

NR/SIG/10663 Signal Maintenance Specifications		
NR/SMS/Part/Z		
Reference Values		
Issue No: 08	Issue Date: 05/03/16	Compliance Date: 04/06/16

This section provides details of measurements and voltages that are to be expected and/or achieved in the tasks and tests in the NR/SMS suite.



Caution:

These do not supersede any values in Network Rail company standards. If you are in doubt about any value, ask your SM(S).

Each of the groups listed below contains reference values related to various equipment associated with that group.

Equipment Group	NR/SMS	Issue
Signals	NR/SMS/Part/Z01	06
Points	NR/SMS/Part/Z02	06
Train Detection	NR/SMS/Part/Z03	05
Level Crossings	NR/SMS/Part/Z04	02
Cables	NR/SMS/Part/Z05	02
Primary/Secondary Cells	NR/SMS/Part/Z06	01
Bus Bar Earth Leakage	NR/SMS/Part/Z07	01

END

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AWS

HEIGHT

above/below rail level	±12mm
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INDUCTOR WIRING

Yellow Inductor: 12V Operation (Parallel Coils)

Magnet Type	Connections			
	Strap		B12	N12
Old Pattern	1 and 2	3 and 4	4	1
New Pattern (First Issue)	1 and 2	3 and 4	1	4
New Pattern (Latest Issue)	1 and 2	3 and 4	4	1

Yellow Inductor: 24V Operation (Series Coils)

Magnet Type	Connections		
	Strap	B12	N12
Old Pattern	2 and 3	4	1
New Pattern(First Issue)	2 and 3	1	4
New Pattern(Latest Issue)	2 and 3	4	1

Green Inductor: 60V Operation (Extra Strength)

Magnet Type	Connections		
	Strap	B60	N60
Green	None	4	1

Vortok Type Inductor:

Plug coupler contact allocations specified in standard drawing T00036

Magnet Type	Plug coupler contact number	
	Feed	Return
Yellow	1	2

COIL RESISTANCES

Standard Strength and Electro-Magnets

24V Operation (Coils Wired in Series)	60Ω
12V Operation (Coils Wired in Parallel)	15Ω

VORTOK TYPE INDUCTOR

Voltages/Current Permutations

Inductor	Voltage Nominal	Voltage Minimum	Voltage Maximum	Current Nominal	Casing Extends Below sleeper level?
Yellow Electro (YE)	24V	18.8V	35.0V	0.5A	No
Yellow Supp. (YS)	24V	18.8V	35.0V	1.56A	No

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When testing any plug coupled equipment an appropriate break out device shall be used.

Under no circumstances should meter leads or prods be brought into contact with the plug coupled pins or sockets.

VORTOK TYPE INDUCTOR	
Coil Impedances	
Yellow Electro (YE) 24V Operation	48Ω
Yellow Supp. (YS) 24V Operation	12Ω

VOLTAGE & CURRENT READINGS						
Electro-Magnet Voltages/Current Permutations						
Inductor	Coils Parallel /Series	Voltage Nominal	Voltage Minimum	Voltage Maximum	Current Nominal	Casing Extends Below Sleeper Level?
Yellow Electro Mk1	P	12V	10.5V	-	0.75A	Yes
	S	24V	21V	-	0.38A	
Yellow Electro Mk2	P	12V	10.8V		0.85A	No
	S	24V	21.6V	24V	0.45A	
Green Electro Mk1	P	24V	-	-	2.3A	Yes
	S	28V	-	-	1.15A	
Green Electro Mk2	-	60V	51V	60V	1.5A	No
Yellow Supp.	-	24V	22.8V	25.8V	1.26A	Yes
Yellow Supp.	-	24V	22.8V	32V	1.5A	No
Green Supp. Mk2	-	110V	93.5V	121V	2.3A	No



When testing the AWS standard strength suppressor magnet using a calibrated S&P meter it should be noted that in some track circuited areas the 'E' and 'P' indicator may oscillate between the two indications when 'suppression' is active. This is not a fault condition.

SIGNALS

SIGNAL BEAM ALIGNMENT	
At 3m above rail level	183m

SIGNAL LAMP VOLTAGES	
Filament Lamps	
Conventional SL35 (Heads & PLJIs all areas except SIMIS-W interlockings)	10.5V to 12.1V
Conventional SL35 (Heads & PLJIs SIMIS-W interlockings only)	10.5V to 10.8V
Conventional SL35 (MSL/MWL Light Units)	11.3V to 11.7V



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Filament Lamps		
8000 hour SL35 W interlockings)	(main filament only, all areas except SIMIS-W interlockings)	11V to 12.1V
8000 hour SL35 only)	(main filament, SIMIS-W interlocking areas only)	10.5V to 10.8V
8000 hour SL35	(Where BR942 spec relays are used as a UECR on PLJIs)	10.5V to 12.1V
Other 12V lamps	(all except electric lit semaphores)	11.3V to 11.7V
Other 12V lamps	(Electric lit semaphores only)	10.3V to 11.7V
10V 50W QH Lamps	(SIMIS-W interlockings only)	9.8V to 10.2V
4V lamps	(Electric lit semaphores)	3.7V to 3.9V
4.5V lamps	(Electric lit semaphores)	4.4V to 4.6V
6V lamps	(Electric lit semaphores)	5.7V to 6V
110V lamps	(All signals & indicators not fed direct from a bus bar)	100V to 110V
110V lamps	(All signals & indicators fed direct from a bus bar)	99V to 121V
LED Light Engines		
Howells LED SL35 Light Engine	(MK1 Light Engine)	11V to 13V
Howells LED SL35 Light Engine	(MK2 Light Engine)	10.5V to 11.5V
Ansaldo Interlocking Areas (Manchester South only)		
SD321 Colour light Signal	(Quartz Halogen Lamps)	11.6V to 12.2V



The auxiliary filament of an 8000hr lamp is not long life therefore this shall be set to the range listed for a conventional SL35.

Change lamps running on auxiliary filaments as soon as possible.

The setting of all auxiliary filament voltages should be approximately the same as the main filament to retain the same light output.

No conventional or 8000hr SL35 lamp shall be left with a voltage of less than the minimum listed.

If the voltage on any unlit SD321 lamp exceeds 0.8V, report the situation to your SM(S) immediately.



The main filament in long life lamps should be set to the higher range of the limits to ensure correct operation of the filament. In areas that are prone to voltage variations this may not be possible. If you are in any doubt, ask your SM(S).

The preferred maximum voltage for a conventional SL35 lamp is 10.9V, although this may not be practicable in areas where the mains supply is prone to variation. In these areas, a higher voltage setting may be required to ensure the minimum voltage does not drop below 10.5V. If you are in any doubt, ask your SM(S).

In SIMIS-W interlocking areas the target voltage for both conventional and 8000hr SL35 lamps is 10.7V. Due to the tapings on the transformer this voltage may not be possible to get exactly, in this case the slightly higher obtained voltage shall be used as this will be closer to the 10.7V target.

The target voltage for 10V 50W QH lamps is 10V

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In some areas electric lit semaphore signals have series resistors in the B12 lamp feed; this is in order to provide a lamp voltage of 10.7V. This is to provide a light output similar in hue to an oil lamp which will not be distorted by the hue of the coloured lenses.

LED Signal Lamp Modules	
Input to SLM	99V to 120V

Quartz Halogen Lamps	
12V QH lamps (Except fibre optic heads)	11.7V to 12.3V
12V QH lamps (Fibre optic main heads)	11.75V to 12.25V
10V QH lamps (All applications)	9.7V to 10.3V



12V quartz halogen lamps fitted in a signal head with a 110/10V transformer will blacken. Technicians shall replace them with a 10V rated quartz halogen lamp or advise their SM(S). Replacement of the 110/10V signal head transformer if 10V quartz halogen lamps are not available shall be considered by the SM(S).



Set Quartz Halogen lamps to run as close as possible to their rated voltage.

SIMIS-W INTERLOCKING AREAS	
Current Ranges	
SL35 lamps Som/Som5	140mA – 170 mA
SL35 lamps Som6	140mA – 175 mA
10V QH Lamps Som/Som 5	350mA – 457 mA
10V QH Lamps Som6	350mA – 470 mA

SIGNAL ARM, BALANCE LEVER AND LIGHT REPEATER CONTACTS	
Arm repeater on	–5° to 5°
Arm repeater wrong	5° to 35°
Arm repeater off	35° to 65°
Arm repeater wrong	65° or more
AWS energised	25° to 65°



Lower quadrant signals have the same measurements below the horizontal (0° being the horizontal)

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SIGNAL SIGHTING DISTANCES				
Line Speed	7 Seconds, Initial Sighting		4 Seconds, Continuous Sighting.	
	Yards	Metres	Yards	Metres
20	68	62	39	36
30	102	93	59	54
40	137	125	78	71
50	171	155	98	89
60	205	186	117	106
70	239	217	137	125
80	273	248	156	142
90	308	279	176	160
100	342	311	196	178
110	376	342	215	195
120	410	372	235	213
125	427	388	244	222



All distances are rounded up to the nearest yard or metre.

Signals commissioned after December 2000 will have an 8 second initial sighting. This can be obtained by doubling the distance in the 4-second columns

Invensys Rail Modular Power Box Voltage Tolerances			
Voltage	Minimum	Nominal	Maximum
24V dc	20V dc	24V dc	30Vdc
36V dc	30V dc	36V dc	45V dc
110V ac	92V ac	110V ac	137Vac
120V dc	100Vdc	120V dc	150V dc

End

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POINTS

TRACK GAUGE	
Plain Line	1435mm nominal (1432mm – 1438mm depending on sleeper type). Gauge widening may be applied on tight curves.
Vertical S&C	1432mm (gauge widening on tight curves only permitted on tight curves)
Inclined S&C	1435mm (gauge widening on tight curves only permitted on tight curves)



Further details on track gauge can be found in NR/L2/TRK/001

SWITCH OPENINGS		
Pts Type	At Lock Arm	At Toe
RCPL Plain Lead	105mm to 110mm (Optimum 108mm)	105mm to 110mm (Optimum 108mm)
IBCL Plain Lead	105mm to 110mm (Optimum 108mm)	105mm to 110mm (Optimum 108mm)
HPSS	N/A	112mm to 114mm
RCPL Switch Diamonds	82mm to 87mm (Optimum 82mm)	85mm to 90mm (Optimum 85mm)
Mechanical or Machine (All types)	N/A	102mm to 120mm (Optimum 108mm)

RESIDUAL SWITCH OPENING		
From first to last stretcher bar (all permutations)	Nominal	Maximum
	1.5mm	4.0mm



On HPSS point systems the RSO is between 0 to 2mm from take-off stretcher along the switch becoming 2.5mm to 3mm at the rear stretcher
See NR/L2/SIG/11400 for more details

FREE WHEEL CLEARANCES		
Switch Type	Clearance	Comment
RT60 & NR60	60mm	Minimum gap throughout the moveable length of the switch
Other types	50mm	Minimum gap throughout the moveable length of the switch In proximity to the rear stretcher bar, the minimum FWC must be enlarged if track gauge is wider than the nominal value, see below
Single & double slips	45mm	Minimum gap throughout the moveable length of the switch where the line speed is ≤ 60 mph
	50mm	Minimum gap throughout the moveable length of the switch where the line speed is > 60 mph



details on RSO and FWC can be found in NR/L2/TRK/001

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FORMULA FOR CALCULATING REQUIRED FREE WHEEL CLEARANCE AT EACH STRETCHER BAR

$$\text{RWC(SB)} = \text{NWC(SB)} + \text{MTG(SB)} - \text{NTG}$$

RWC (SB)	Required Free Wheel Clearance at specific stretcher bar
NWC(SB)	Nominal Free Wheel Clearance at specified stretcher bar
MTG (SB)	Measured Track Gauge (static) at specific stretcher bar
NTG	Nominal Track Gauge



Further information on calculating FWC can be found in NR/L3/TRK/6100/Mod03 Installing stretcher bars and setting them to the correct length



If you are in doubt about any measurement or calculation of FWC or FWP, ask your SM(S).



Typically for :

- Plain leads in vertical S&C with designed FWC of 50mm the FWP value would be 1432mm minus 50mm which equals 1382mm.
- Slips in vertical S&C (where there is a permitted 45mm FWC) the FWP would be 1432mm minus 45mm which equals 1387mm
- CEN60 in inclined S&C with a designed FWC of 60mm the FWP value would equal 1435mm minus 60mm which equals 1375mm.

KICKING STRAP CLEARANCES

S&C with conventional slide chairs	min 3mm, max 6mm
S&C fitted with rollers	min 6mm, max 9mm

FACING POINT LOCK

Will Lock	Will Not Lock
1.5mm	3.5mm

DETECTION

Type	Detection	
	Made	Broken
RCPL	2.5mm	4mm
IBCL	3.5mm	5mm
HPSS (CEN54)	N/A	8mm
HPSS (NR60/RT60)	N/A	10mm
BR998 & other supp. types	6mm	8mm
SO Hydraulic Supplementary	2mm	4mm
All Others	3.5mm	5mm

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POINT FITTINGS



Point fixings are required to be torque tightened/checked to ensure a secure connection. Some torque wrenches apply a direct torque to the fixing, others utilise an extension piece connected to the wrench, which changes the amount of torque applied to the fixing.

Where an extension piece is required, the relevant tables below include a "Torque Wrench Setting" column. This is the value the torque wrench should be set to, when using the correct extension piece.

TUBULAR STRETCHER BARS

INSTALLATION TORQUE VALUES		
All Bolts on Tubular Stretcher Bar Assemblies (All Locations)		
	Torque Wrench Setting	Applied Torque
All Switch Rail Bolts	340Nm	440Nm
All Motion Unit to Tube Bolts	340Nm	440Nm
Kicking Strap Nuts	200Nm	250Nm
Locking Devices on Tubular Stretcher Bar Assemblies (All types of tubes)		
Primary Locking Collars	340Nm	440Nm
Secondary Cap Screws	Until washers are compressed	

CHECK TORQUE VALUES		
All Bolts on Tubular Stretcher Bar Assemblies require to be checked during SMTH Testing		
	Torque Wrench Setting	Applied Torque
All Switch Rail Bolts	270Nm	350Nm
All Motion Unit to Tube Bolts	270Nm	350Nm



See NR/L2/TRK/6100/Mod04 Tubular Stretcher Bars for full details of the correct tooling to be used to secure all fastenings on tubular stretcher bars