Australian Government
National Measurement Institute

Bradfield Road, West Lindfield NSW 2070

Certificate of Approval
NMI 6/14B/26

Issued by the Chief Metrologist under Regulation 60
of the
National Measurement Regulations 1999

This is to certify that an approval for use for trade has been granted in respect of the instruments herein described.

Accurate Systems Model AS-DT1 Discontinuous Totalising Automatic Weighing Instrument

submitted by Accurate Weighing Machines Pty Ltd
trading as Accurate Systems
40 Punari Street
Currajong QLD 4812

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

This approval has been granted with reference to document NMI R 107, *Discontinuous Totalising Automatic Weighing Instruments (Totalising Hopper Weighers)*, dated July 2004.

This approval becomes subject to review on 1/06/20, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern and variant 1 provisionally approved – interim certificate issued	8/05/15
1	Pattern and variants 1 & 2 approved – certificate issued	2/07/15

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number ‘NMI 6/14B/26’ and only by persons authorised by the submittor.

Instruments purporting to comply with this approval and currently marked ‘NMI P6/14B/26’ may be re-marked ‘NMI 6/14B/26’ but only by persons authorised by the submittor.

It is the submittor’s responsibility to ensure that all instruments marked with this approval number are constructed as described in the documentation lodged with the National Measurement Institute (NMI) and with the relevant Certificate of Approval and Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with document NMI P 106.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificate No S1/0B.

The values of the performance criteria (maximum number of scale intervals etc.) applicable to the instrument shall be within the limits specified herein and in any approval documentation for the components where they are approved separately.

This approval shall NOT be used in conjunction with General Certificate No 6B/0.

Signed by a person authorised by the Chief Metrologist to exercise their powers under Regulation 60 of the *National Measurement Regulations 1999*.

Dr A Rawlinson

TECHNICAL SCHEDULE No 6/14B/26

1. Description of Pattern **provisionally approved on 8/05/15**
approved on 2/07/15

An Accurate Systems model AS-DT1 Class 0.5 discontinuous totalising automatic weighing instrument (DTAWI) having a weigh hopper of 20 000 kg maximum capacity.

This approval (pattern and variant 1) applies to instruments located at the following Queensland Sugar Limited sites:

Mourilyan: Mourilyan Bulk Sugar Terminal
Mourilyan Harbour
Mourilyan QLD 4858

Cairns: Cairns Bulk Sugar Terminal
Cnr Cook & Draper Strees, Portsmith
Cairns QLD 4870

The instrument is installed in a permanently fixed location.

Note: This approval has been granted with reference to document NMI R 107, *Discontinuous Totalising Automatic Weighing Instruments (Totalising Hopper Weighers)*, dated July 2004. The following description is intended to introduce terms used in this Certificate and Technical Schedule which may be additional to those in that document but which are consistent with the terminology in the document.

The system aims to provide a *bulk load delivery* using a particular automatic *delivery sequence* (the term 'delivery' may also be taken to refer to 'receipt').

This sequence involves the totalisation of the results of a number of *discrete load deliveries* or *weighing cycles*, each of which involves the division of the bulk product into *discrete loads*, according to a *target discrete load* the mass of which is then determined by weighing to give the *discrete load delivered* following which the product is discharged to the bulk output. Note that the *target discrete load* may be achieved by stopping or slowing the bulk product delivery prior to the *target discrete load* value being reached according to *discrete load target shutoff adjustments* (such as inflight adjustments or slow flow pre-sets).

Each *discrete load delivered* is totalised (at any time this may be termed the *cumulative totalisation*).

The *target discrete load* is generally a pre-selected value that is the same for most of the *discrete load deliveries* (this may be termed the *pre-selected target discrete load*). However for the final one or two deliveries in the *bulk load delivery* the *target discrete load* may differ (for example to avoid excessively large or small *discrete loads*). In addition, arrangements for stopping or slowing the bulk product delivery prior to the *target discrete load* value being reached may vary for the final discrete deliveries in the delivery sequence according to *target totalised load shutoff adjustments* (such as inflight adjustments or slow flow pre-sets).

The *totalised bulk load delivered* may be intended to be close to a requested amount (*target totalised load*) in which case adjustments and pre-sets as described above may be used to achieve this as closely as possible.

Alternatively the *totalised bulk load delivered* may be the quantity measured without a particular target totalised load.

The *totalised bulk load delivered* is the cumulative totalisation (sum of all discrete loads delivered), in the complete *bulk load delivery*. The transaction is based on the *totalised bulk load delivered* (not the *target totalised load*).

1.1 Details

The Accurate Systems model AS-DT1 instrument (Figure 1) is a Class 0.5 discontinuous totalising automatic weighing instrument having a weigh hopper with a maximum capacity of 20 000 kg. The indication of the weigh hopper (which is used to determine discrete load values that are totalised and then rounded to the nearest totalisation scale interval to provide the totalised load value) has a scale interval of 10 kg.

The instrument is approved for use with a minimum totalised load (Σ_{min}) of not less than 10 000 kg and a totalisation scale interval of 10 kg. The instrument is set to have a target discrete load of from 16 000 to 18 000 kg.

The AS-DT1 instrument permanently records the *totalised bulk load delivered* and the net value of each discrete load delivered. This information can be sent to a printer if required.

Note: The discrete load values are NOT approved for trade use. The totalised bulk load delivered (a total of the discrete load delivered values) is the value approved for trade use.

1.2 Weighing System

The pattern comprises components as described below (see Figure 2 for an overview).

(*) For items marked (*) below, 'Compatible and Equivalent' equipment may be used. 'Compatible and Equivalent' refers to equipment of the same or better specifications, requiring no changes to software for satisfactory operation of the complete system.

(a) A weigh hopper with out-feed gate, using four (4) Flintec model RC3D-30t-C4 load cells of 30 000 kg maximum capacity. The load cells are also described in the documentation of approval NMI S522, and are mounted as shown in Figure 4a and 4b. The load cells are located symmetrically around the weigh hopper.

(b) A Systec model IT6000E digital indicator for the weighing system (the digital indicator is also described in the documentation of approval NMI S556). The indicator is fitted with associated networking and input/output modules as necessary to control gates of the hoppers, interface with relevant sensors (e.g. upper garner fill level), and communicate with any plant control system, computer, printer etc.

(c) A Schneider Electric model Modicon M340 P342020 (*) programmable logic controller (PLC). See Figure 3. Special temperature limits of 0°C to 40°C apply.

(d) Accurate Systems QSL_BW_PLC software (version V1.0.00), which runs on the programmable logic controller mentioned in (c) above, and utilises the weight readings from the digital indicator to determine the discrete load values and totalises them, and rounds to the nearest totalisation scale interval, to determine the *totalised bulk load delivered*, and stores the weighing data.

Note: The software version may have an associated 'Build number'. Build numbers subsequent to Build V1.0.00 are acceptable provided they do not involve metrological changes.

(e) A personal computer with VMS ('Vessel Management System') and SCADA software to provide the operator interface by which the operator can control the system, and access the protected weighing data. This software manages the overall loading plan (e.g. for a number of holds within a vessel), providing target totalised load values to the PLC, and incorporates a database into which the *discrete load delivered* values are recorded and from which reports regarding total deliveries are generated.

Note: The system may also be controlled and weighing data accessed by other (networked) computers.

(f) A printer (to print transaction data), or equivalent record in electronic form (*).

(g) Actuators and associated position sensors to control the product in-feed and the out-feed gates for the weigh bin. (*)

The system is designed to ensure retention of metrological information in the event of a power failure, including transition to an emergency power supply if necessary for this purpose.

1.3 Indicator and PLC Control

The QSL_BW_PLC software running on the PLC, along with weight data from the digital indicator, controls the weighing sequence, including checking of various aspects of the system operation (blocked chutes, gates open or closed as appropriate) and filling of the weigh-bin by starting and stopping of product flow (opening and closing of in-feed and out-feed gates) according to messages from the plant operator's control system.

The QSL_BW_PLC software running on the PLC, uses inputs from the system to determine when no further product delivery is required (e.g. when the in-feed bin is empty, the out-feed bin is full, or sufficient product has been supplied). In some cases these inputs may be provided by the plant operator's control system (e.g. to indicate that sufficient product has been supplied).

Weight data from the digital indicator is continually provided to the BULKmetrix software which uses this information to determine the discrete load values, totalise them to determine the *totalised bulk load delivered*, and store this weight data.

Where sufficient product has been supplied, the QSL_BW_PLC software finalises the delivery and totalises the discrete load deliveries to form the *total bulk load delivered* value.

The weight data, together with information regarding the weighing sequence status, is also provided continually to the operator interface computer(s). The operator interface computer(s) can retrieve weight data for printing if required.

1.4 Operation

An overview of the sequence of operation of the system is shown in Figure 5 and typical operator screens are shown in Figures 6 and 7.

The system is considered to be a discontinuous totalising automatic weighing instrument as it follows a predetermined program of automatic processes characteristic of the instrument. The product is weighed by individual discrete loads, which are totalised to determine the bulk product weighed.

(a) After power up initialisation, the weighing system requires valid information regarding the *target totalised load* and to be sent from the VMS system before weighing operations can commence. All plant equipment, including the weigh scale indicator and load cell combination must also be functioning correctly. When these prerequisites are satisfied and the downstream plant is running in sequence, the batch weigher is able to start its operating cycle. The weighing process will stop if a fault is detected on any piece of equipment.

(b) A normal start of the weighing cycle occurs at the beginning of a bulk load delivery, or immediately following the completion of a previous cycle. However in some cases a re-start from a previously interrupted delivery may occur. The state of the weighing cycle is recorded on an interruption, so that upon re-start, the cycle can recommence in the appropriate state.

(c) At the start of the weighing cycle, the cycle number is incremented, and the target gross weight (*target discrete load*) is set in the PLC of the weighing system, generally this is a fixed value and will not vary between deliveries.

(d) The weigh hopper is then filled by opening the feed hopper gate. The PLC utilises information from the weighing indicator, and calculations regarding 'in-flight material', to determine a 'fill target' weight at which closing of the feed hopper gate is triggered.

(f) Once all gates are closed, and the weigh hopper indicator provides a stable unchanging reading for 24 updates of the scale output (i.e. 1.5 seconds), the gross weight value from the weigh hopper indicator is recorded, along with the cycle number, time and date.

(g) The discharge hopper level is then checked to ensure that it has sufficient capacity to accept the full weigh hopper discharge. Weigh hopper emptying is then permitted.

(h) The weigh hopper gate is opened to discharge the product into the discharge hopper below.

To achieve an efficient cycle time (system throughput), the system uses an 'Empty Target', determined from discharge rates in previous measurement cycles. Once the 'Empty Target' is reached this triggers closing of the weigh hopper gate.

(i) Once all gates are closed, and the weighing indicator shows a stable unchanging reading for 24 updates of the scale output (i.e. 1.5 seconds), the tare hopper weight is recorded, along with the cycle number, time and date.

(j) The gross weight value for the loaded bin at (f), minus the tare weight value for the empty bin at (k) is the *discrete load delivered* from the weigh bin (shown as 'net' value). This can then be added to previous cycles to provide a cumulative totalised load.

(k) If the *target totalised load* has been reached, the PLC ceases the weighing cycle until any further delivery is initiated by the VMS system. Otherwise the batch weighing cycle is continued at step (b) above.

(l) The gross, tare and net weight for each weighing cycle (from (f), (k) and (l) above) are provided to the VMS/SCADA system and permanently recorded in the system database for determining of the *totalised bulk load delivered*. Various reports are available to view or print (a typical example is shown in Figure 8).

1.5 Verification Provision

Provision is made for the application of a verification mark.

1.6 Sealing Provision

The digital indicator shall be sealed as described in the documentation of its approval (see 1.2 (b) above). Access to the VMS software is password protected.

1.7 Markings and Notices

(a) Instruments carry the following markings, grouped together in a clearly visible place on the instrument, either on a descriptive plate fixed near the indicating device or on the indicating device itself:

Manufacturer's mark, or name written in full	Accurate Systems
Indication of accuracy class	0.5
Pattern approval number for the instrument	NMI 6/14B/26
Model number	AS-DT1
Serial number of the instrument	.....
Maximum capacity	*Max* = 20 000 kg (#)
Minimum capacity	*Min* = 6000 kg (#)
Minimum totalised load (not less than)	Σ_{min} = 10 000 kg (#)
Totalisation scale interval	d_t = 10 kg
Special temperature limits	0°C to 40°C
Material to be measured	.....

(#) These markings shall also be shown near the display of the result if they are not already located there.

(b) Instruments carry a notice visible to the operator stating TARGET DISCRETE LOAD SHALL BE 16 000 kg to 18 000 kg ONLY, or similar wording.

Note 1: Markings for variants vary according to particular characteristics.

Note 2: The 0°C limit of the special temperature limits derives from the specified operating temperature range of the programmable logic controller (item 1.2(c) above). Where the programmable logic controller is within an environment controlled to be within the 0°C to 40°C range, the normal operating temperature range of -10°C to 40°C applies to other items of equipment (e.g. load cells).

2. Description of Variant 1 **provisionally approved on 8/05/15**
approved on 2/07/15

The pattern (model AS-DT1) as a Class 0.5, 1 or 2 discontinuous totalising automatic weighing (DTAW) instrument having a weigh hopper of 20 000 kg maximum capacity, and a totalisation scale interval (d_t) of 10 kg. The instrument is set to have a *target discrete load* of from 6000 to 18 000 kg, and shall have a minimum totalised load value (Σ_{min}) of no less than 10 000 kg.

The indication of the weigh hopper (which is used to determine discrete load values that are totalised and then rounded to the nearest totalisation scale interval to provide the totalised load value) has a scale interval of no greater than 10 kg.

3. Description of Variant 2 approved on 2/07/15

Model AS-DT1 discontinuous totalising automatic weighing (DTAW) instruments of Class 0.5, 1 or 2, similar to the pattern but having a weigh hopper of 25 000 kg maximum capacity, and a totalisation scale interval (d_t) of 10 kg. The instrument is set to have a *target discrete load* within the range of 6000 to 21 000 kg, and shall have a minimum totalised load value (Σ_{min}) of no less than 10 000 kg. Markings of 1.7(a) and (b) shall be provided (modified appropriately as per this variant).

The indication of the weigh hopper (which is used to determine discrete load values that are totalised and then rounded to the nearest totalisation scale interval to provide the totalised load value) has a scale interval of no greater than 10 kg.

This variant applies to instruments located at the following Queensland Sugar Limited sites:

Townsville: Townsville Bulk Sugar Terminal
Lennon Drv
South Townsville QLD 4810

Lucinda: Lucinda Bulk Sugar Terminal
Dungeness Rd, Lucinda Point
Lucinda QLD 4850

Mackay: Mackay Bulk Sugar Terminal
Ken White Ave, Mackay Harbour
Mackay QLD 4740

Bundaberg: Bundaberg Bulk Sugar Terminal
46 Wharf Drv, Bundaberg Port
Burnett Heads QLD 4670

TEST PROCEDURE No 6/14B/26

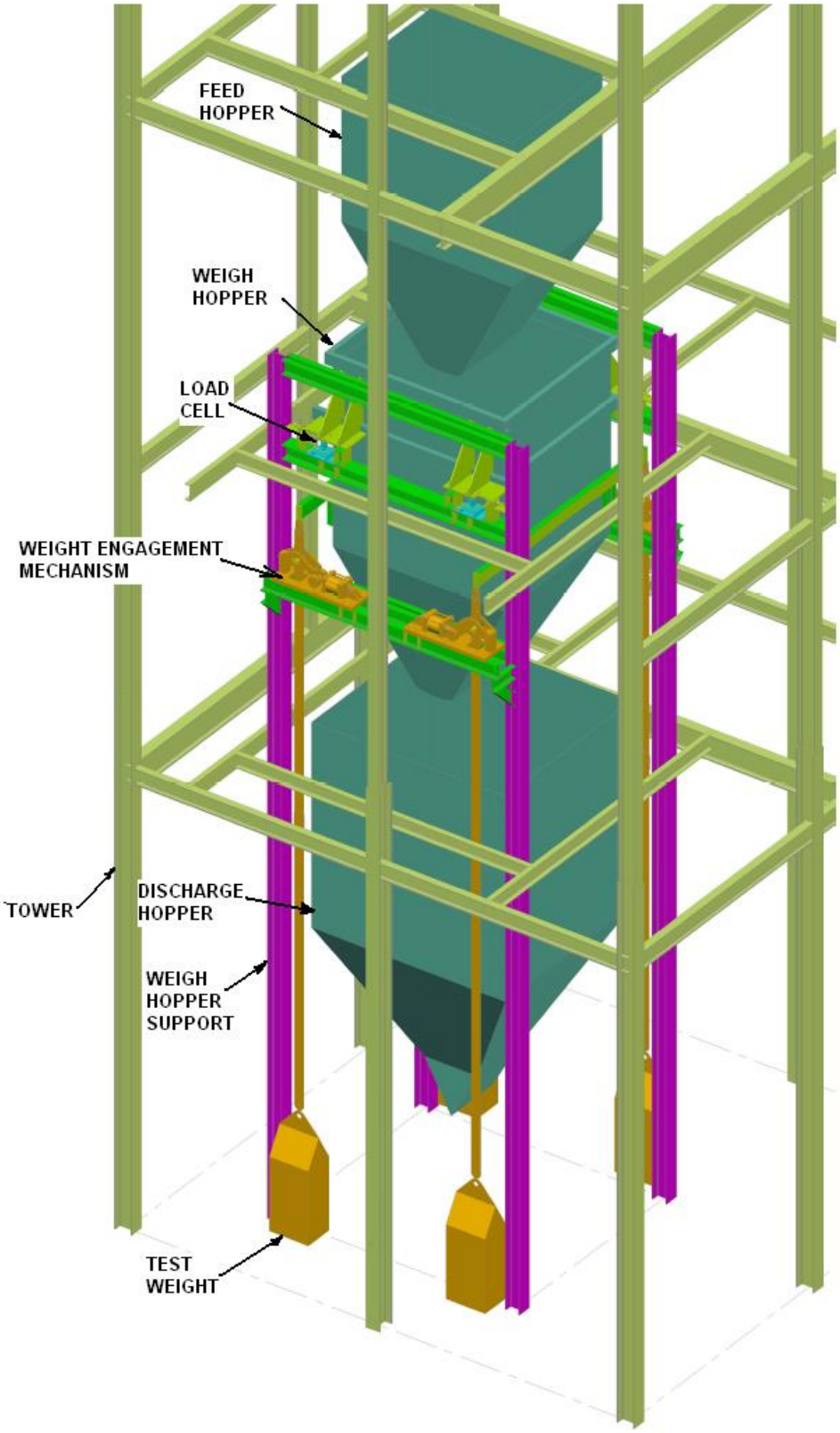
Instruments shall be tested in accordance with any relevant tests for this category of instrument.

Ensure that the programmable logic controller is only being used within the special temperature limits stated elsewhere in this Technical Schedule.

Maximum Permissible Errors

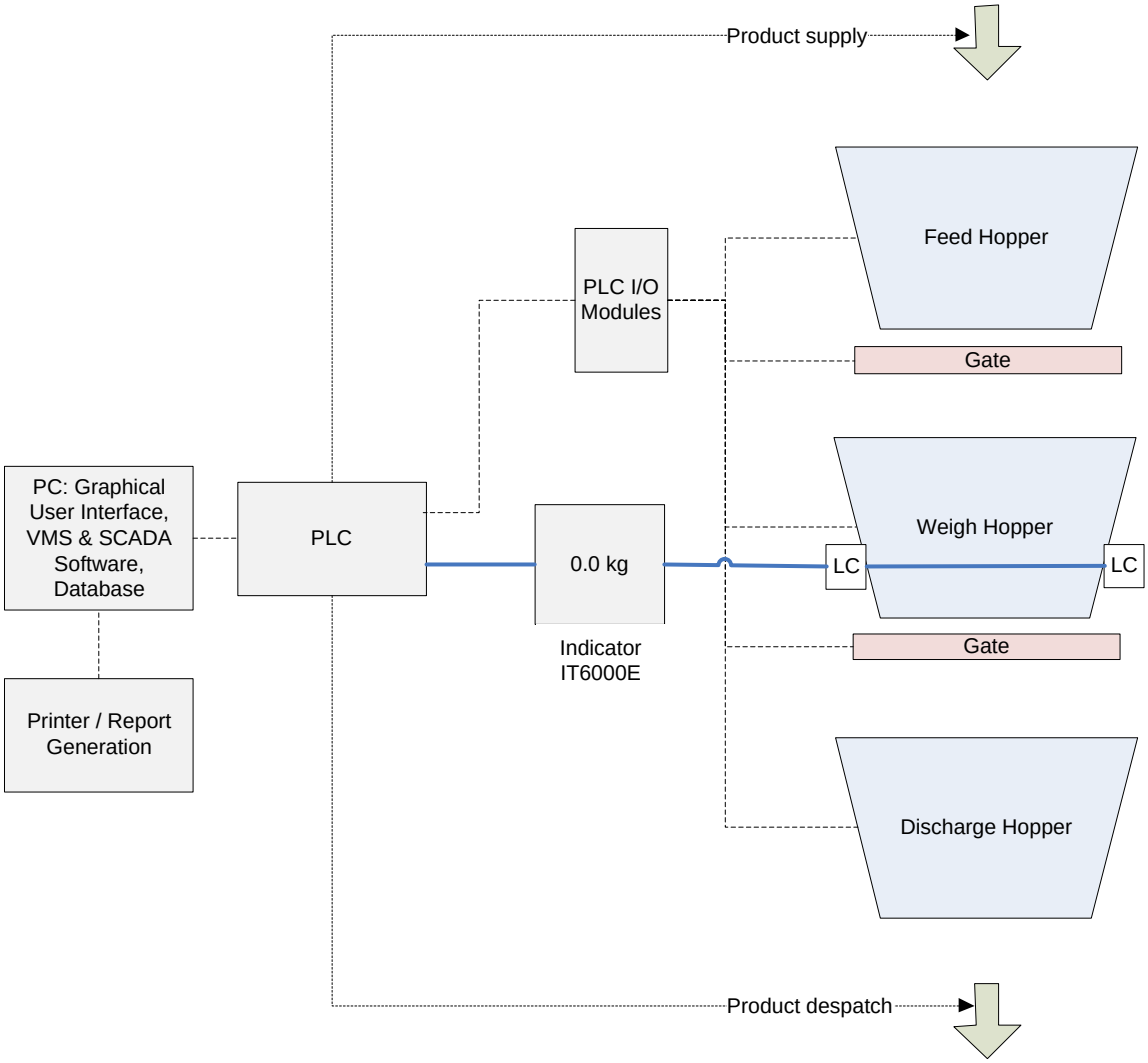
The maximum permissible errors are specified in Schedule 1 of the *National Trade Measurement Regulations 2009*.

FIGURE 6/14B/26 - 1



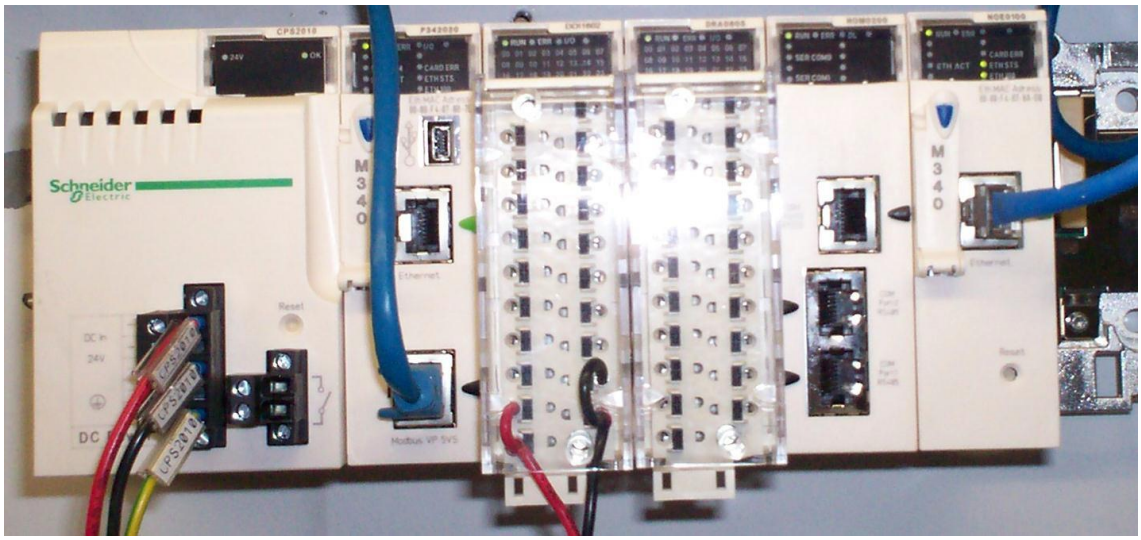
Accurate Systems Model AS-DT1 Discontinuous Totalising Automatic Weighing Instrument

FIGURE 6/14B/26 - 2



Accurate Systems Model AS-DT1 Weighing Instrument – System Overview

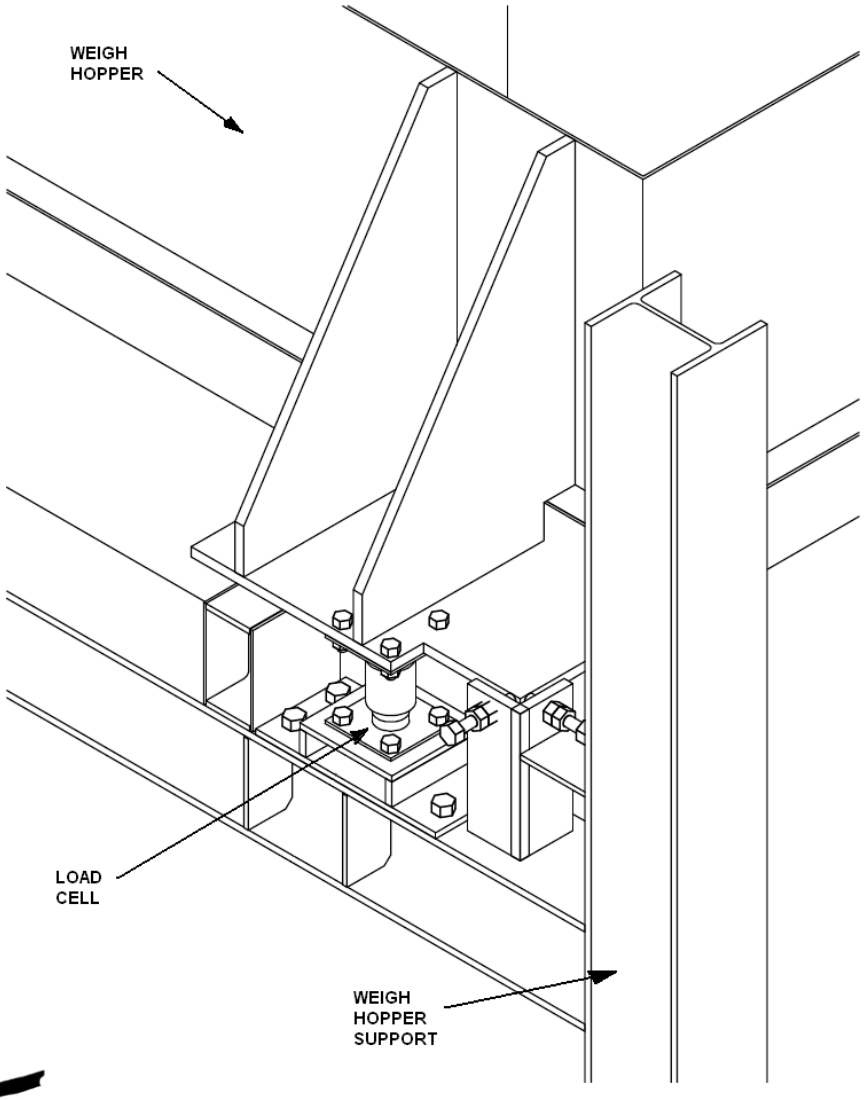
FIGURE 6/14B/26 – 3



Schneider Modicon M340 P342020 PLC

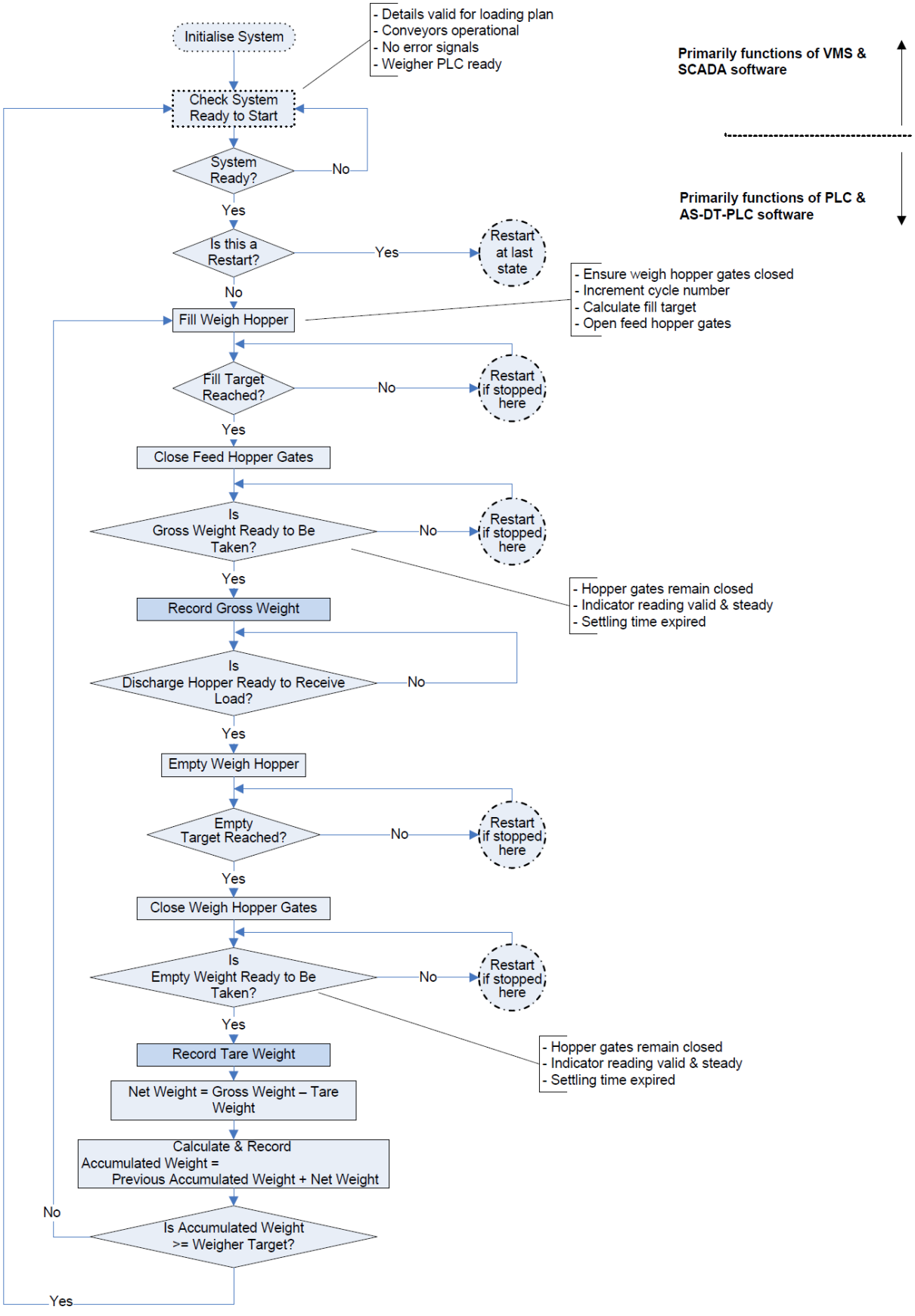
FIGURE 6/14B/26 – 4

(a) Load Cell



(b) Load Cell Mounting

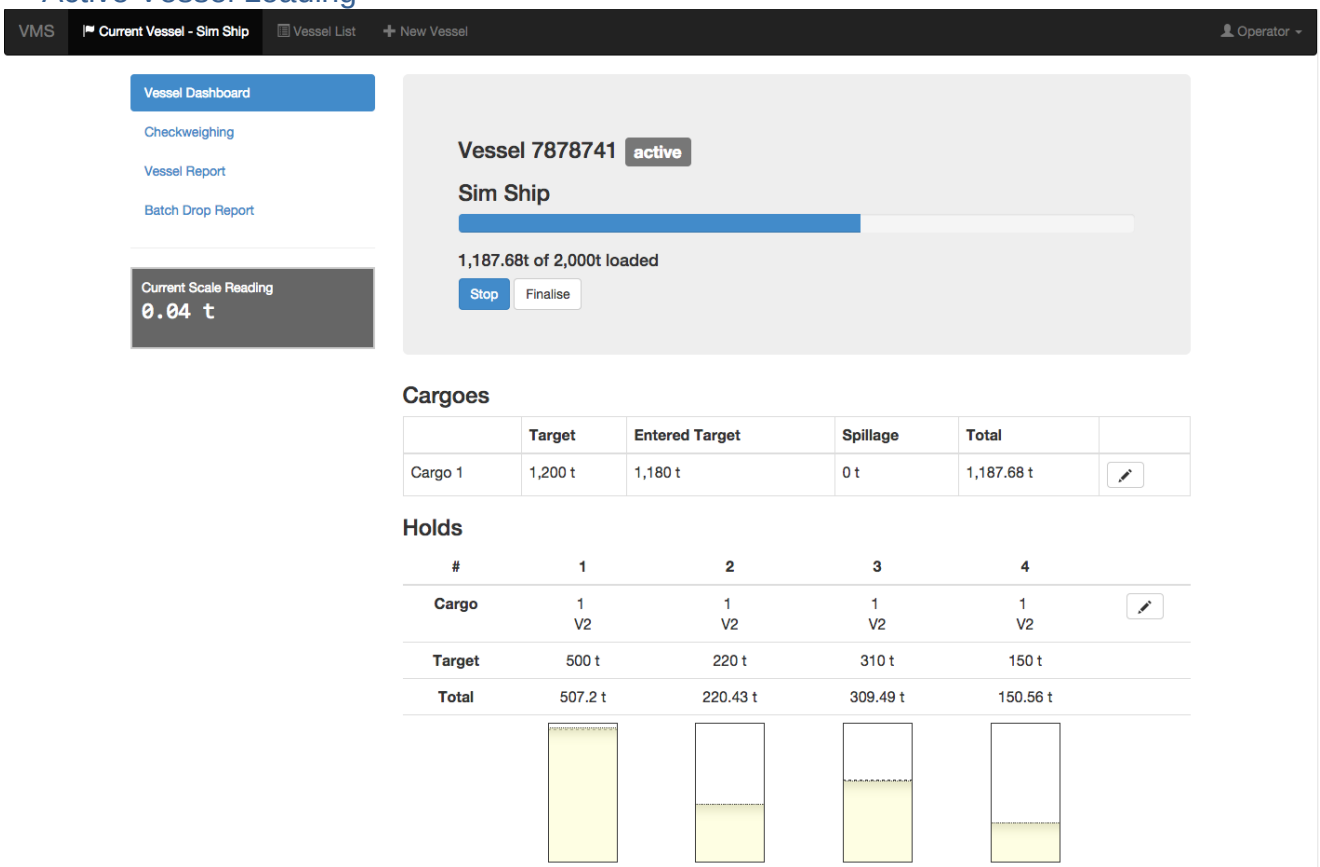
FIGURE 6/14B/26 – 5



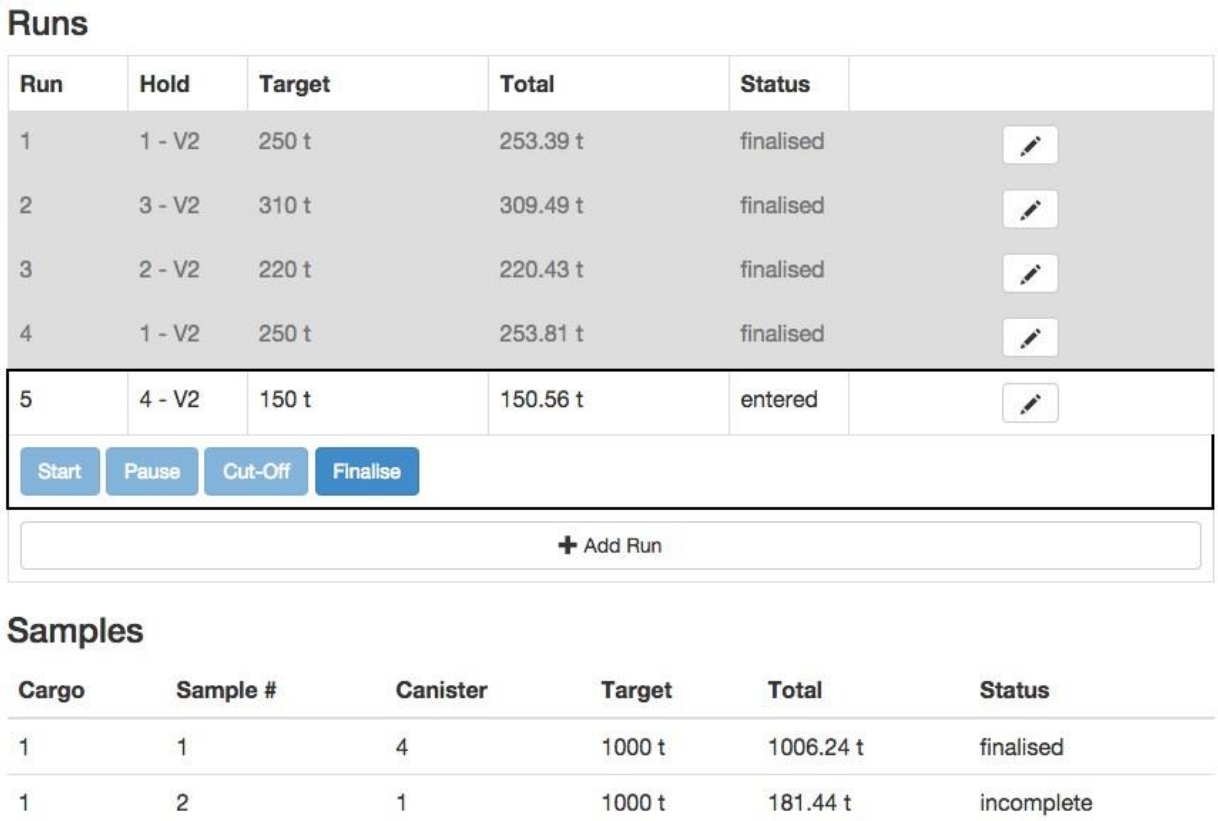
Weighing Sequence Flowchart (Overview)

FIGURE 6/14B/26 – 6

Active Vessel Loading

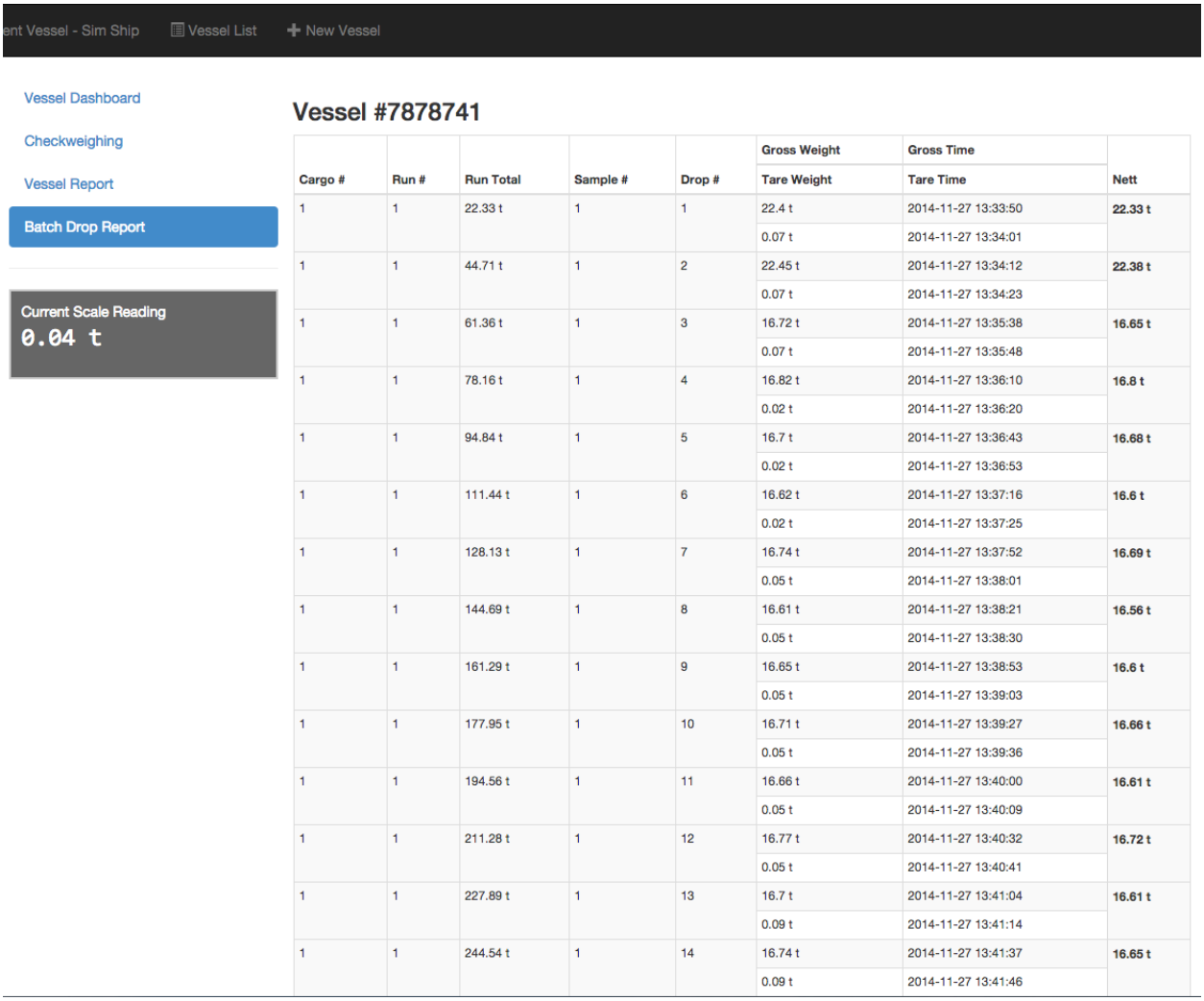


Active Vessel Targets



Accurate Systems Model AS-DT1 System Operator Screens (Typical)

FIGURE 6/14B/26 – 7



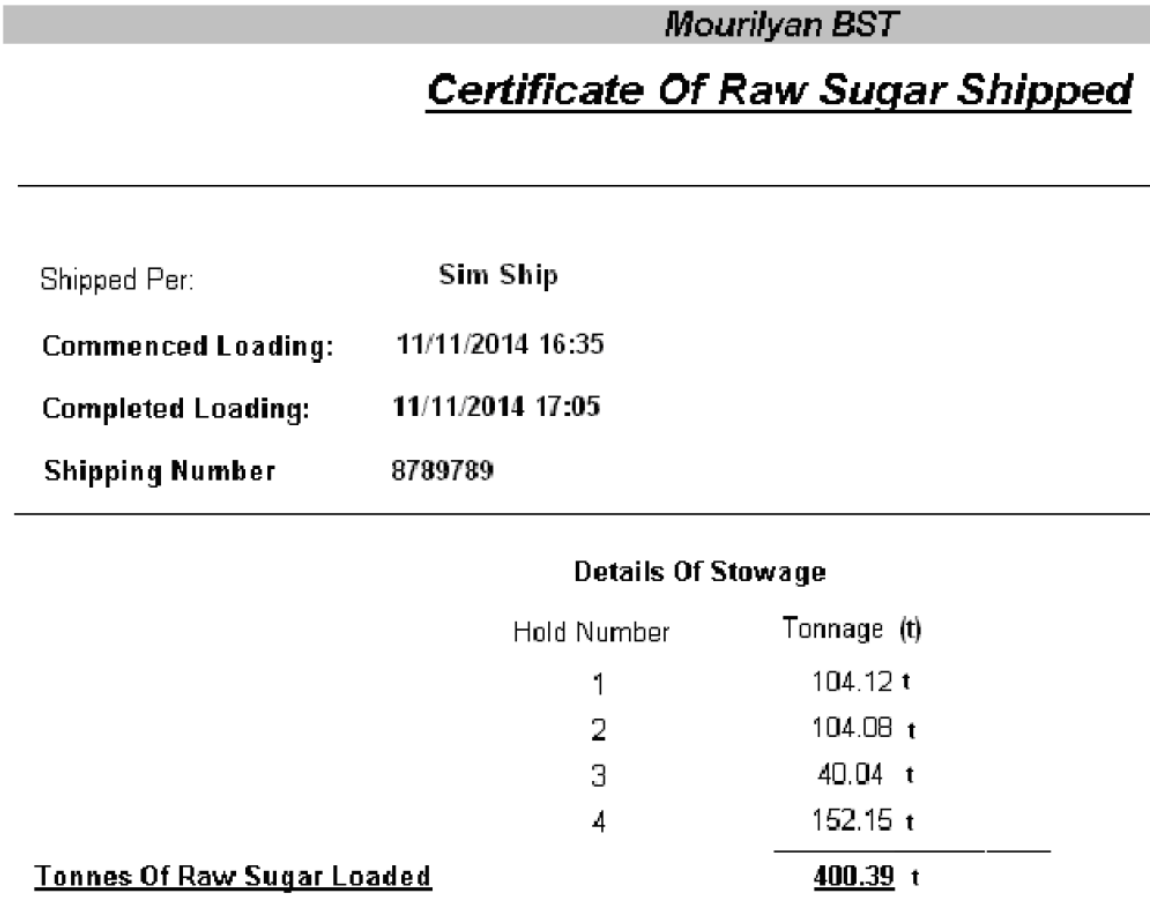
Cargo #	Run #	Run Total	Sample #	Drop #	Gross Weight / Tare Weight	Gross Time / Tare Time	Nett
1	1	22.33 t	1	1	22.4 t	2014-11-27 13:33:50	22.33 t
					0.07 t	2014-11-27 13:34:01	
1	1	44.71 t	1	2	22.45 t	2014-11-27 13:34:12	22.38 t
					0.07 t	2014-11-27 13:34:23	
1	1	61.36 t	1	3	16.72 t	2014-11-27 13:35:38	16.65 t
					0.07 t	2014-11-27 13:35:48	
1	1	78.16 t	1	4	16.82 t	2014-11-27 13:36:10	16.8 t
					0.02 t	2014-11-27 13:36:20	
1	1	94.84 t	1	5	16.7 t	2014-11-27 13:36:43	16.68 t
					0.02 t	2014-11-27 13:36:53	
1	1	111.44 t	1	6	16.62 t	2014-11-27 13:37:16	16.6 t
					0.02 t	2014-11-27 13:37:25	
1	1	128.13 t	1	7	16.74 t	2014-11-27 13:37:52	16.69 t
					0.05 t	2014-11-27 13:38:01	
1	1	144.69 t	1	8	16.61 t	2014-11-27 13:38:21	16.56 t
					0.05 t	2014-11-27 13:38:30	
1	1	161.29 t	1	9	16.65 t	2014-11-27 13:38:53	16.6 t
					0.05 t	2014-11-27 13:39:03	
1	1	177.95 t	1	10	16.71 t	2014-11-27 13:39:27	16.66 t
					0.05 t	2014-11-27 13:39:36	
1	1	194.56 t	1	11	16.66 t	2014-11-27 13:40:00	16.61 t
					0.05 t	2014-11-27 13:40:09	
1	1	211.28 t	1	12	16.77 t	2014-11-27 13:40:32	16.72 t
					0.05 t	2014-11-27 13:40:41	
1	1	227.89 t	1	13	16.7 t	2014-11-27 13:41:04	16.61 t
					0.09 t	2014-11-27 13:41:14	
1	1	244.54 t	1	14	16.74 t	2014-11-27 13:41:37	16.65 t
					0.09 t	2014-11-27 13:41:46	

Cargo #	Run #	Run Total	Sample #	Drop #	Gross Weight / Tare Weight	Gross Time / Tare Time	Nett
1	1	22.33 t	1	1	22.4 t	2014-11-27 13:33:50	22.33 t
					0.07 t	2014-11-27 13:34:01	
1	1	44.71 t	1	2	22.45 t	2014-11-27 13:34:12	22.38 t

Accurate Systems Model AS-DT1 System Operator Screens (Typical)

FIGURE 6/14B/26 – 8

Certificate of Tonnage Loaded on Vessel (Typical)



Mourilyan BST

Certificate Of Raw Sugar Shipped

Shipped Per: **Sim Ship**

Commenced Loading: 11/11/2014 16:35

Completed Loading: 11/11/2014 17:05

Shipping Number 8789789

Details Of Stowage

Hold Number	Tonnage (t)
1	104.12 t
2	104.08 t
3	40.04 t
4	152.15 t
Tonnes Of Raw Sugar Loaded	**400.39** t

Typical Output/Printout

~ End of Document ~