Stewart & Associates (Aust) Pty. Ltd.
Consulting Engineers
Incorporated in Victoria
ABN 31 097 022 083
Suite 306, 63 Stead Street,
South Melbourne 3205 Vic.
Phone: (03) 9690 7772
Email: gordons1441@bigpond.com
Specialist in:
Lifting Equipment

5th January 2022

Jatco Engineering Australia Pty Ltd
PO Box 260
GPO Ballarat Vic 3353

Att. Mr John Carrol,

Re:- Re:- AS 2550.1, Section 7, Clause 7.3.5
Tadano GR-700E-1-00212, S.No. 54637, Year of manf. 2012
Hour meter reading:- 6184hrs

The mechanical work has included winches, winch shafts, couplings, brakes, hydraulic pumps and motors, hydraulic hoses, relief valves etc.

The structural integrity has been proven by NDT inspection, overall visual inspection, boom and carrier separation with reinstatement as deemed necessary by the writer.

The crane is suitable for on-going service within the manufacturer's ratings for a period of not less than 10 years mechanically and 25 years structurally unless exceptional circumstances arise to damage the crane.

The crane in my opinion now meets the requirements of AS 2550.1 - 2002 Section 7, Clauses 7.3.5 and 7.3.6 and by that the expectations of the Occupational Health & Safety Regulations 2007 and is therefore suitable for use.

10 & 25 year strip down background.

Ref:- AS 2550.1 – 2002, Clause 7.3.5 – Major Inspection

The following cranes shall be subjected to a major inspection to assess their suitability for continued operation:

(a) Cranes that have reached the end of their design life or …. after 25 years for structural and 10 years for mechanical components.

1. A cranes design life may not be the same as its actual life and depends on such factors as its classification, usage and its operating environment

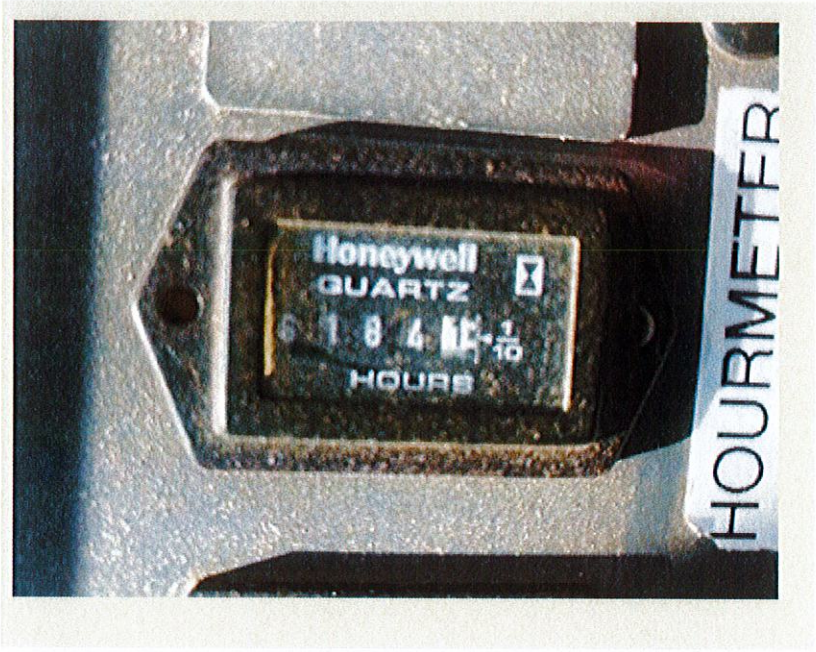
The crane is suitable for on-going service within the manufacturer's ratings for a period of not less than 10 years mechanically and structurally unless exceptional circumstances arise to damage the crane.

The crane in my opinion now meets the requirements of AS 2550.1 - 2002 Section 7, Clauses 7.3.5 and 7.3.6 and by that the expectations of the Occupational Health & Safety Regulations 2007 and is therefore suitable for use.

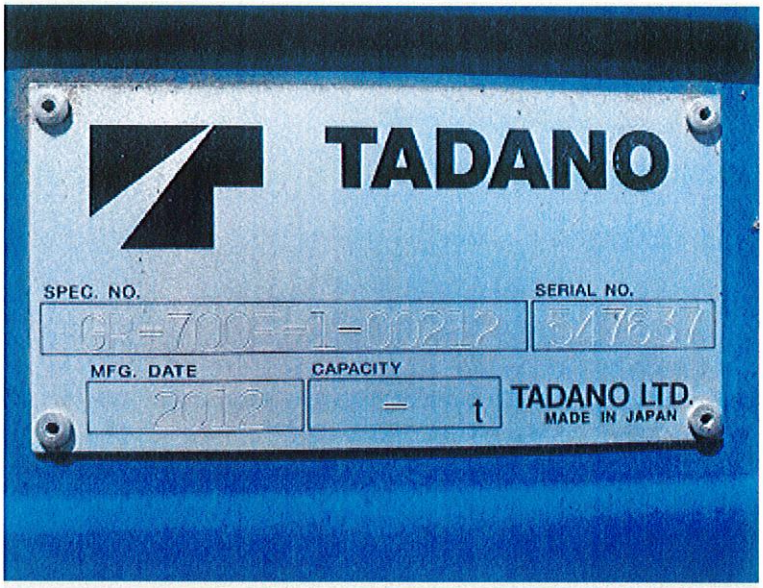
Yours faithfully

Gordon J Stewart FIE(Aust), CP.Eng, – Principal
Formally Member of AS 1418 committees for IE(Aust), Associate writer of AS 2550.1, Section 7

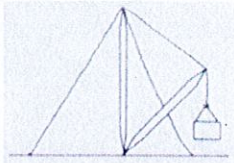
General view at current time.

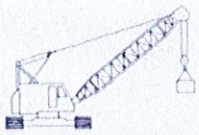


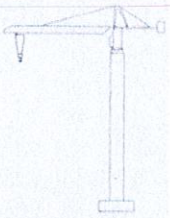
Hours at this major service.



Marking Plate as fitted.







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6th December 2018

JATCO Engineering Pty Ltd
PO Box 260
GPO Ballarat Vic 3353

Att. Mr John Carroll,

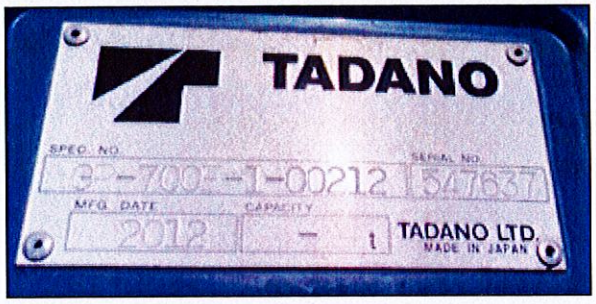
Re:- TADANO:- Model GR-700-1-00212, S.No. 547637, Year of build 2012
Owner:- Jatco Engineering Pty Ltd
Addition of calliper brake as required by CFMMEU – Summary of calculations.

Dear John,

This crane is not designed with "free-fall" capacity. It follows that the load lines of both winches are hydraulically driven up and down.

The existing (manufacturer's) brake is designed as a holding brake which actuates once the load movement is stopped by the hydraulic drive motor. We have referenced the hydraulic circuit as found in the crane service manual. The notes are in English and we have not altered the existing hydraulic circuit. As noted in the attached part drawing we have added a third braking system with delayed application.

Gordon

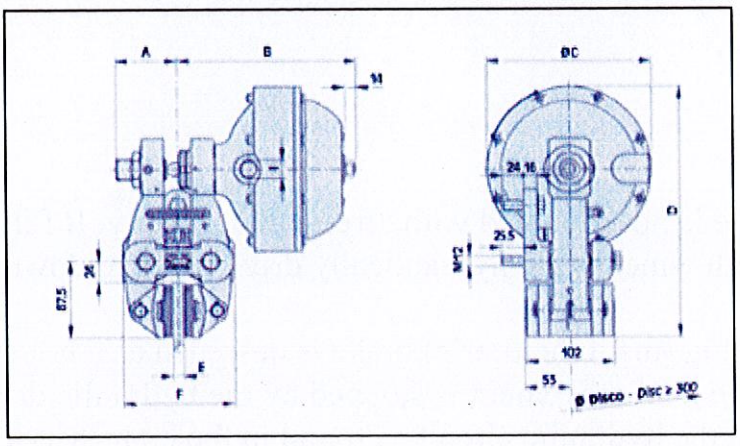


Crane identification.

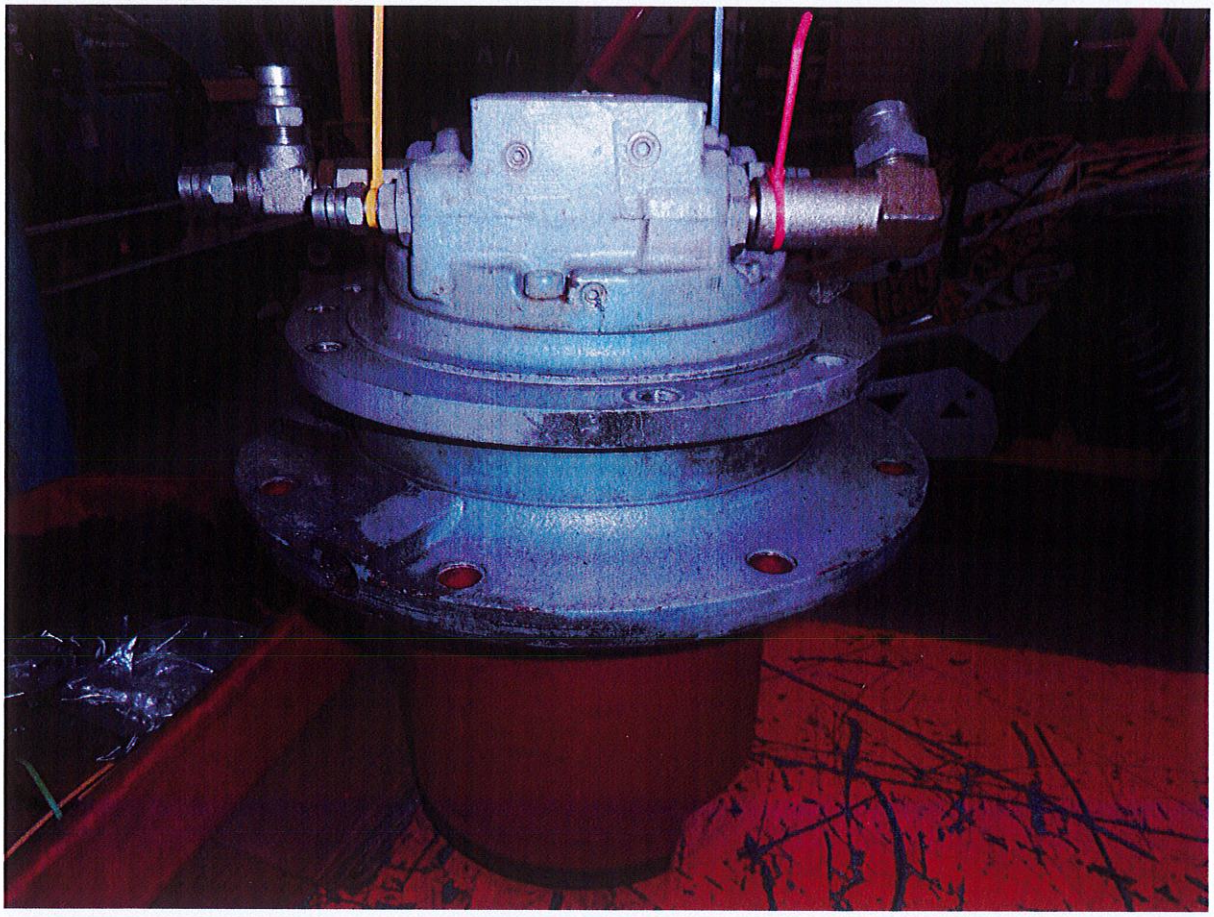
The calliper brake which we have fitted is spring applied when the pneumatic pressure is reduced to zero by manual activation or by the winch drum over-speeding. Additionally the new brake does NOT replace or interfere with the original total braking system by the manufacturer.

Examination of the crane has revealed that a brake disc can be fitted into the area at the LH side of the main auxiliary drum with the calliper body fitted to the rear panel after strengthening. Calculations are provided to confirm the brake suitability.

To enable the work to be carried out the auxiliary drum has been removed for fitting of the brake disc which is both bolted and spigot fitted to the existing drum.

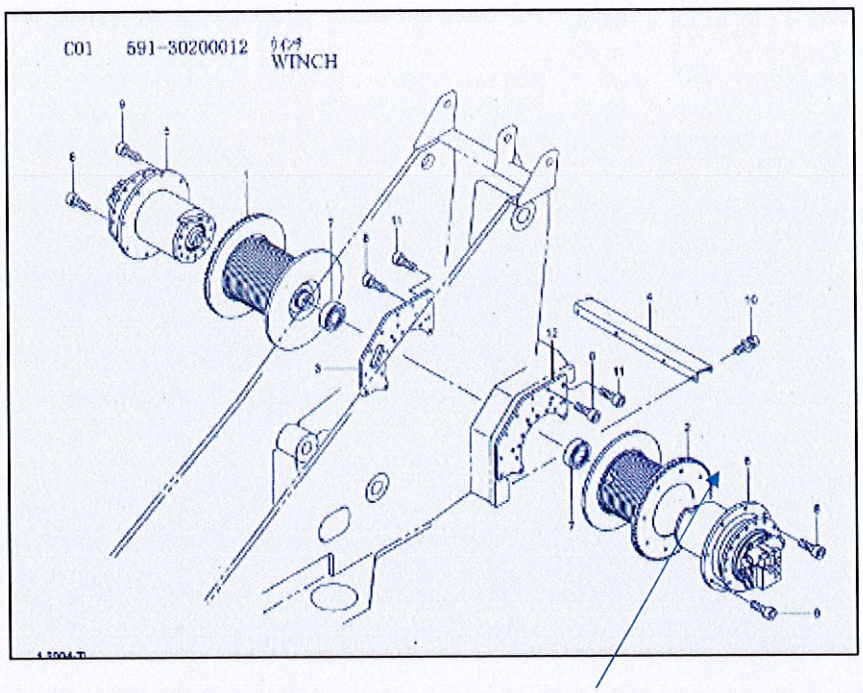


The air operated/spring applied brake to be fitted



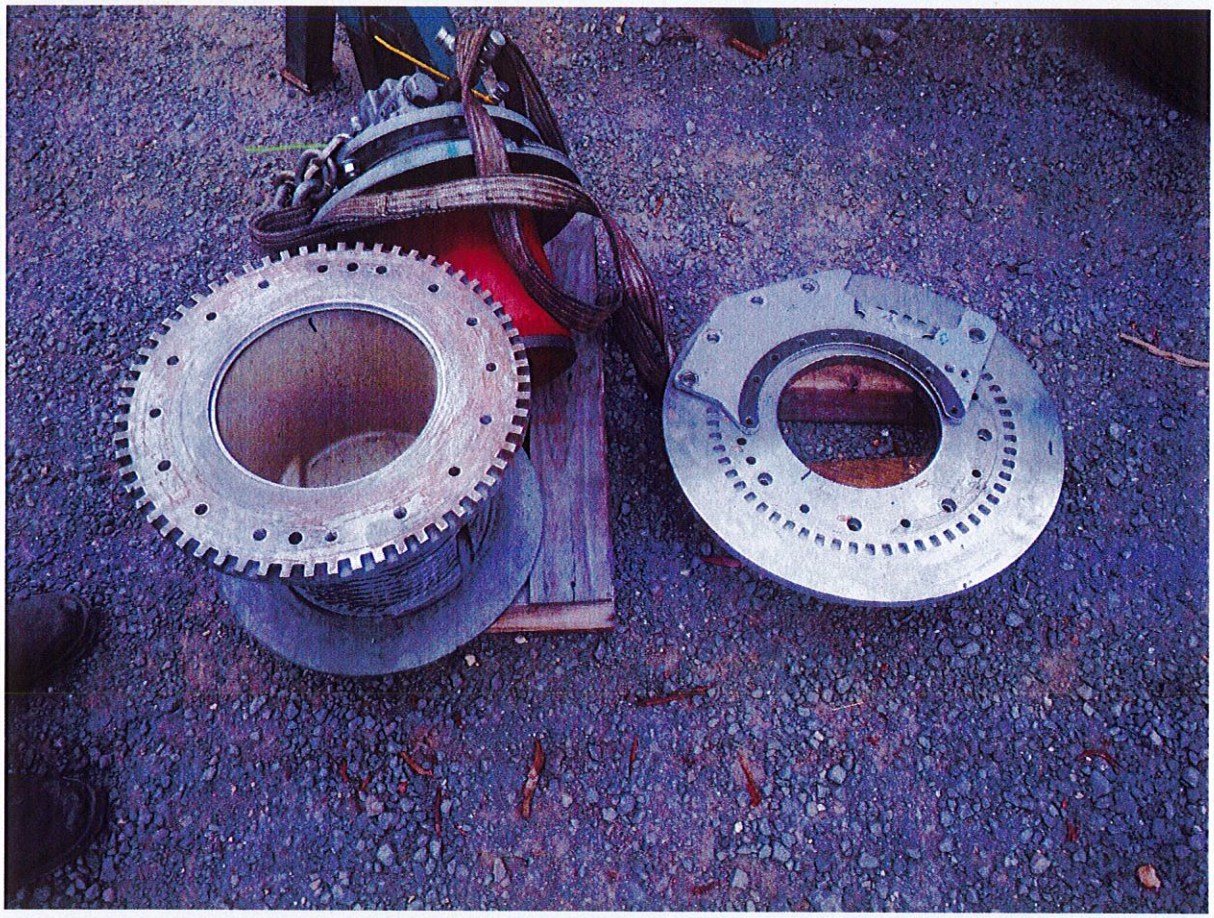
Auxiliary winch drive removed.

Gordon

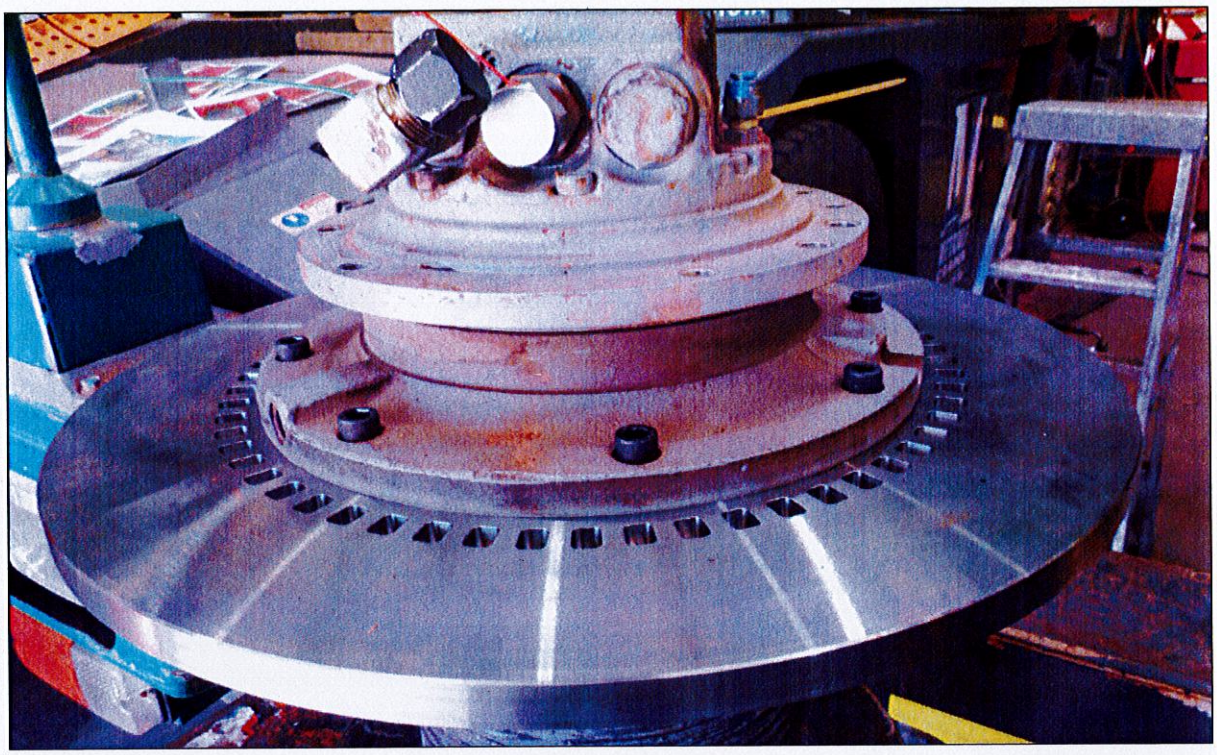


New brake disc to be fitted between Nos, 2 & 6

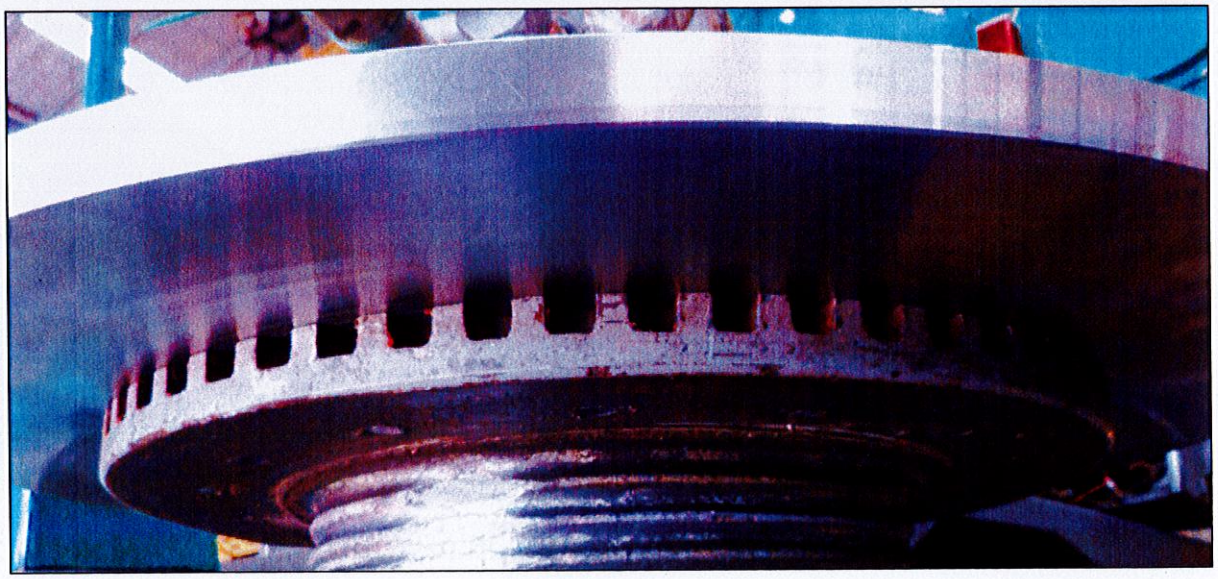
Gordon



New brake disc and aux. winch drum modification.



Newly fitted brake disc.



Underside view.

All dimensions in the attached calculation are approximate but within industry accepted tolerances for mechanical fitting.

Gordon

The brake units are: Coremo Ocmea S.p.A Series failsafe callipers D-3N to Drg. No. A2605 and are standard calliper units with spare parts available in Australia.

It is my opinion that this additional brake attachment is not a crane modification as it has not altered any part of the original crane structure/mechanics/electrical/hydraulic system but is an additional device fitted at the direction of CFMEU and VWA without the support of the Japanese designers. For these reasons significant care has been taken in fitting the device to ensure it will hold 54.9kN line pull factored by 2.0 but not interfering with the original crane function.

Finding the Inertia of winch drum:-

Existing flanges:

$$Wk^2 = \frac{L(r^4_1 - r^4_2)}{8.3 \times 10^{-6}}$$

$\delta w = 76.7 kN/m^3$, L = 19mm x 2 = 0.038m

$R_1 = 0.32m$ $R_2 = 0.1m$

$= 47.55\ Nm^2$

New disc:

$= 98.15\ Nm^2$ L = 0.025 $R_1 = 0.43m$ $R_2 = 0.1m$

Central drum:

$= 44.0\ Nm^2$ L = 0.38m $R_1 = 0.18m$ $R_2 = 0.1m$

Hoist rope:

@ 53kg/100m x 65m length = 34kg drum dia. =0.364 m
3 layers 0.400mØ x 0.25m wide

L = 0.38m $R_1 = 0.4m$ $R_2 = 0.18m$

$Wk^2 = 2600.0\ Nm^2$

Total inertia: *(no value allowed for torque resulting from lifted load.)*

$47.55 + 98.15 + 44.0 + 2600 = 2740\ Nm^2$

Torque required to stop load:-

$T = I\acute{a}$

$= \frac{Wk^2 (\gamma n)}{9.81\ t}$ $Wk^2 = 2740\ Nm^2$ assume $t = 2.5sec$ if the rope speed is 125m/min

then 2.6m/sec will be unwound per second.

Drum circ. = 2.67m

$2.6/2.67 = \sim 1$ rps

$6.2832 \times 1.0 = 6.3$ rad/sec

Area of friction surface:- (by measurement from selected shoe segment.)

$0.151m \times 0.355m = \sim 0.0536m^2$ $[5352mm^2]$

Friction power absorbed:-

$P_f = T_f w$ $T_f = 2740\ Nmm^2$ $w = 6.3$ rad/sec

$= 17262\ N$

Component wear ratio:-

WR = >0.46 W/mm ^{2} for infrequently used brakes which are allowed to cool between applications.

$WR = P_f/A$

17262/ 5352 = 3.2 W/mm^2

Checking mean radius of brake force:-

Spring force selected as 18.4kN from available Bellville springs,

$R_m = \frac{T_f}{fN}$ $f = 0.25$ average value

$= \frac{1100}{0.25 \times 18400} = 239$ mm

Data:- No. 12mm bolts x 16
No. dowels x 2 [12mmØ]

If the dowels were of mild steel (300mPa) [they are of higher grade]:-

By AS 1250 clause 5.10.1

$0.45 F_y = 138$ mPa

$F_y = 300$ mPa hence OK

$V = 6t = 59$ kN

Moment to be resisted by bolt pattern:

$M = 59(420) = 24721$ Nmm

Direct shear force to each bolt;

Load per bolt; $F_s = P/16 = 1545$ N/bolt

Radius about centroid:-

$r = 162.5$ mm

Primary shear load per dowel:-

$$F' = V/4 = \frac{59}{4} = 14.9 \text{ kN}$$

The secondary shear forces are equal hence:-

$$F'' = \frac{M}{4r} = \frac{24721}{4 \times 310} = 19.9 \text{ kN}$$

If the dowels were of mild steel [they are of higher grade]:-

By AS 1250 clause 5.10.1

$0.45 F_y = 318$ mPa

The total area of steel based on 16 No screws each being 12mmø and the two dowels:-

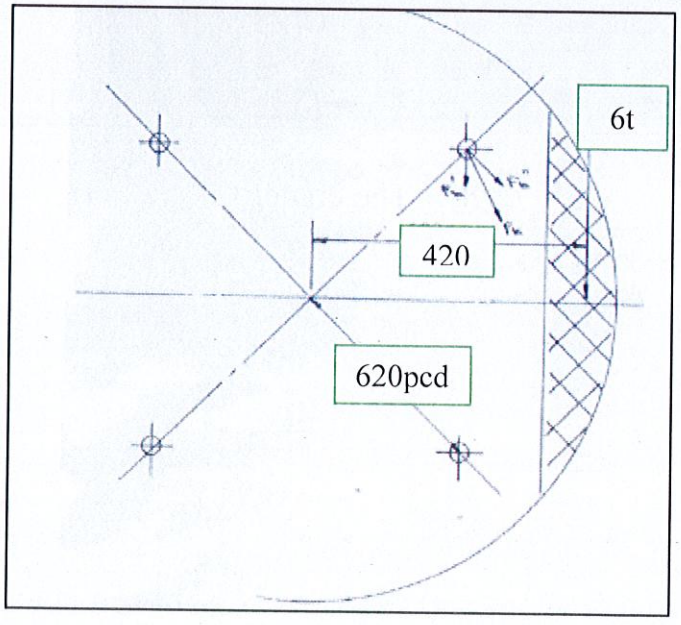
113 x 16 = 1808 mm^2
113 x 2 = 226.0 mm^2

2034 mm^2 which is adequate to hold the brake applied load.

Brake appears satisfactory to stop and hold load of 6 tonnes which is assumed to be more than a man box. Note that the load is always stopped by the hydraulic motor and the manufacturer's brake, even in the event of a hydraulic hose failure. The cranes load line has a safety factor of 4.0 when new. The drum shaft of this crane appears to have a safety factor against breaking of 30:1. It follows that the most likely line of failure would be a leaking hydraulic hose, over speed of winch, or activation of third brake by crane operator.

Confirmation of the disc attachment to the existing drum is confirmed below. The designer assumes that the 12mmø dowels [350mpa yield] will carry the shear load and the m12 – GRADE 8.8 cat BOLTS will hold the disc in place. [in reality these screws will share the shear load].

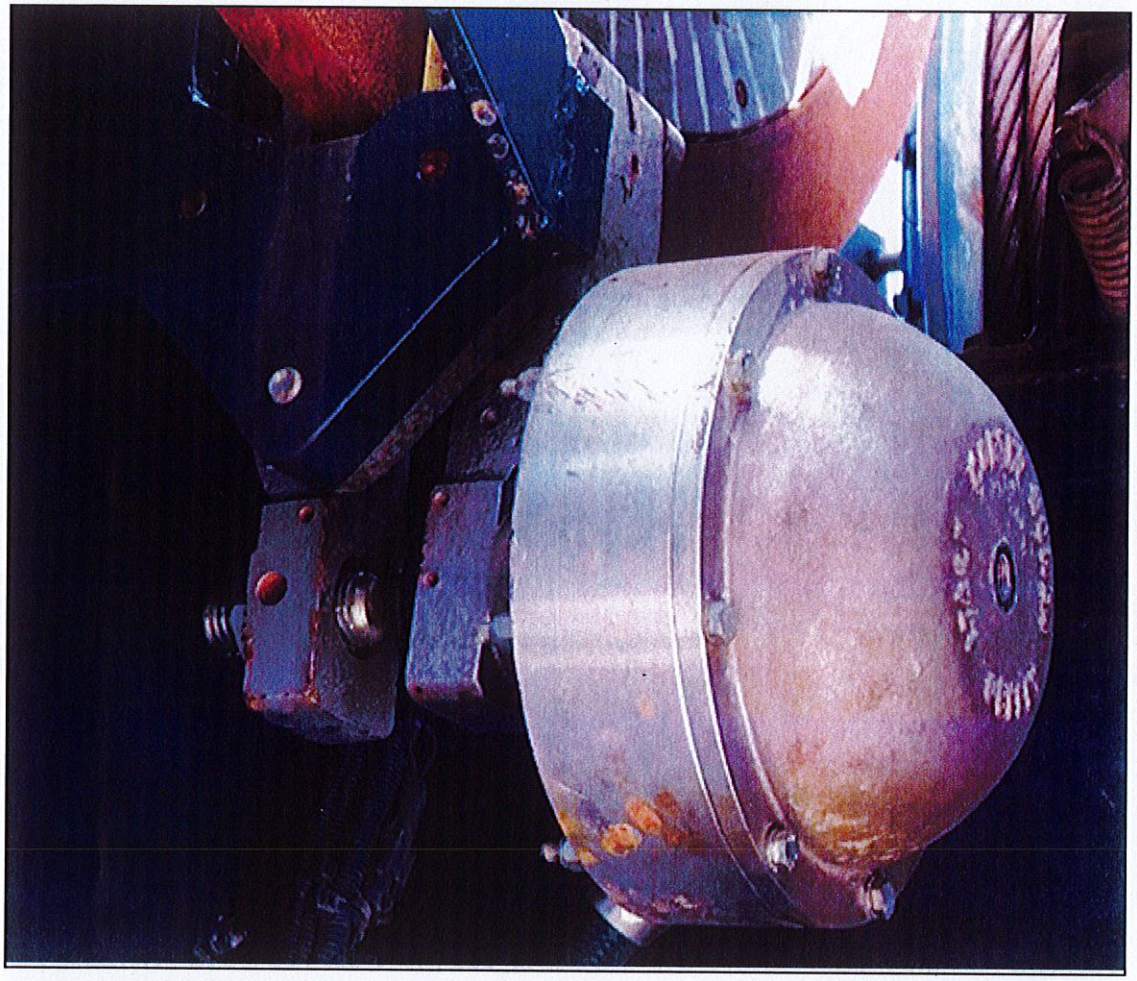
The design load for man box operation is approximately a 2 tonne line pull. This load is assumed to act at the centre of the disc brake shoe as shown in the attached sketch.



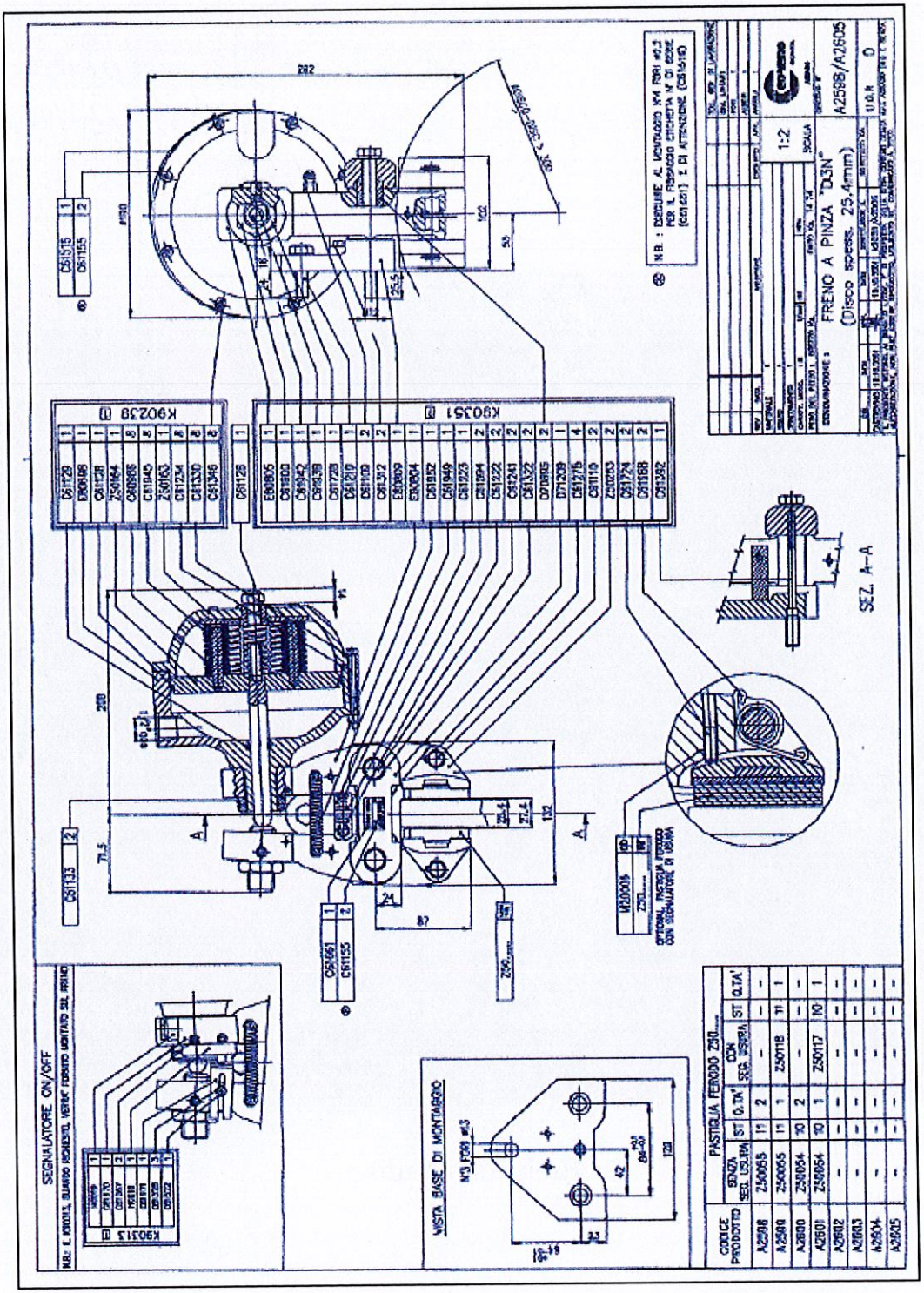
The addition of this THIRD brake does not add to the safety of the crane but is a requirement of the CFMMEU along with WorkCover Victoria.

Brakes on the winch drum are a through-back idea from old type friction winches as called for in Australia Standard CB2 – 1938 and BS 2573 – 1921 at which time the designed braking system was unreliable.

The crane.



Brake unit & disc.



Yours faithfully

Gordon J Stewart FIE(Aust), CP.Eng, NER, RPEQ – Principal
Formally member AS1418/2550 committees for IE(Aust)

Gordon