, 75%, 50%, 25%, replace.

100% 30.75 mm	75% 30.50 mm	50% 30.25 mm	25% 30.00 mm	Plan to replace 29.75 mm
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Example, 28 mm rope: new groove 30.75 mm, minimum gauge 29.75 mm. Life remaining = $(\text{gauge now} - \text{minimum}) / (\text{new} - \text{minimum})$. Crane Rope Solutions planning practice: "Plan to replace" is the last 0.25 mm step at or above the minimum, so plan the work before the groove goes below it. Example figures; use your manufacturer's limit where it has one.

What CSA Z150:26 says. CSA Z150 4.7.5.1 (design): the sheave groove radius shall exceed the nominal rope radius by a minimum of 6%, but shall not exceed 10%. In service, sheave grooves shall be measured to determine whether they are within the limits specified by the manufacturer or, if there are none, by the rope manufacturer or applicable standards (5.5.6.1.2). A worn or damaged groove may be restored only if approved by the sheave manufacturer (5.5.6.2).



Don't have gauges? Scan to see our groove gauges.

Want a free gauge? Give us a shot at quoting your wire ropes and we will send you a free groove gauge, just to say thank you.

604-813-WIRE (9473) | dean@craneropesolutions.com



EXAMPLE, made-up readings. A 28 mm rope filled in to show how the sheet works. Your blank sheet is pages 1 and 2.

Wire rope inspection sheet: CSA Z150:26

One rope per sheet. How to fill it in: page 4. Mark ✓ nothing found, X found (write where and what), N/A does not apply. **Free analysis:** send us a photo of the completed sheet for a same-day response (page 2).

Date 2026-04-03	Inspection type (codes: page 4) A	Hours (machine or rope) 4,318	Inspector (print) J. Smith	Trolley distance (m) or boom angle (°) 60 deg	Hook height (m) and hook load 15 m, block
Customer / owner Example Crane Co.	Site / location Vancouver yard	Crane make ABC Cranes	Crane model Example 100T	Serial number EX-12345	Unit number 12
Winch number W1	Winch duty (main hoist, aux, boom hoist, trolley) Main hoist	Rope length (m / ft) 210 m	Nominal diameter d (mm) 28	Construction (e.g. 6x36 WS) 8x26 WS	Core (IWRC, WSC) IWRC
Lay (ordinary / regular or Lang, direction) Right regular lay	Grade / finish 1960 / bright	OEM specified breaking force (crane manual, not the mill cert) Per crane manual	Minimum breaking force (mill cert) Per mill cert	Date installed 2025-12-15	Certificate number EX-0001
Rope manufacturer / supplier Crane Rope Solutions	Drum: single or multi-layer Multi-layer	Sheaves: steel or synthetic Steel	Load-bearing wires in outer strands (n) 208 (8 x 26)	Rotation-resistant category N/A (not RR)	

Your limits for this rope (how to work them out: page 6; tables: page 8)

Broken wires: sections of rope working in steel sheaves and/or spooling on a single-layer drum	Broken-wire limit (reached or exceeded: removal): over 6d 9 over 30d 18			Tables 2 / 3
Broken wires: sections of rope spooling on a multiple-layer drum (crossover zones and wrap interference)	Broken-wire limit (reached or exceeded: removal): over 6d 18 over 30d 36 (N/A if single-layer)			Tables 2 and 3, footnote ‡
Diameter loss limit (Table 4, % of nominal d below dref): tick your rope	☐ IWRC, 6 strands or less, 19 class: more than 5.0% ☐ IWRC, over 6 strands, 36 class: more than 2.5%	☐ IWRC, 6 strands or less, 36 class: more than 4.0% ☐ Rotation-resistant (all): more than 3.5%	☒ IWRC, over 6 strands, 19 class: more than 3.5%	5.5.4.2 d)
Your minimum diameter = dref - (% x nominal d)	27.86 mm			Table 4
Sheave grooves	Rope nominal Ø (d): 28 mm Manufacturer's groove limit (if none: rope manufacturer's or applicable standards): 29.75 mm (5.5.6.1.2) Design range d x 1.06 = 29.68 to d x 1.10 = 30.80 mm (4.7.5.1) Pitch Ø at least 15 d boom hoist / 18 d load hoist / 16 d load block (4.7.6)			

Reference diameter dref (measured after break-in, on rope not subjected to bending or wear; copy it from the logbook, do not re-measure):

—**28.84**— mm, measured at —**1**— m from the —**dead**— end on (date) —**2025-12-16**—. D1 —**28.88**— mm, D2 —**28.80**— mm, averaged (CRS practice).

1. Diameter: D1 and D2 at right angles, average (D1 + D2) / 2 (averaging: CRS practice)

#	Measured at	D1 (mm)	D2 (mm)	Average (mm)
1.1	3 m from the dead end	28.62	28.54	28.58
1.2	120 m from the drum end	28.50	28.42	28.46
1.3	150 m from the drum end	28.76	28.72	28.74
1.4	180 m from the drum end	28.80	28.74	28.77
1.5	___ m from the ___ end			
1.6	___ m from the ___ end			

3. Other measurements

	Check	Reading	Where (m from which end)
3.1	Lay length (mm), same place each time (CRS practice)	190	3 m from the dead end

Reading this example: n = 8 strands x 26 wires = 208, so Table 2 row "201 to 220" (it lists 8 x K26WS): 9 over 6d and 18 over 30d, and 18 / 36 at cross-over zones and where wraps interfere due to fleet angle effects (Tables 2 and 3 footnote). 8x26 WS is sold as an 8x19 class rope (supplier information, not from the standard; check the rope certificate). Table 4, IWRC over 6 strands, 19 class: more than 3.5%. 3.5% x 28 = 0.98 mm, so the minimum is 28.84 - 0.98 = 27.86 mm.

Reading this example: The lowest average at this inspection is 28.46 mm at point 1.2 (120 m from the drum end). The minimum diameter at the top of this sheet is 27.86 mm, so every reading passes.



EXAMPLE, made-up readings. Page 2 of the example sheet.

2. Broken wires: one line for every broken wire or group you find

	Where (m from which end)	Zone SH or ML	Ø at this spot D1 / D2 (mm)	Broken wires in 6d	Broken wires in 30d	Breaks within 6d of an end connection	Outer wires broken at the core	Notes
2.1	120 m from the drum end	SH	28.50 / 28.42	3	6	0	0	6 within 840 mm
2.2	35 m from the drum end	ML	28.80 / 28.74	1	2	0	0	Crossover zone
2.3	___ m from the ___ end		/					

Zone SH: rope working in steel sheaves and/or spooling on a single-layer drum. Zone ML: multiple-layer drum, for deterioration at the cross-over zones and interference between wraps due to fleet angle effects, not sections of rope which only work in sheaves and do not spool onto the drum (Tables 2 and 3, footnote †). Outer wires broken at the core: outer wires broken where they touch the core, seen as a wire or loop sticking out (5.5.4.2 c). Ø at this spot: D1 and D2 measured where the breaks are, so the diameter and the breaks at the same spot are judged together (CRS practice). Broken-wire limits: page 1.

	Check	✓ / X / N/A	If X: where and what		Check	✓ / X / N/A	If X: where and what
4. Rope condition				5. Rope ends and drum and block			
4.1	Broken wires very close together (local grouping)	✓		4.21	Rope test (magnetic rope test or other non-destructive test), if one was done: date and result (CRS practice)	N/A	
4.2	Rotation-resistant rope: local core deterioration	N/A		5.1	Corroded or broken wires at or near terminal ends	✓	
4.3	Waviness	✓		5.2	Rope at the wedge socket	✓	
4.4	Strand extrusion or wire extrusion	✓		5.3	Rope spooled in the lower drum layers	✓	
4.5	Kinks or tightened loops	✓		5.4	Drum flange points, crossover points, repetitive pickup points	✓	
4.6	Crushing	✓		5.5	Drum cracked, worn or deformed	✓	
4.7	Birdcaging	✓		5.6	Hook and dead-end lug: magnetic particle inspection	✓	MPI 2026-04-02: no indications
4.8	Bends or other distortion (unstranding, main-strand displacement, core protrusion)	✓		5.7	Hook: cracks, throat opening, twist	✓	
4.9	Heat damage	✓		5.8	Hook: corrosion, gouging, deformation	✓	
4.10	Electric arcing	✓		5.9	Hook nut: corrosion, deterioration, loose set screws	✓	
4.11	Contact with high-voltage lines	✓		5.10	Dead-end attachment lug: cracks, wear, damage	✓	
4.12	Rope length on the drum	✓		5.11	Block sheaves: alignment (bearing clearance), free movement, nicks, cracks	✓	
4.13	Local increase in diameter	✓		5.12	All bolts tight and undamaged; safety latch works	✓	
4.14	Unevenness of outer strands	✓		5.13	Weight and rated load capacity posted on a plate or permanent marking	✓	
4.15	General corrosion	✓					
4.16	Broken or cut strands	✓					
4.17	Wear	✓					
4.18	Reeving as the crane and rope makers recommend	✓					
4.19	Ambient temperature above 82 °C (180 °F)	✓					
4.20	Lubrication condition	X	30-40 m from drum end: dry; lubricated				

6. Sheaves: one line per sheave (groove gauges: page 9; groove limits: page 1)

	Sheave (which one)	Groove Ø (mm) or gauge OK / not OK (5.5.6.1.2)	Groove wear: general or uneven wear, flat spots (5.5.6.1.1); negative impressions (CRS practice): ✓ / X	Flange: chips or damage (5.5.6.1.4); broken, deformed or cracked (5.5.6.3): ✓ / X	Bearing: freewheeling, no excessive play (5.5.6.1.5): ✓ / X	If X: where and what
6.1	Boom tip 1	30.25	✓	✓	✓	
6.2	Boom tip 2	29.75	✓	✓	✓	At limit: plan to replace (CRS)
6.3	Block 1	30.50	✓	✓	✓	
6.4	Block 2	30.00	✓	✓	✓	
6.5	Block 3	30.25	✓	✓	✓	

Location of defects, repairs, reinspection findings (5.3.5.2.2 a) Lines 2.1, 2.2; row 4.20 (lubricated)	Next periodic / next annual due (annual: end of the same month next year, 5.3.5.1 c) 2026-05-03 / annual 2027-04-30	Competent person: name and signature (5.3.5.2.2 e)) J. Smith	Date 2026-04-03
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Reading this example: Line 2.1, 120 m from the drum end: 3 breaks in 6d (limit 9), 6 in 30d (limit 18): the Table 2 limits are not reached. Those breaks are more than 6d from any end connection, and more than two, so 5.5.4.2 b) says the termination should be remade where possible to shorten the rope, or the rope should be replaced. The competent person decides.

Reading this example: The manufacturer's groove limit in this example is 29.75 mm (made up: use the figure from your manual, 5.5.6.1.2). Boom tip 2 reads 29.75 mm: at the limit, so it still passes. A worn groove may be restored only if the sheave manufacturer approves (5.5.6.2); otherwise plan to replace it (Crane Rope Solutions practice).



Words used on these forms

From CSA Z150:26

Term	Clause	What it means
Nominal diameter, d	Table 4 Note	The conventional diameter value by which a rope is named, designated or ordered.
Measured diameter, dm	Table 4 Note	The actual diameter found by direct measurement.
Reference diameter, dref	Table 4 Note	The measured diameter of a section of rope not subjected to bending, wear or other significant deformation or degradation, taken after break-in.
% reduction	Table 4 Note	$(d_{ref} - d_m) / d \times 100$.
6 x d and 30 x d	Tables 2 and 3	A length of rope 6 or 30 times the nominal rope diameter.
Load-bearing wires	Tables 2 and 3, footnote	Filler wires are not load-bearing wires and are not counted in the total wires in the outer strands.
Broken wire	Tables 2 and 3, footnote	A broken wire has two ends; count it as one wire break.
Multiple-layer drum values	Tables 2 and 3, footnote	Apply to deterioration at the cross-over zones and interference between wraps due to fleet angle effects, not to sections of rope which only work in sheaves and do not spool onto the drum.
Periodic inspection (crane)	5.3.2.2 b)	As the manufacturer specifies, or every 500 h of machine time, but at least every six months.
Annual inspection	5.3.2.2 c)	By the end of the twelfth month after the previous inspection.

Competent person: the person who does the periodic and annual rope inspections (5.5.3.2, 5.5.3.3) and signs the annual mechanical report (5.3.5.2.2 e)); the final annual report is approved by an engineer or the manufacturer (5.3.5.4). Rotation-resistant rope diameter loss goes to a qualified person (5.5.4.2 e)).

Words this form uses (Crane Rope Solutions)

D1 and D2	Two diameter readings at the same point, at right angles to each other. The form uses their average.
Negative impressions	The pattern of the rope's strands pressed or worn into the groove surface of a sheave or drum.
Measured at	A point you can find again, written as the distance from the drum end or the dead end.
Winch number	The number or name of the winch this rope is on.
Winch duty	What the winch does: main hoist, auxiliary hoist, boom hoist, trolley.
OEM specified breaking force	The breaking force the crane manual asks for. Not the figure on the mill certificate.
Minimum breaking force (mill cert)	The figure on the rope's mill certificate.
Drum end / dead end	The drum end is where the rope is fixed to the drum. On this form the dead end means the other end of the rope and its end fitting (button, wedge socket, spelter socket).

