

SSI Signalling Principles Group

ELECTRO-HYDRAULIC TRAINSTOPS

1. DOCUMENT STATUS

This document was originally produced as a Draft Document Issue 1 Dated 09/05/1996, and was not formally approved. In view of the proposed re-use of this of this document for revisions to Willesdan interlockings, the document has been re-reviewed by SSI SPG at its meeting on 16th March 2005. Amendments to Issue 1 as agreed at that meeting have been incorporated, together with minor further changes reviewed in correspondence.

NOTES ARISING FROM REVIEW BY SSISPG ON 16TH MARCH 2005

DIS18 was produced prior to the publication of GE/RT8018 "Mechanical Trainstop Systems". The use of the guidance presented in this discussion document does NOT override any of the requirements made in that standard. In particular:

1. No guidance is provided on the use of trainstops for speed control.
2. No provision is made for proving trainstop effective in the signaller's indication.
3. No guidance is given on the operation of tripcock testers and their indication to drivers.
4. There is an outstanding issue relating to the interpretation of Clause 7.3 of GE/RT8018. This was discussed in DIS99 (Issue 5 dated 03/02/02) relating to the general review of the impact of new standards on SSI. The relevant clause of DIS99 reads as follows:

GK/RT0017 Section 6, first paragraph required:

"The clearance of a signal reading to a signal at which a trainstop is fitted shall prove that the trainstop is effective or the forward route has been authorised."

Note that this is a "Time-of-clearance-only" control. This control was interpreted by SSISPG DIS81 Section 4.5.1 item (ii) as follows:

Proof of Trainstop Ahead

Section 6, first paragraph: The term "the forward route authorised" should be interpreted as "trainstop authorised to move to the ineffective position" thus "trainstop on or controls for trainstop".

However, GE/RT8018 Section 7.3 requires:

"A signal shall not be permitted to clear for a movement up to a signal at danger (or up to buffer stops) unless the trainstop at that signal, and any trainstops leading up to it, are in the Effective position."

Arguably this should still be interpreted as "trainstop on or controls for trainstop". Consider the situation where the signal ahead is in the process of clearing but its trainstop has failed to be detected in the off position and thus the signal ahead is held at red. This interpretation allows the signal in rear to clear and thus permits double-block working in the event of a trainstop failure with only one signal having to be tripped past by a train. If the above is strictly adhered to then double-block working in the event of a trainstop failure will not be permitted, i.e. the signal in rear will also be held at red, and thus both signals will have to be tripped past by a train.

The above has been reported to RSSB and logged by them for attention when the standard is next revised.

This interpretation will need resolving before an SSI Applications Manual document on SSI data for trainstops can be prepared.

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3. BACKGROUND

In the Willesden Suburban Scheme, the Trainstop data proved to be deficient in three ways:-

- (a) The pump was not being turned off quickly enough when the Trainstop is detected off, thus leading to excessive leakage developing and frequent motoring down required.
- (b) too many Elapsed timers used - two per Trainstop.
- (c) excessive data processing time.

Initial proposals from the SSI Signalling Principles Group successfully dealt with (a) and (b) but further refining was required to reduce (c).

The basic principles embodied in the following data are:-

- (A) Each signal is required to prove its Trainstop “off” before displaying a proceed aspect and continuously thereafter.
- (B) Each signal is required to prove that the next signal’s Trainstop is “on” or that that signal is “off”.
- (C) Each signal is required to prove that any countermoved signal’s Trainstop is “off” before its own Trainstop is driven “off” and the countermoved signal’s Trainstop is maintained “off” until the passage of a train or the route is cancelled without the passage of a train.

4. TRACKSIDE HARDWARE

The track mounted equipment consists of a Trainstop arm operated by an hydraulic ram against a spring, together with a rotary detector fitted with three micro-switches. These items are attached to a common baseplate mounted on the sleeper ends.

The electro-hydraulic Trainstop power pack, which is mounted on a separate concrete stool, contains a motor driven pump and a valve. The valve retains the fluid pressure after the motor has driven the Trainstop to the “off” position and the motor current has been cut off. Both valve and motor operate at 110 Volts d.c.

5. LOCATION CIRCUITS

Typical operating and detection circuits for this type of trainstop are shown on drawing W920004 sheet 21 attached.

Two outputs of the Signal Module are used to operate SSI interface relays VMR and VR. The valve is operated directly by VR. The motor is operated by contactor VMPR which is controlled by a front contact of VMR in conjunction with the back contact of V(CUT-OFF)R.

Note that the detection relay, V(CUT-OFF)_R, is fed from a 50 Volts d.c. supply. This is acceptable in d.c. traction areas because it is performing a non-vital role. A back contact of this relay is used to de-energise VMPR immediately detection is made thereby removing the deficiency in Section 3 (a).

The three micro-switches are connected to the Signal Module contact sensing inputs as follows:-

“ON” - Switch A depressed and switch B released, closes the circuit which proves the Trainstop is fully “on”.
Used for signal aspect control.

“OFF” - Switch B depressed and switch A released, closes the circuit which proves the Trainstop arm is sufficiently “off” to avoid tripping a train.
Used for signal aspect control.

“CUT-OFF” - Switch C depressed closes the circuit which proves the Trainstop is fully “off”.
Used to cut off the motor power and to cause re-motoring if the arm creeps back up.

Each of the above contacts are allocated to one bit of the input telegram message; in the attached example drawing to inputs 4, 3 and 2 respectively.

6. SSI DATA IDENTITIES USED

For each signal or LOS equipped with a Trainstop: in this example signal 44:-

6 latches - L44V(ON), L44V(OFF) , L44V(C.OFF) , LE44V, L44V(REMOT) , L44TS

1 elapsed timer - E44V

For each signal or LOS equipped with a Trainstop at which a countermove can be made:-

2 latches - L44TS(1) , L44CM

For each pair of signals at an Interlocking boundary, as specified in Section 12:-

1 latch - L%VZ in the Interlocking containing the advance signal,
incorporating the advance signal number.

7. DETECTION OF TRAINSTOPS - IPT File

All Trainstops have the same data structures for detection. The following example applies to the Trainstop for signal 44 shown on the attached drawing:-

*I20 "L44V(ON) 4 , "L44V(OFF) 3 , "L44V(C.OFF) 2

8. COMMON TRAINSTOP OPERATION & TIMING DATA

The output telegram bit allocation used in the example is:-

Motor- bit 1 Valve - bit 2

8.1 Standard ON and OFF Execution Sets

These four data executions sets are provided for each Trainstop and they should be placed in numerical order immediately before the Telegram Data in the OPT file.

```
*440FF      G s 2                               / valve (VR)
              if LE44V xs
              then E44V = 0 , LE44V s
              \
              if L44V(C.OFF) s                     / start of T/S operation
              then E44V stopped                     / prime for re-motor
              else @44PUMP
              \
\
```