Emergency Brake System

What will be checked?

- EBS parts
- system overview
- mechanical implementation
- electrical implementation
- the required hardwired logic
- EBS supervision

If the service brake is used as redundancy also the service brake parts must be shown here.

PDF document formating rules:

- document name on each page
- vehicle number on each page
- team name on each page
- university name on each page
- revision and date on each page
- page number and total numer of pages on each page
- correctly rotated
- vector graphics except real pictures and renderings (minimum 300 dpi)
- properly printable to A4 or A3

Keep in mind that only things you show can be reviewed.

Status: PASSED

List of Used Parts

What will be checked?

- EBS actuators
- EBS valves
- EBS sensors
- other EBS related parts

Attribute	Value	Status	Reviewer Comment
Actuators	FESTO - ESNU-25 series	PASSED	
Valves	1. FESTO - VUVS-L20-M32U-MD-G18-F7-1C1 2. Landefeld - KH xx MK Ball Valve	PASSED	
Sensors	1. Autosen - Pressure Sensor AP016 2. ADZ Nagano - Pressure Transmitter SME series	PASSED	
Others	1. ProToyz - 13ci/0,2l 200 bar HP-System 2. ProToyz HP Regulator - HP Regulator	PASSED	

System Overview, Renderings, and Wiring Diagrams

What will be checked?

- vehicle overview
    1. top and side view of the vehicle with transparent or removed bodywork
    2. all parts from the hydraulic/pneumatic diagram are marked/listed
    3. all EBS relevant actors marked/listed
    4. all sensors used for EBS monitoring marked/listed
    5. all ECUs and logic parts involved in EBS marked/listed
    6. deactivation points marked
    7. all relevant mechanical assemblies shown in the mechanical parts document marked/listed
    8. all items are correctly referenced to the according documents and marked
    9. example/template
- operation diagram
    1. shows the full control flow on block diagram level
    2. shows a flowchart for the EBS startup procedure
    3. shows a flowchart of the continuous monitoring performed by the EBS supervisor
    4. example/template
- mechanical parts
    1. all relevant parts and assemblies are shown (e.g. pedal box assembly)
    2. all self build parts are shown (e.g. pressure transducer)
    3. every single part/assembly has its own page
    4. sub-assemblies/parts are shown grouped on an additional pages after assembly (if needed)
    5. cut views provided for all self developed hydraulic/pneumatic parts
    6. all parts named unambiguously corresponding to the vehicle overview and hydraulic diagram
    7. example/template
- electrical wiring diagram
    1. all contol units involved in the EBS functionality included
    2. all EBS relevant sensors included
    3. full supply path of the EBS actuators included
    4. connection of the RES shown
    5. both TS activation buttons included
    6. all namings are unique and fit to the other documents
    7. SDC relay is named with manufacturer and type
    8. control units/PCBs are named properly and linked to the schematic diagrams document
    9. example/template
- pneumatic/hydraulic systems
    1. diagram/schematic is embedded as vector graphic
    2. clearly structured diagram/schematic with clear energy flow direction
    3. all hydraulic and pneumatic components are included
    4. vehicles brake system included
    5. all components are named uniquely by function
    6. all Components have an EN81346 abbreviation
    7. all components are linked to the AAIR item name
    8. self build components are marked as such and shown in the mechanical parts document (names must be identical)
    9. all coils/sensors are uniquely named and clearly identifiable in the wiring diagram
    10. example/template
- Schematics of hard wired EBS logic and supervisor
    1. interface (signal names) equals wiring diagram
    2. Schematic of hard wired logic
    3. Schematic of EBS supervisoor
    4. Schematic of hard power stages driving the EBS actuators
    5. PCB scope marked if more than one PCB used
    6. example/template
- supervised EBS signals message definitions
    1. all signals sent to the data logger
    2. **use Markdown for list formating**

Attribute	Value	Status	Reviewer Comment
Vehicle Overview and EBS Components Positions	ASF_148_2676_1556467656.pdf	PASSED	
Operation Diagram	ASF_148_2664_1556378148.pdf	PASSED	Your State diagram shows that EBS will get triggered in Finished state. Make sure that this do not mean, that ASSI starts falshing blue and sound is played. Otherwise this will lead to dnf.
Mechanical Parts	ASF_148_2665_1556467697.pdf	PASSED	
Electrical Wiring Diagram	ASF_148_2662_1556467734.pdf	PASSED	
Pneumatic/Hydraulic Systems	ASF_148_2663_1556467773.pdf	PASSED	
Schematics of hard wired EBS logic and supervisor	ASF_148_2666_1556467791.pdf	PASSED	
Supervised EBS Signals	• Pressure sensors BP1 to BP6 ◦ BP1 & BP4 -> Pressure in reservois ◦ BP2 & BP3 -> Pressure after manual valves ◦ BP5 & BP6 -> Pressure after normally open valves • Fault ID • Current EBS State	PASSED	

Description

What will be checked?

- functional description
    1. theory of operation
    2. energy flow
    3. passive systems with mechanical energy storage (DV3.1.3)
    4. can easily deactivated by any official (DV3.1.6)
- functional safety
    1. how the EBS gets activated
    2. how functionality of the EBS is ensured (DV3.2.1)
    3. how the EBS is monitored for failures (if necessary) (DV3.2.1)
    4. how the EBS is triggered if monitoring system fails (if monitoring is necessary) (DV3.2.1)
    5. how the to way monitoring with the service brake is done (if used as redundancy) (DV3.2.6)
    6. how the EBS is checked to be fully functional on startup (DV2.4.1)
    7. that the EBS cannot be triggered in manual mode (DV2.2.5)
- system critical signals
    1. describe how the requested SCS failures are detected
    2. a single sentence for each signal type used (T11.9.2)
- hardwired logic
    1. describe your hardwired logic
    2. if the reference design is used, state so
    3. if the reference design was adopted, only describe your changes and briefly state why
    4. use the same names/references for all components and signals used in the schematic
    5. keep it short and use whitespace

- **use Markdown for text formating**
- **keep your answers short**
- **we won't read any books/prose**

Attribute	Value	Status	Reviewer Comment
Functional Description	Mechanical energy is stored in form of compressed air in a gas tank (CM1: ProToyz HP System, 200bar, 0.21l). In case the RES is triggered it will open the shutdown circuit. This would remove the 12V power given to normally open valve (QM3: Festo: VUVS-L20-M32U-MD-G18-U5-F7-5C1) through the hardwired logic thus making the valve go to the open state. This will let the compressed air flow to the EBS actuator (MM1: Festo: ESNU-25-25-P) which piston moves out and presses on the brake pedal. The force on the brake pedal will lead to a pressure rise in the front and rear brake circuit by the master brake cylinders (GP1 & GP2: Beringer	PASSED	

	MC127), the brake calipers (MM4-MM8: ISR 22-049) get activated. Once the EBS has been triggered it must be manually disengaged. A track marshall would have to 1. turn ASMS off 2. close the manual inlet valve (QM1: Landefeld Messing-Minikugelhahn). and 3. release the pressure in the cylinder by pressing a button located on the side of the normally open valve. To ensure redundancy there are two completely identical circuits installed.	
Functional Safety	The functional safety is given by two identical, independent pneumatic circuits (main and second) which can act individually. Compressed air is stored in two independent pressure tank (CM1 & CM2: ProToyz HP System, 200bar, 0.21l) The EBS supervisor permanently monitors all relevant signals, if there is any critical signal, EBS main circuit gets activated (activation is also monitored by the supervisor), if the EBS main circuit activation fails the EBS second circuit gets activated. The EBS activation valves (QM3 & QM4: Festo-VUVS-L 20-M32U-MD-G18-U5-F7-5C1) are solenoid valves which are normally open. If there is any powerloss in the system (e.g: general failure in the LV circuit, LVMS or ASMS turned to OFF, RES gets activated) the valves of both circuits switch to open and both EBS systems gets activated	PASSED
System Critical Signals	Pressure sensors BP1-BP6 are connected via pulldown	PASSED

	resistor to the EBS supervisor. These signals will be checked to be in range and also for shorts to ground. (a,b, c) The brake line pressure signal is received over CAN and will be checked by checksum and timeouts.(d) The hardwired logic signals are all either pullup or pulldown types as designed in the EBS reference guide. All shutdown circuit relevant parts are connected in accordance to the design guidelines and a fault will cause the shutdown circuit to open. A failure or implausibility in any of the used signals will trigger the EBS and open the shutdown circuit turning off the engine.	
Hardwired Logic	The Hardwired logic used is the exact same as that described in the EBS reference guide. It uses two latches K1 and K2 to latch the state of the SDC.	PASSED