AUSTRALIAN RAIL TRACK CORPORATION LTD

Ref No: 08-08-11-035

New Equipment & Systems Approval - Hollow Steel Sleeper for Wayside Equipment Installation

1. Determination of Need

ARTC, in conjunction with the rolling stock operators, is undertaking the installation of rolling stock wayside monitoring equipment at a number of sites in NSW, Vic and SA.

Installation of this equipment requires the running of cables, power and data, to and from the track side monitoring equipment sensors to the data collection and processing equipment located in specially equipped huts at each site.

A mechanism is required to allow the cables to pass from equipment sensors on one side of a track or tracks, to the equipment hut on the other side of the track.

For the monitoring equipment to have maximum effectiveness downtime from damage by ballast or other debris thrown about by passing trains needs to be minimised; to this end, the mechanism by which the cables pass under the track is required to enclose the cables, and to be both robust and long lasting.

2. Significant Change or Not

This change in equipment is assessed as **MINOR**

3. Review Panel

- John Cowie - Manager, ISP, Standards and Systems
- Tim Calver - Standards and Technical Services Engineer
- Ian Domleo – Senior Track and Civil Consultant

4. Equipment Suitability

Equipment chosen for the task is a steel hollow sleeper as per VAE Railways Systems drawing VAM 13768 rev B (attached).

The sleeper is derived from the in-bearers which are part of the assembly of a 60kg Standard Gauge Tangential Turnout currently being trailed in NSW.

Sleeper cross section, material thickness and grade are the same as for the in-bearer of the Turnout. The hollow sleeper varies in that it is ***not*** notched at one end as is the in-bearer, removing an area of stress concentration, and there are two lengths of sleeper being used.

1. 4.50m to which acoustic monitoring equipment will be mounted; and
2. 4.00m, to act only as a cable conduit.

VAE initially undertook a Finite Element Analysis of the turnout in-bearer with attachments as follows.

1. VAE Railways Systems drawing number VAM 13768 rev B;
2. VAE Railways Systems drawing number VAM 13575 rev D;
3. VAE Railways Systems Report *"Finite Element Analysis In-Bearer Systems Version J"*;
4. VAE Approval Application – Point Layout Operation and Components Inbearer Steel Sleepers for Spherolock; and
5. VIPAC Engineers and Scientists LTD drawing number 5656-0114

Further to this analysis Worley Parsons also undertook a Finite Element Analysis (attached) on the in-bearer sleeper to accurately represent the loading conditions experienced. Results varied from the initial analysis completed by VAE and on further inspection of the VAE report it was concluded that the load assumptions were inadequate for the typical condition experienced by the in-bearer sleeper.

1. Worley Parsons 2006, "*ARTC Hollow Sleeper – Final Report*", Document No. 500/09962, Advanced Analysis Division, Victoria.

The suitability of the sleeper was determined to be adequate for its application.

5. Approval

Worley Parsons performed an FEA analysis reviewing the initial VAE analysis, assessment of an improved design, assessment of as-installed arrangement and assessment of unbraced sleeper arrangement for both the 2.6m and 4.5m long sleepers to be installed.

Results obtained for the long sleeper show that the 35t axle load induces a minimum factor of safety of 1.1 in fatigue. As the minimum factor of safety is above 1.0 and with added conservatism within the analysis, the 4.5m long sleeper is proven to be of adequate design.

The short sleeper shows a minimum factor of safety of less than 1.0 in the as-designed configuration. A re-design was performed and analysed in an effort to increase the factor of safety. The re-designed short sleeper has a minimum factor of safety of around 1.2 in the region of a non load bearing weld with an allowable 35MPa (BS 7608:1993). The remaining factors of safety values calculated for the design are all now greater than 1.2 and as such, the design is deemed to be adequate for the proposed load. The final analysis performed gives an indication of the suitability of the design to be used without welding in the struts. The results show that the unbraced design is adequate, with a minimum factor of safety of 1.33, provided the strut has never been installed or has been removed entirely.

The approval for installation of the in-bearer sleepers is warranted at 35t axle load and is applicable ARTC network wide.

6. Conditions of Approval

- All future installations of in-bearer sleepers should be constructed as to ***Not*** include the cross-braced struts as designed by VAE.
- Only to be installed in track in good complying condition e.g good drainage, ballast depth, compaction, ballast shoulder, well compacted.
- No modification to sleeper whatsoever without written approval from ARTC Standards & Systems department e.g drilling, welding, notching, cutting etc

7. Sign off

Review Panel:

John Cowie	*per signed original*	Date	07/08/2006
Tim Calver	*per signed original*	Date	07/08/2006
Ian Domleo	*per signed original*	Date	07/08/2006

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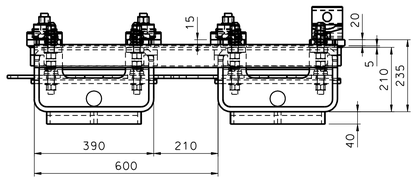

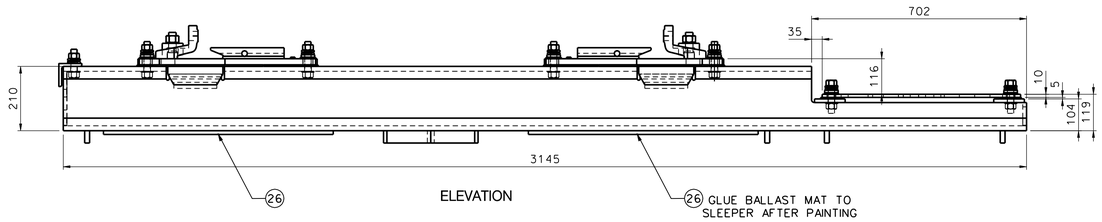

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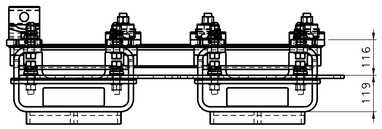
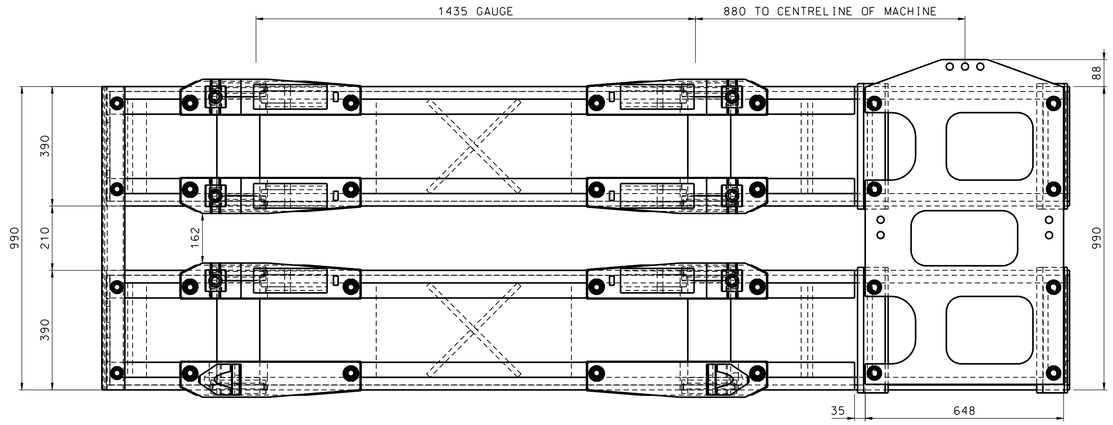




PLAN VIEW

ISO VIEW

BILL OF MATERIAL

	ITEM	DESCRIPTION	QTY	DRAWING	PART No.
	1	STEEL BEARER	2	VAM 13576	E9300180
	2	IBAV PLATE RIGHT HAND	3	VAM 13577	E2500104
	3	IBAV PLATE LEFT HAND	3	VAM 13577	E2500105
	4	PLATE WITH FORGED HORN RIGHT HAND	1	VAM 13578	E2500106
	5	PLATE WITH FORGED HORN LEFT HAND	1	VAM 13578	E2500107
	6	5mm THICK HDPE PAD 591mm LONG	8	VAM 13579	E9400080
	7	5mm THICK HDPE PAD 410mm LONG	4	VAM 13579	E9400080
	8	SWITCH MACHINE BASEPLATE	1	WBS33304137	3330413701
	9	ANGLE BRACKET SEPERATOR	1	WBS33304138	3330413801
	10	"3H" ECCENTRIC INSULATING BUSH FOR 20mm THICK PLAT	16	VAM 13443	E9500031
	11	FLANGED INSULATING BUSH FOR 10mm THICK PLATE	8	VAM 13444	E9500030
	12	M20 WASHER SPECIAL - ZINC PLATED	24	VAM 13700	L8100019
	13	M20 WASHER STANDARD - ZINC PLATED	27		L1720201
	14	M20 SPRING WASHER - ZINC PLATED	27		L1820201
	15	M20 HEX NUT - ZINC PLATED	27		L1220201
	16	M20 HEX HEAD BOLT 65mm LONG - ZINC PLATED	8		L2220065
	17	M20 HEX HEAD BOLT 75mm LONG - ZINC PLATED	3		L2220075
	18	M20 HEX HEAD BOLT 90mm LONG - ZINC PLATED	16		L2220090
	19	RAIL CLIP "K" TYPE	6	VAM 13445	E9300181
	20	M24x60 D-BOLT	6	VAE 87699	L5324001
	21	M24 NYLOC NUT	6		L1324204
	22	M24 BELVILLE WASHER	6		450082934
	23	M27x100 HEX HEAD BOLT COMMERCIAL BL	2		L3227080
	24	M27 STRUCTURAL NUT	2		L3327001
	25	M27 SPRING WASHER	2		L3827001
	26	BALLAST MAT 12x308x750 RUBBER	4		J2800054
•	27	IBAV SPRING PLATE	6	VAE 85554	79813500004
•	28	IBAV SPRING PIN INBEARER	6	VAM 11482	L7100009

• ITEMS SUPPLIED BY VAE

Rev.	Description	Date	Dm.	Ckd.
D	PARTS LIST AMENDED / DRG AMENDED	11/10/05	CMB	DPB
C	BALLAST MAT ADDED TO PARTS LIST	05/08/05	CMB	DPB
B	ITEMS 9 & 11 MODIFIED	09/03/05	TQN	GSB
A	PRELIMINARY FOR REVIEW	19/02/05	TQN	GSB

References

Drawn TQN	Date 16/02/05	Part No. J2600001	VAE RAILWAY SYSTEMS PTY LTD Mackay, Australia A.B.N. 71 071 073 108
Checked GSB	Scale 1:10	Predecessor	INBEARER SWITCH TIE ASSEMBLY FOR 60kg TANGENTIAL TURNOUTS 1435 GAUGE
Approved GSB	Weight (kg)	Specification A.S. 1085.1	

Code	Size	Sheet No.	Dwg. No.	Rev.
	A1	1 of 1	VAM 13575	D

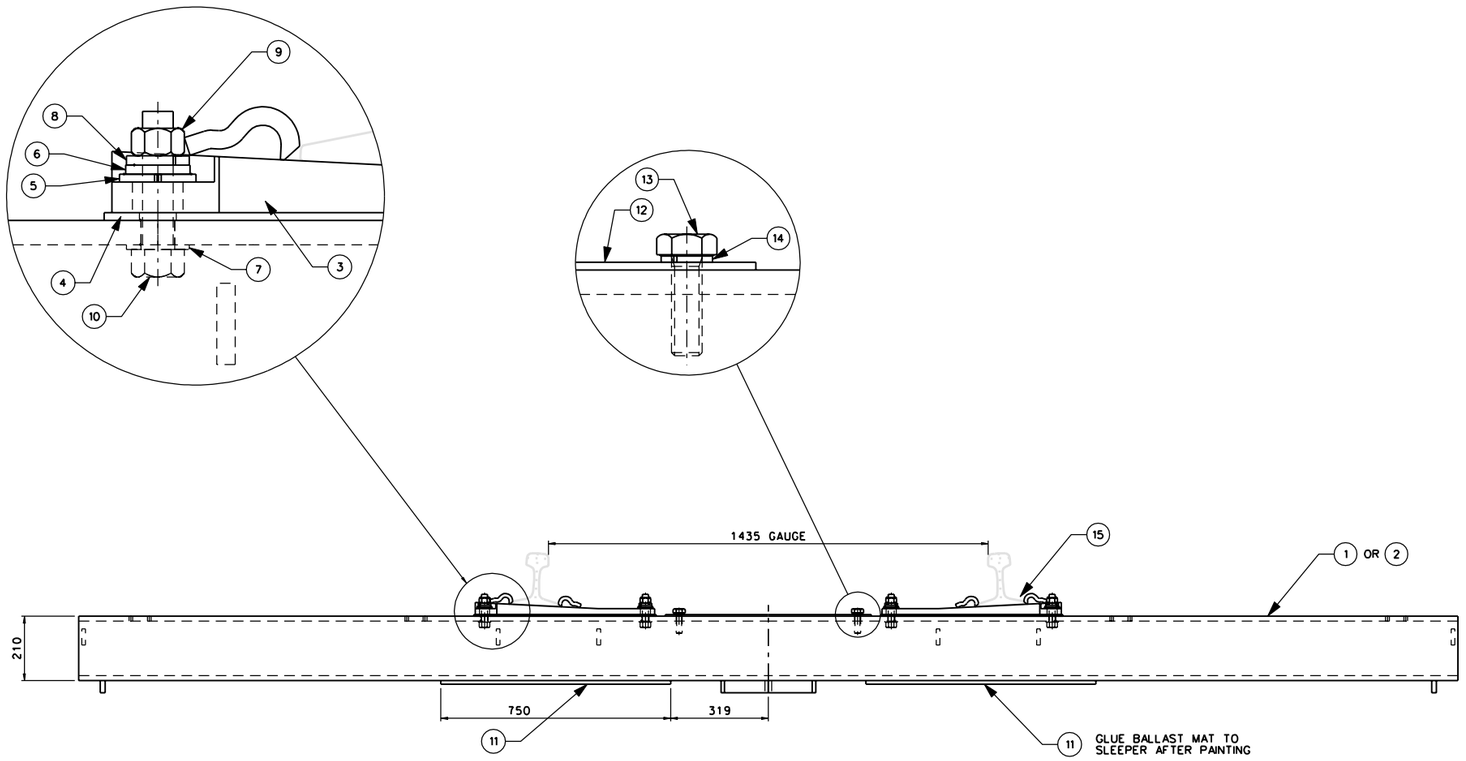
Plotted 24/10/2005 9:59:04 AM Location I:\proj\vam\jh Bearet\dgn\vam13575.dgn

VAE Form No. EF-0403

BILL OF MATERIAL

ITEM	DESCRIPTION	QTY	DRAWING	PART No.
1	STEEL BEARER 4.5 METRES	•	VAM 13766	G8000003
2	STEEL BEARER 2.6 METRES	•	VAM 13767	G8000004
3	BASEPLATE INB-PLT1	2	VAM 13769	
4	5mm THICK HDPE PAD 595mm LONG INB-1	2	VAM 13770	
5	"3H" ECCENTRIC INSULATING BUSH FOR 20mm THICK PLAT	8	VAM 13443	E9500031
6	M20 WASHER SPECIAL - ZINC PLATED	8	VAM 13700	L8100019
7	M20 WASHER STANDARD - ZINC PLATED	8		L1720201
8	M20 SPRING WASHER - ZINC PLATED	8		L1820201
9	M20 HEX NUT - ZINC PLATED	8		L1220201
10	M20 HEX HEAD BOLT 90mm LONG - ZINC PLATED	8		L2220090
11	BALLAST MAT 12x308x750 RUBBER	2		J2800054
12	COVER PLATE	1	VAM 13771	J2600004
13	M20 HEX HEAD BOLT 65mm LONG ZINC PLT	4		L2220065
14	M20 SPRING WASHER ZINC PLT	4		L1820201
•• 15	PANDROL CLIP e2003	4		E9100004

• 1 OFF 4.5m STEEL SLEEPER FOR P/No. J2600002
OR 1 OFF 2.6m STEEL SLEEPER FOR P/No. J2600003
•• ITEM PACKED



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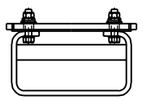
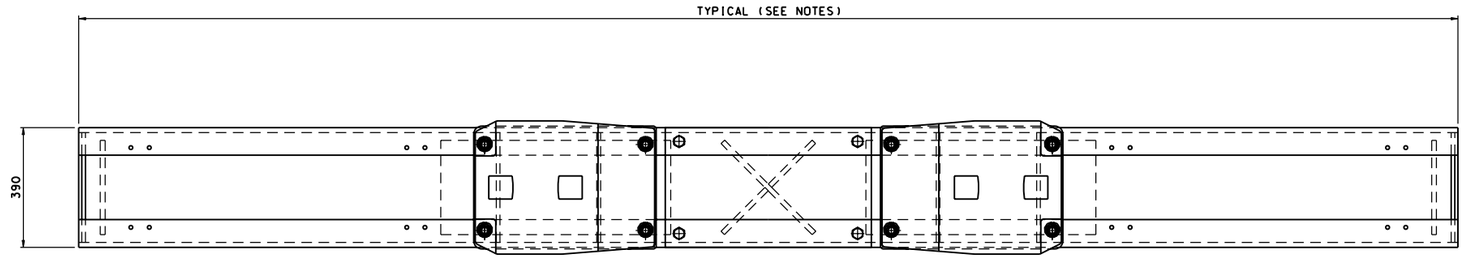




PLAN VIEW

Typical only

NOTES

P/No. 4.5M STEEL SLEEPER ASSEMBLY J2600002
2.6M STEEL SLEEPER ASSEMBLY J2600003

Rev.	Description	Date	Drn.	Chkd.
B	CANTED PLATES ADDED	23/03/06	DMJ	DPB
A	5.0M INBEARER CHANGED TO 4.5M IN LENGTH	20/03/06	DMJ	CMB

References

Drawn DMJ	Date 07/03/06	Part No. SEE NOTES	
Checked CMB	Scale 1:10	Predecessor VAM 13575	
Approved DPB	Weight (kg)	Specification AS1085.1	

VAE RAILWAY SYSTEMS PTY LTD
Mackay, Australia
A.B.N. 71 011 073 155

INBEARER TROUGH ASSEMBLY
FOR 60KG 1435 GAUGE

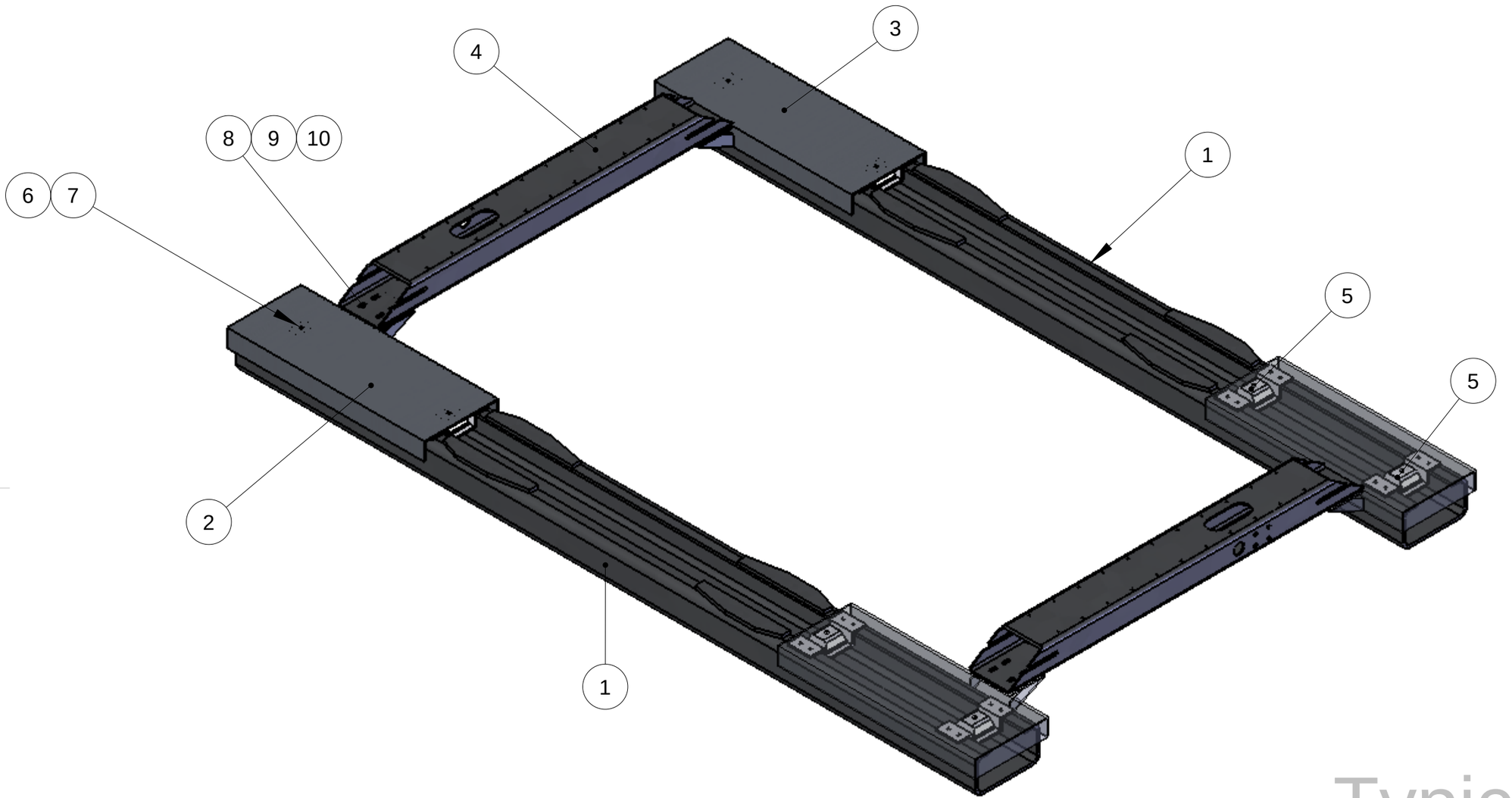
Code	Size	Sheet No.	Dwg. No.	Rev.
	A1	1 of 1	VAM 13768	B

DRAWING No
5656-0114

DO NOT SCALE

USED ON ☒

REVISIONS - SEE DCN FOR DETAILS					
ISSUE	DATE	DRAWN	CHKD	APPROVAL	DCN
A	17 FEB 06	R. Hamilton	-	-	
B	28 FEB 06	R. Hamilton			
C	6 MAR 06	R. Hamilton			



Typical only

ITEM NO.	Default/ QTY.	PART NUMBER	DESCRIPTION	SUPPLIER
1	2	5552-0001	Hollow Sleeper	VAE
2	2	5656-0112-2	Isolator Cover - Right	
3	2	5656-0112-1	Isolator Cover - Left	
4	2	5656-0110	Cabinet Beam	
5	8	5656-0117	Isolator Assy	
6	8	M16 x 25	St Stl Hex Head	
7	8	M16	St Stl Spring Washer	
8	16	M16 x 35	St Stl Hex Head	
9	32	M16	St Stl Plain Washer	
10	16	M16	St Stl Nyloc Nut	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES. GENERAL TOLERANCES ARE:
LINEAR ±0.2 ANGULAR ±1°

MATERIAL AS PER PARTS

FINISH AS PER PARTS

3rd ANGLE PROJECTION

CONTRACT No

DRAWN	R. Hamilton	17 FEB 06
CHECKED	-	-
APPROVED	-	-

SECURITY CLASSIFICATION
UNCLASSIFIED

DRAWING STANDARD DEF (AUST) 5085

VIPAC ENGINEERS & SCIENTISTS LTD
21 KING WILLIAM ST KENT TOWN SA 5067
A.C.N. 005 453 627

TITLE
CABINET MOUNT ASSEMBLY ON SLEEPER

CODE IDENT No Z7F08

DRAWING No 5656-0114

SHEET SIZE A3

SCALE N/A

SHEET NO 1 OF 2

DRAWING No
5656-0114

DO NOT SCALE

USED ON ☒

REVISIONS - SEE DCN FOR DETAILS					
ISSUE	DATE	DRAWN	CHKD	APPROVAL	DCN
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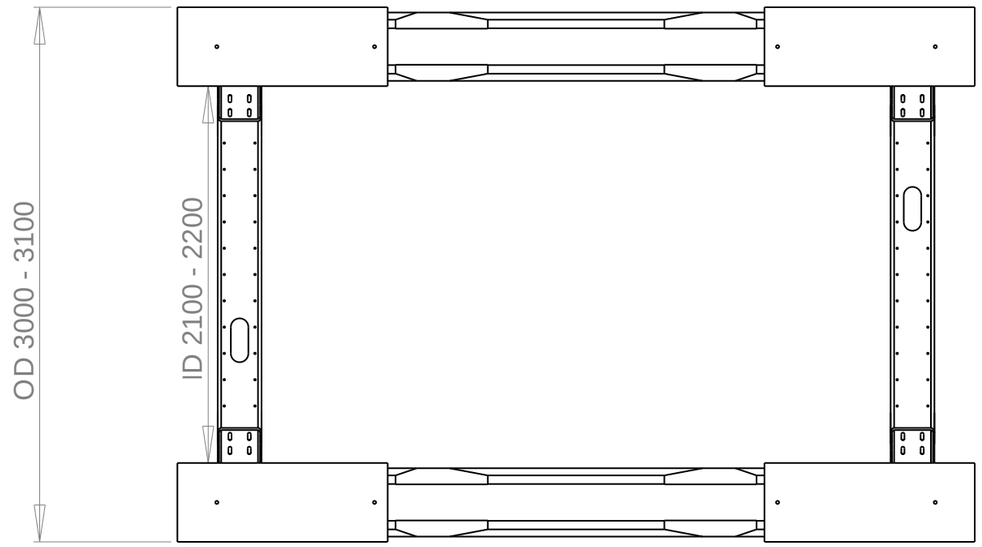
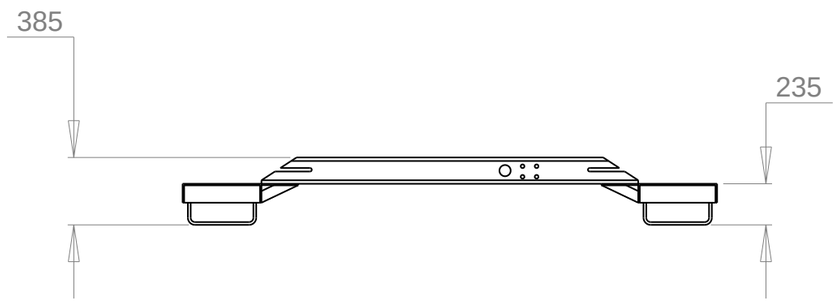
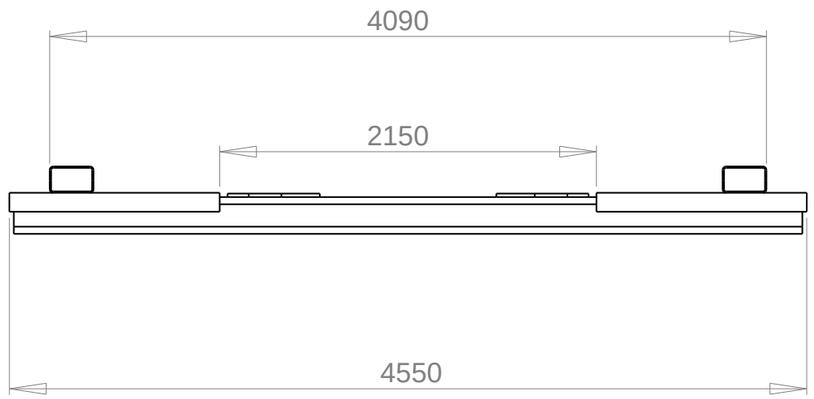
B	28 FEB 06	R. Hamilton			
C	6 MAR 06	R. Hamilton			







Typical only

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LINEAR ±0.2 ANGULAR ±1°

MATERIAL AS PER PARTS

FINISH AS PER PARTS

3rd ANGLE PROJECTION

CONTRACT No

DRAWN	R. Hamilton	17 FEB 06
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APPROVED	-	-

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DRAWING STANDARD DEF (AUST) 5085

VIPAC ENGINEERS & SCIENTISTS LTD
21 KING WILLIAM ST KENT TOWN SA 5067
A.C.N. 005 453 627

TITLE
CABINET MOUNT ASSEMBLY ON SLEEPER

CODE IDENT No Z7F08

DRAWING No 5656-0114

SHEET SIZE A3

SCALE N/A

SHEET NO 2 OF 2