Wabtec CORPORATION

Freight Component

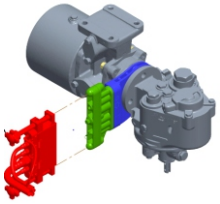
FOUR-PORT RECEIVER & FREIGHT CAR MONITOR ASSEMBLY

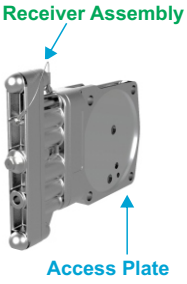
Improves overall wagon health, reduces test time, and increases wagon availability

Wabtec's Automated Four-Port Receiver and Freight Car Monitor assembly comprises of a four-Port Pressure Test Device suitable for automated brake testing that offers significant time and cost savings over manual brake testing device. It also includes an electronic device called the Freight Car Monitor (FCM) that monitors critical wagon functionality and communicates critical data by wireless communication.

Four-Port Automated Brake Pressure Testing Device

4-port ASCTD





Four-Port Automated Brake Testing Equipment

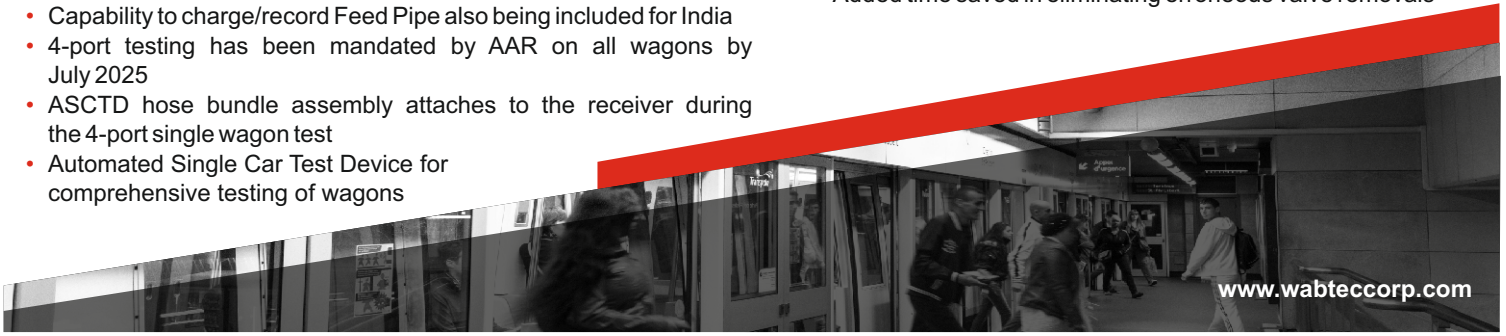
Wabtec offers 4-port receiver and access plate assemblies for application with various distributor valve mounting arrangements. Wabtec's Automated Single Car Test Device (ASCTD) offers significant time and cost savings over manual brake testing device. It is approved and compliant to AAR specification S-4027 and is scalable to accommodate future upgrades including ECP testing. The ASCTD improves the reliability of the pneumatic brake system of every wagon tested.

- Fitted on access plate between C3W Type and KE Type DV & Common Pipe Bracket
- 4-port pressure testing device for complete brake diagnostics
- 4 pressure ports correspond to the following –
  - Brake Pipe
  - Brake Cylinder (Upstream of Empty Load)
  - Auxiliary Reservoir
  - Control Reservoir
- Capability to charge/record Feed Pipe also being included for India
- 4-port testing has been mandated by AAR on all wagons by July 2025
- ASCTD hose bundle assembly attaches to the receiver during the 4-port single wagon test
- Automated Single Car Test Device for comprehensive testing of wagons
- Portable test device is suitable for trackside, sick-line, workshop, yard etc.
- Complete AAR brake system diagnosis of a wagon performed in ~27 mins.
- Foolproof design – system has ability to pinpoint at problem causing areas
- Software will not proceed if a problem is detected; no manual overriding
- Suitable for replacing the current manual SWTR Test regime completely
- ASCTD is an established technology

Results in a healthier wagon fleet & lower maintenance costs

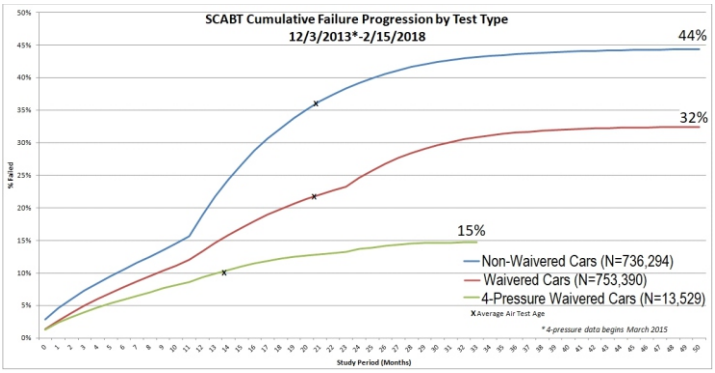
KEY CUSTOMER BENEFITS

- Average test time is ~30 minutes; considerably less time than current manual single wagon test method (3 to 4 hours)
- Reduces "false failures" due to human error common in manual testing
- Less manpower required to perform the 4-port single wagon test
- Saves time and improves accuracy of wagon brake testing
- Records and displays system leakage and pressure data
- Users can connect wirelessly and interface with specific device
- Documented test results provide an irrefutable record of compliance while reducing costly mis-diagnosis and erroneous removal of properly functional distributor valve portions
- Precise measurement & data recording – electronic pressure & flow transducers
- Accurate, consistent qualification of brake system
- Consistent performance – Tests are performed the exact same way every time
- Diagnostics – operators are directed to specific problem area(s) to assure efficient defect identification
- Real direct & indirect savings –
  - Huge savings in actual testing time over current regime
  - Added time saved in eliminating erroneous valve removals



- Time and labor savings –
  - Simultaneous, multi-function processing saves test time
  - Optimal test sequencing minimizes test time
- Independent control of cylinder pressure – improves efficiency
- Provides Station side access to the testing ports of the DV
- Avoids disconnection of a wagon from the rake during periodic tests
- Can be designed for proper fitment and 4-port access to accommodate all distributor valve mounting arrangements
- A complete test with consistent test execution & accurate results

Accuracy of ASCTD



Freight Car Monitor

The Freight Car Monitor (FCM) system is an electronic device mounted to a rail vehicle. The device monitors the wagon functionality and brake control valve parameters to determine the operational condition and status of the brake system. The device will monitor the wagon brake systems and indicate state of condition by wireless communication or when manually downloaded.

Current Features:

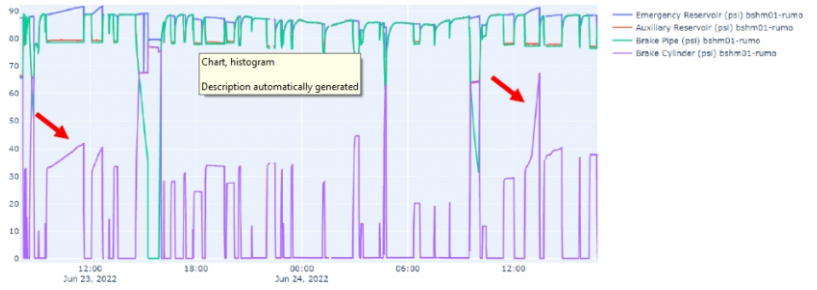
- 4 Pressure Data feed from receivers
- GPS Location feed
- Vibration (3 axis) / Impact Detection
- Temperature Monitor
- Battery Powered -capable of up to 1.5 years battery life

- Only condition-based monitoring of freight car brakes are performed in USA.
- During a 30-month period, only 15% of cars fitted with Receiver Assembly and tested with the ASCTD were brought in for re-checking of brakes.
- However, the cars being tested with manual single wagon test equipment had a failure rate of almost 3 times, i.e., about 44%.
- All wagons in USA have been mandated to be fitted with a Receiver by 2025.
- Freight cars are tested for brakes only once a failure is reported in the USA.
- With the introduction of ASCTD, the failure rates have dropped by almost 1/3rd hence improving freight car availability and reduction in the total cost of maintenance.
- With improved maintenance regime being proposed in India, the Automated single car testing will improve brake health efficiency of wagons in India as in seen in the USA. Over 300 units are currently in use at railcar repair facilities in North America.

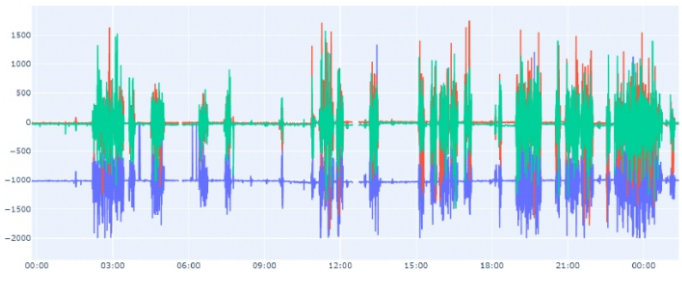
KEY CUSTOMER BENEFITS

- Real time monitoring of the brake system performance provides a platform for predictive maintenance procedures.
- Benefits of an FCM could ultimately lead to a reduction in fleet maintenance cost by eliminating unnecessary test requirements on cars with no operating issues.
- The information provided by the FCM could accurately identify issues with the brake control valve and brake cylinder. With this information, the FCM could detect issues with the brake pipe/auxiliary differentials, brake cylinder leakage, reservoir leakage, application and release times.
- In addition to diagnosing issues with the control valve on a freight car the FCM could be configured to include handbrake sensors, GPS location, car vibration information and door latch sensors.
- The information provided by the FCM could lead to regulatory relief for railroads

FCM Test Data



4-pressure data from field tests



Vibration data from field tests