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CERTIFICATE OF APPROVAL No 6/10B/4 VARIATION No 1

This is to certify that the following modification of the pattern of the

Railweight (Coupled-in-motion Train) Weighing Instrument

approved in Certificate No 6/10B/4 dated 15 May 1974,

submitted by Evans Deakin Marketing Group, Evans Deakin Industries Ltd, 1644 Ipswich Road, Rocklea, Queensland, 4106,

has been approved under the Weights and Measures (Patterns of Instruments) Regulations as being suitable for use for trade.

Date of Approval: 17 June 1977

The approved modification, described in Technical Schedule No 6/10B/4 - Variation No 1 and in drawings and specifications lodged with the Commission, provides for an additional instrument at Phosphate Hill, Queensland.

Approval was granted on condition that:

- 1. The approval is limited to the instrument located at Phosphate Hill, Queensland.
- $2\overline{.}$ The maximum axle load of a wagon to be weighed is 16,5 tonnes.
- 3. The maximum train speed when weighing is in progress is 5 km/h.
- 4. The number of wagons in the train is not less than 30 and not more than 64.
- 5. The instrument is only used for measuring the gross weight of trains comprising four axle wagons with automatic couplers, when each wagon is evenly loaded with a non-liquid load so that its gross weight is between 50 and 65 tonnes.
- 6. At verification the maximum permissible error for the static test of the weighbridge is = 0.5 scale interval for the first 500 scale intervals,



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NATIONAL STANDARDS COMMISSION

TECHNICAL SCHEDULE No 6/10B/4

Pattern: Railweight Coupled-in-motion Weighing System

<u>Submittor</u>: Evans Deakin Marketing Group, 1644 Ipswich Road, Rocklea, Queensland, 4106.

Date of Approval: 15 May 1974

Conditions of Approval:

Approval was granted on condition that:

- (a) the approval is limited to the system located at Gillman, South Australia, with the Serial Number RC 1002;
- (b) the maximum axle load of a wagon to be weighed is 25 tonnes;
- (c) the maximum train speed is 5 km/h;
- (d) the maximum number of wagons is 25;
- (e) the system shall not be used for weighing tank wagons or for determining the tare weight of individual wagons;
- (f) the tolerance for the weighing of individual wagons coupled-in-motion shall be $\pm 0, 4$ tonne;
- (g) the tolerance for the total weight of a train coupled-in-motion shall be $\pm 0.5 / \sqrt{n\%}$ or 0.1% of the total train weight, whichever is the greater, for a train of n wagons;
- (h) no service tolerance will apply to the dynamic weighing tolerances; and
- (i) the service period is twelve months.

The instrument conforming with this approval shall be marked with the approval number "NSC No 6/10B/4".

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Introduction:

The Railweight weighing-in-motion system has load-cell mass transducers whose output voltages are processed electrically to produce averaged values for the fluctuating loads presented by moving vehicles on the load platform.

The system incorporates a calibration check against a preset simulated load and a correction derived from the check is applied to each weighing. The calibration check is automatically applied as the first unit of a train approaches the weighing platform; this is referred to as the "Auto-cal" throughout this schedule.

The test specifications have been tailored to suit the individual installation as many factors associated with the overall layout of a weighing-in-motion system can influence the final results.

Description:

The pattern (see Figure 1) is of a weighing instrument for the determination of individual wagon weights and total train weights, when weighed coupled-in-motion, and comprises the following components:

- 1. <u>Weighing platform</u>, which supports a short section of rail track on four load cells. The platform is stayed longitudinally and transversely (see Figure 2).
- 2. Four BLH load cells Type C2P1 (see Figure 3).
- 3. <u>Upper headwork</u> (see Figure 4), which displays the weight of each axle of each wagon. The following switches and indicators on the headwork are used during testing of the instrument; they are not sealed; incorrect use will not affect the accuracy of performance of the instrument:
 - (a) cal/recal indicators which indicate that the instrument requires calibration, or has automatically recalibrated. A track switch operated by the engine will cause the instrument to automatically recalibrate (auto-cal) by comparing a simulated load with a fixed calibration value. The difference between these quantities will then be applied as a correction factor to each wagon axle weighed;

- (b) mode auto/ext normally in ext position. In auto it will cause the instrument to repeatedly indicate the weight;
- (c) total switch, which causes the printer to print the total train weight; this empties the printer memory and cancels the auto-cal;
- (d) reset switch which when operated cancels the auto-cal;
- (e) display 0,020/0,005 switch, which selects for the display the normal increment of 0,020 tonne or the test increment of 0,005 tonne;
- (f) read-test switch, which causes a single weigh cycle to occur; and
- (g) error test, which simulates an overspeed condition.
- 4. <u>Lower headwork</u> (see Figure 5), has all controls other than the "balance adjustment", balance-indication meter, and fixed cal 1 and 2 and logic simulation switches sealed behind a metal cover by two lead-plug seals. A lockable door encloses this unit.

In operation, balance is adjusted so that the pointer is in the centre of the balance-indication meter. The exact adjustment is not important as any error will be compensated for by the auto-cal.

Fixed cal 1 and 2 allow the operator to check the calibration and performance of the system by simulating a test load. When the instrument is in "static balance" (refer Static Tests), and the cal 1 or cal 2 switch is pressed coincidentally with the read-test switch, the indicator will show the cal 1 and cal 2 figures marked within the cabinet door. This test establishes that the instrument has not changed its performance.

The logic simulation switches enable service personnel to simulate operation of the track switches.

5. <u>Ticket printer</u> (see Figure 6), prints the weight of each wagon and has provision for the operator to enter on the ticket, adjacent to the wagon weight, a wagon identification number.

- 6. <u>Voltage and temperature monitoring unit</u> (see Figure 7), has two temperature switches, set not more than 10° C apart, which prevent the instrument indicating or printing when the temperature falls below or rises above these temperature limits. The unit also prevents indication or printing for 30 minutes after any interruption to the supply voltage.
- 7. <u>Voltage stabiliser</u>, prevents variation in supply voltage from affecting the operation of the instrument.
- 8. <u>Track switches</u> (see Figure 8), are operated by the wagons. The track switches provide logic signals which prevent the engine weight from being printed, enable the instrument to recognise the axle configurations on each wagon, and operate the auto-cal before each train is weighed.

The instrument is marked:

NSC No 6/10B/4 Static capacity 30 tonnes Maximum axle load 25 tonnes Maximum train speed 5 km/h Printer increment 0,020 tonne Maximum number of wagons in a train 25

Test Specifications:

- 1. <u>Static Tests</u>
 - (a) With 0,005-tonne increment selected, mode auto/ext switch on ext and the auto-cal cancelled by the reset switch, balance, on the main weight indicator, shall show 0,000 tonne with intermittent indicating of 0,005 tonne.
 - (b) When a two-axle rail trolley, which has a wheel base shorter than the length of the weighbridge, and which is loaded so that one axle carries a load of about 25 tonnes and the other about 5 tonnes, is weighed several times (the entire trolley being on the weighbridge and the heavy end located successively on each end), the weight indicated should be correct within $\pm 0,010$ tonne.

- (a) When tested with a test train comprising sixteen wagons, eight of which are 4-axle wagons and eight of which are 2-axle wagons, and with the wagons loaded so that:
 - (i) two of each type of wagon are empty (E);
 - (ii) two of each type of wagon have axle loads above 15 tonne(H); and
 - (iii) four of each type have axle loads between 8 and 15 tonne(M); and

with the wagons assembled in an order which ensures a thorough mixing of heavy and light wagons, at train speeds between 1 km/h and 5 km/h the errors in individual wagon weights and total train weights shall be within the tolerance specified in the Certificate, that is, $\pm 0,400$ tonne for individual wagons and $\pm 0,125\%$ of the total train weight ($\pm 0,5/\sqrt{n\%}$ or 0,1% of the total train weight, whichever is the greater for a train of n wagons).

- (b) When a train passes over the weighbridge at above 6 km/h the overspeed sensor should operate and the ticket printer should print an "E" symbol instead of the weight of each wagon.
- (c) When the keyboard on the ticket printer is used during a train weighing to enter the wagon number, a Δ symbol is printed after the number and the number entered cannot change the weight information entered by the weighing instrument.

3. Other Tests

- (a) Raising or lowering the internal temperature of the instrument to above or below the temperatures at which the two limit switches are set, by operating the switch on the temperature monitoring unit, should suppress indication and printing. These temperatures should be not more than 10° C apart.
- (b) An interruption to the supply voltage will suppress the indication of weight and the operation of the ticket printer for not less than 30 minutes.

- (c) The ticket printer will not operate when:
 - (i) 0,005-tonne increment is selected;
 - (ii) the "auto-cal" is not "in".
- (d) The operation of the total switch will cause a total to be printed and the "auto-cal" to cancel.
- (e) The instrument will "auto-cal" before each train is weighed.
- (f) The instrument will not print the weight of any engine.



NATIONAL STANDARDS COMMISSION

TECHNICAL SCHEDULE No 6/10B/4

VARIATION No 1

Pattern: Railweight (Coupled-in-motion Train) Weighing Instrument

Submittor: Evans Deakin Marketing Group, Evans Deakin Industries Ltd, 1644 Ipswich Road, Rocklea, Queensland, 4106.

Date of Approval of Variation: 17 June 1977

The modification described in this Schedule applies to the pattern described in Technical Schedule No 6/10B/4 dated 30 May 1974.

Conditions of Approval:

- 1. The approval is limited to the instrument located at Phosphate Hill, Queensland.
- 2. The maximum axle load of a wagon to be weighed is 16,5 tonnes.
- 3. The maximum train speed when weighing is in progress is 5 km/h.
- 4. The number of wagons in the train is not less than 30 and not more than 64.
- 5. The instrument is only used for measuring the gross weight of trains comprising four axle wagons with automatic couplers, when each wagon is evenly loaded with a non-liquid load so that its gross weight is between 50 and 65 tonnes.
- 6. At verification the maximum permissible error for the static test of the weighbridge is $\pm 0,5$ scale interval for the first 500 scale intervals, ± 1 scale interval for scale intervals over 500 and up to 2000 and $\pm 1\frac{1}{2}$ scale intervals over 2000 scale intervals, both when evenly loaded and when loaded so that, in turn, each end of the bridge has a load of not less than 14 tonnes more than the other end.
- 7. The maximum permissible errors for the static test of the weighbridge for periodic inspections in service at twelve-monthly

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intervals are double these values.

- 8. The maximum permissible error for the dynamic test of the train weight coupled-in-motion is \pm 0,1% of the train weight; no additional error is permissible for periodic inspection in service at five-yearly intervals.
- 9. The Commission can require the static tests of the weighbridge, and the dynamic test of the train weight, to be repeated within the first five years.
- The instrument conforming to this approval is marked with the approval number "NSC No 6/10B/4".

Description:

The approved modification provides for an additional instrument at Phosphate Hill, Queensland, for the measurement of the gross weight of trains when loaded with solids (phosphate) and coupledin-motion.

The instrument is similar to that described in the pattern, except for the relocation of some of the switches and indicator lights on the upper headwork.

The instrument is marked:

Static capacity	25 tonnes
Type of wagon	4-axle
Maximum axle load	16,5 tonnes
Maximum train speed	5 km/h
Indicator and printer increment	0,020 tonne
Minimum number of wagons in	
train	30
Maximum number of wagons in	
train	64
Auto Cal tonnes	
Fixed Cal 1 tonnes	
Fixed Cal 2 tonnes	

Special Tests:

The test procedure is divided into static and dynamic tests; the static tests are repeated annually and the dynamic tests at intervals of up to five years. The dynamic tests must be repeated when:

1. the installation is significantly modified, for example, the

curve of the compensated track is varied, additional points are installed, or the distance of the loading point from the weigher is changed;

- 2. the dynamic calibration is changed, that is, the indicated quantity when the auto-calibration is operated differs from the Auto-cal figure marked on the instrument; or
- 3. the maximum axle load, the number of axles on a wagon or the number of wagons in a train is to be varied.

Static Tests:

- Zero with 0,005-t increment selected, mode auto/ext on ext and the Auto-cal cancelled by the operation of the reset switch, zero is adjusted so that the weight indicated is 0,000 t with intermittent indications of 0,005 t.
- 2. End Test when a two-axle rail trolley, which has a wheel base shorter than the length of the weighbridge and which is loaded so that one axle carries a load of about 14 tonnes more than the other axle,* is weighed several times (the entire trolley end being on the weighbridge and the heavy end located successively on each end), the weight indicated should be within the maximum permissible error for that load.

For the purpose of this test the approximate load on each axle may be determined by "end-to-end" weighing, that is, with only one axle at a time located on the weighbridge.

Dynamic Tests:

The instrument should be tested' with trains made up of the type

- * The recommended method of loading the rail trolley is to group the load symmetrically about one axle, with a counterbalance load at the opposite end of the rail trolley.
- [†] For each weighing, the Auto-cal correction, that is, the weight added to or subtracted from the weight of each axle of each wagon by the Auto-cal circuits, should be recorded. For example, an Auto-cal indication of 10,465 t would be a correction for each axle weighed of 10,500 t - 10,465 t = 0,035 t. For a four-axle wagon it represents a dynamic calibration correction of + 0,14 t (4 × 0,035 t).

Recording the various dynamic calibration settings allows the test results, obtained before the final dynamic calibration setting is fixed, to be mathematically corrected to be the test results which would have been obtained had all the tests been repeated after the final dynamic calibration setting was determined.

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of wagons normally weighed.

<u>Initial Calibration</u> — The dynamic calibration (Auto-cal) is first adjusted on the basis of not less than five test weighings of a train made up of not less than six loaded wagons, each of gross weight not less than 55 tonnes, and each of weight known to \pm 0,02 t, when weighed coupled in motion at train speeds between 1 and 5 km/n.

Final Calibration and Verification Test:

- 1. The dynamic calibration is further adjusted, if necessary, during or after not less than 15 test weighings of the six known-weight wagons when included in a train made up in each of the following combinations of known-weight and empty wagons; not less than five weighings are made for each combination:
 - (a) when the train comprises the six known-weight wagons followed by 64 empty wagons;*
 - (b) when the train comprises the six known-weight wagons followed by 45 empty wagons;*
 - (c) when the train comprises the six known-weight wagons followed by 30 empty wagons."

The dynamic calibration is satisfactory in regard to the ability of the instrument to determine the gross weight of trains when weighed during loading when -

- (a) the maximum number of wagons is 64;
- (b) the maximum number of loaded wagons between the loading position and the weighing position when a wagon weight is being determined is six; and
- (c) the gross weight of each wagon is between 50 and 65 tonnes;

provided that:

- (a) the maximum error in each corrected total weight of the six known-weight wagons for each of the combinations of known-weight and empty wagons (20 weighings) is within
- * In each case, including the initial calibration, the six knownweight wagons may be preceded by any number of empty or full wagons; this will not affect the calibration result.
- [†] Corrected after appropriate adjustments for any changes in the dynamic calibration during the series of tests.

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- (b) the mean of the corrected* total weights of the six knownweight wagons for all the combinations of known-weight and empty wagons (20 weighings) is within 0,1% of the known total weight of the six wagons.
- 2. If the instrument may also be used for determining the gross weight of trains when weighed after the complete train is loaded (reweighed), the dynamic calibration should be further checked (not reset) by, say, three test weighings of a train made up of six known-weight wagons followed by 64 fully loaded wagons; the entire train is weighed. Two results are obtained, the indicated weight of the six known-weight wagons and the indicated weight of the 72-wagon loaded train.

The dynamic calibration is also satisfactory in regard to the ability to determine the gross weight of trains when fully loaded, provided that:

- (a) the mean of:
 - (i) the average of the corrected total weight of the six known-weight wagons weighed by themselves (initial calibration), and
 - (ii) the average total weight of the six known-weight wagons weighed when followed by 64 fully loaded wagons,

is within 0,1% of the weight of the six known-weight wagons; and

(b) the weight of the train comprising the 72 loaded wagons is within 0,1% of the mean of the indicated train weights.

^{*} Corrected — after appropriate adjustments for any changes in the dynamic calibration during the series of tests.



FIGURE 6/10B/4 - 1







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Lower Headwork





