Functional description of fuel supply system

E38, E39, E46, E52, E53

General information

Fuel supply systems for spark-ignition engines

Fuel system

The electric fuel delivery pump in the fuel tank generates pressure in the fuel system. This pressure is set at a certain level by the pressure regulator.

Ventilation system

The ventilation system is a closed system which is vented via an activated carbon filter. The carbon in the activated carbon filter is stored in the form of a granulate. The large surface area of the carbon absorbs the fuel vapours which occur in the fuel tank. The activated carbon filter needs to be regenerated at regular intervals for it to be able to continue absorbing fuel vapours. Regeneration is performed by flushing out with fresh air through the intake manifold. This process is controlled by the engine control unit.

Fuel supply systems for diesel engines

Fuel system

The electric fuel delivery pump in the fuel tank supplies fuel to the engine. Two types of high-pressure pump are used for injection into the cylinders.

1. The distributor injection pump. This supplies each cylinder with fuel directly through the respective injector.
2. The high-pressure pump for common rail systems. This generates the necessary pressure in the fuel rail for all injectors.

On common rail systems, a third pump has been incorporated between the high-pressure pump and the electric fuel delivery pump, the so-called inline pump (M57) or gear pump (M67). This pump supplements the fuel delivery pump in the fuel tank when large quantities of fuel are required.

Ventilation system

Diesel fuel is not easily volatised, eliminating the necessity for an activated carbon filter. The fuel tank is ventilated directly into the atmosphere.

1. Fuel supply system E38/39

1.1 Description of parts

1. Fuel tank (E38 steel, E39 plastic)	16. Float valve (USA only)
2. Electric fuel delivery pump	17. Fuel return line
3. Surge chamber	18. Fuel feed line
4. Suction jet pump	19. Fuel filter
5. Pressure relief valve	20. Pressure regulator
6. Overflow protection valve	21. 3/2-way valve (M52 USA only)
7. Pressure check line (USA only)	22. Fuel rail
7. Refuelling vent line (all countries)	23. Flush line

8. Non-return flap	24. Engine control unit
9. Filler neck	25. Fuel evaporation control valve
10. Fuel filler cap	26. Intake manifold
11. Tank expansion line	27. Vacuum line (leak diagnosis pump USA only)
12. Refuelling vent line (USA only)	28. Activated carbon filter
12. Operating vent line (all countries)	29. Breather pipe
13. Operating vent line	30. Leak diagnosis pump (USA only)
14. Expansion tank	31. Tank leak diagnosis module (USA only)
15. Rollover valve	32. Dust filter (USA only)

1.2 Functional description (please refer to drawing 1.4/1.5/1.6/1.7/1.8)

Fuel system

The right-hand side of the saddle-shaped fuel tank has a surge chamber with the electric fuel delivery pump. The surge chamber guarantees correct fuel supply from the fuel delivery pump in all operating states of the vehicle. The suction jet pump installed in the base of the surge chamber supplies the surge chamber with fuel. Fuel is transferred from the left-hand side of the fuel tank to the surge chamber by the suction jet pump integrated in the tank expansion line. Both suction jet pumps are driven by the fuel return line.

The pressure relief valve controls the pressure required for the suction jet pumps to operate. The overflow protection valve protects the fuel return line. Should the pressure drop in the event of damage or the fuel return line becoming separated, the valve will close.
This prevents the fuel from overflowing from the fuel tank in extreme vehicle positions (rollover, inclination). The non-return flap prevents the fuel from sloshing back in the fuel filler neck when the fuel pump nozzle cuts off.

Fuel supply to the engine

M52TU (please refer to drawing 1.5, view A)

The fuel is fed from the electric fuel delivery pump to the fuel rail via the fuel feed line and the fuel filter. Excess fuel is diverted back to the fuel tank by the pressure regulator fitted to the fuel rail and the fuel return line.

M52 USA and M73 (please refer to drawing 1.5/1.6)

The fuel is fed from the electric fuel delivery pump to the fuel rail via the fuel feed line and the fuel filter. Excess fuel is fed back to the fuel tank by the 3/2-way valve (please refer to view A), the pressure regulator and the fuel return line.
This engine fuel circuit with return from the fuel rail is activated for the engine start and for a predefined period of < 1 minute thereafter.
After this phase, the 3/2-way valve cuts in and interrupts the fuel return from the fuel rail. At the same time, the pipe junction immediately on the fuel filter is activated by the 3/2-way valve to the pressure regulator (please refer to view B).
The fuel rail is then return-free.

M62TU/54 (please refer to drawing 1.4, view B and drawing 1.7/1.8)

The pressure regulator and fuel filter are combined in a single unit.
The fuel is fed from the electric fuel delivery pump to the fuel rail via the fuel feed line and the fuel filter/pressure regulator unit.
The fuel rail is return-free. The fuel flows back to the fuel tank directly from the fuel filter/pressure regulator unit.

Ventilation system USA (please refer to drawing 1.6/1.7/1.8)

The fuel tank is ventilated through the refuelling vent line during refuelling.

With its large cross-sectional area, the refuelling vent line quickly feeds the displaced volume (fuel vapours) to the activated carbon filter via the expansion tank.
The activated carbon absorbs the fuel contained in the fuel vapours. The purified air is then fed into the atmosphere through the breather pipe, the leak diagnosis pump or the tank leak diagnosis module and dust filter.
Ventilation during operation of the vehicle is maintained in the same manner through the refuelling vent line and operating vent line.
The condensed components of the fuel vapours are fed back from the expansion tank into the fuel tank through the operating vent line.
In the event of overfilling, the float valve in the refuelling vent line (E39 only) will be closed by the rising fuel level. This prevents the expansion tank from filling.
The rollover valve on the top of the expansion tank will close in the event of the vehicle turning over. This prevents the fuel from escaping into the activated carbon filter.
The activated carbon filter is regenerated by flushing out with fresh air.
The engine control unit opens the fuel evaporation control valve. This applies the vacuum generated in the engine intake manifold to the flush line.
In this way, the activated carbon filter is flushed out with a supply of fresh air through the breather pipe, the leak diagnosis pump or the tank leak diagnosis module and the dust filter. The components of fuel gathered by the activated carbon filter are fed into the engine's combustion through the air supply and the flush line.
This process is only possible with the engine running.

Ventilation system - all countries (please refer to drawing 1.4/1.5)

Please refer to ventilation system USA with the following differences:

1. When refuelling, the fuel tank is ventilated through the refuelling vent line, which feeds the displaced volume into the fuel filler neck. Instead of the refuelling vent line (USA) with a large cross-sectional area, there is a second operating vent line with a smaller cross-sectional area. The float valve is eliminated.
2. The activated carbon filter has a smaller capacity.
3. The leak diagnosis pump or tank leak diagnosis module and dust filter are eliminated.

Leak detection for tank ventilation system USA (please refer to drawing 1.6/1.7/1.8)

The leak diagnosis pump (please refer to drawing 1.6/1.7) or tank leak diagnosis module (please refer to drawing 1.8) serves to detect leaks in the tank ventilation system as part of the legally specified on-board diagnosis system.
The tank ventilation system is charged with pressure and the pressure loss in the event of a leak detected.
The leak diagnosis pump measures the pressure loss via the recharge time. The pump is driven by the vacuum from the intake manifold through the vacuum line.
The tank leak diagnosis module detects the pressure loss via the current consumption of the integrated pump. The air required for this is fed through the dust filter.
Both systems are controlled by the engine control unit.
The pressure check line connects the fuel tank and the fuel filler neck. This allows a leak in the area of the fuel filler neck / fuel filler cap to be detected.

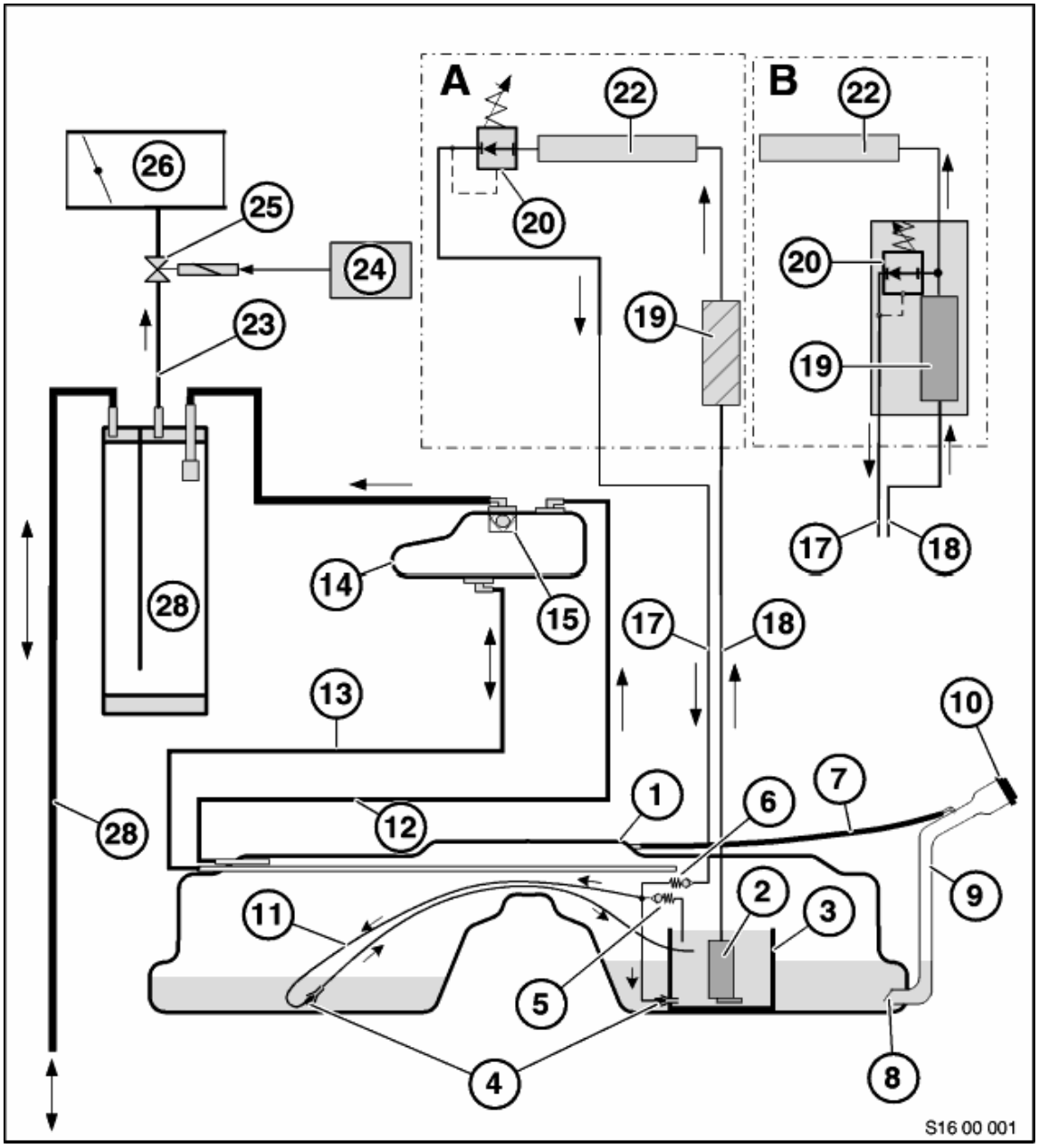
Fuel level measurement in the fuel tank

The fuel level is measured by a lever-type sensor on each side of the fuel tank. The right-hand lever-type sensor is integrated into the fuel delivery unit. The left-hand lever-type sensor is located in the left-hand sensor unit. The actual fuel level in the tank is determined by linking the ohm values of the left and right-hand lever-type sensors.

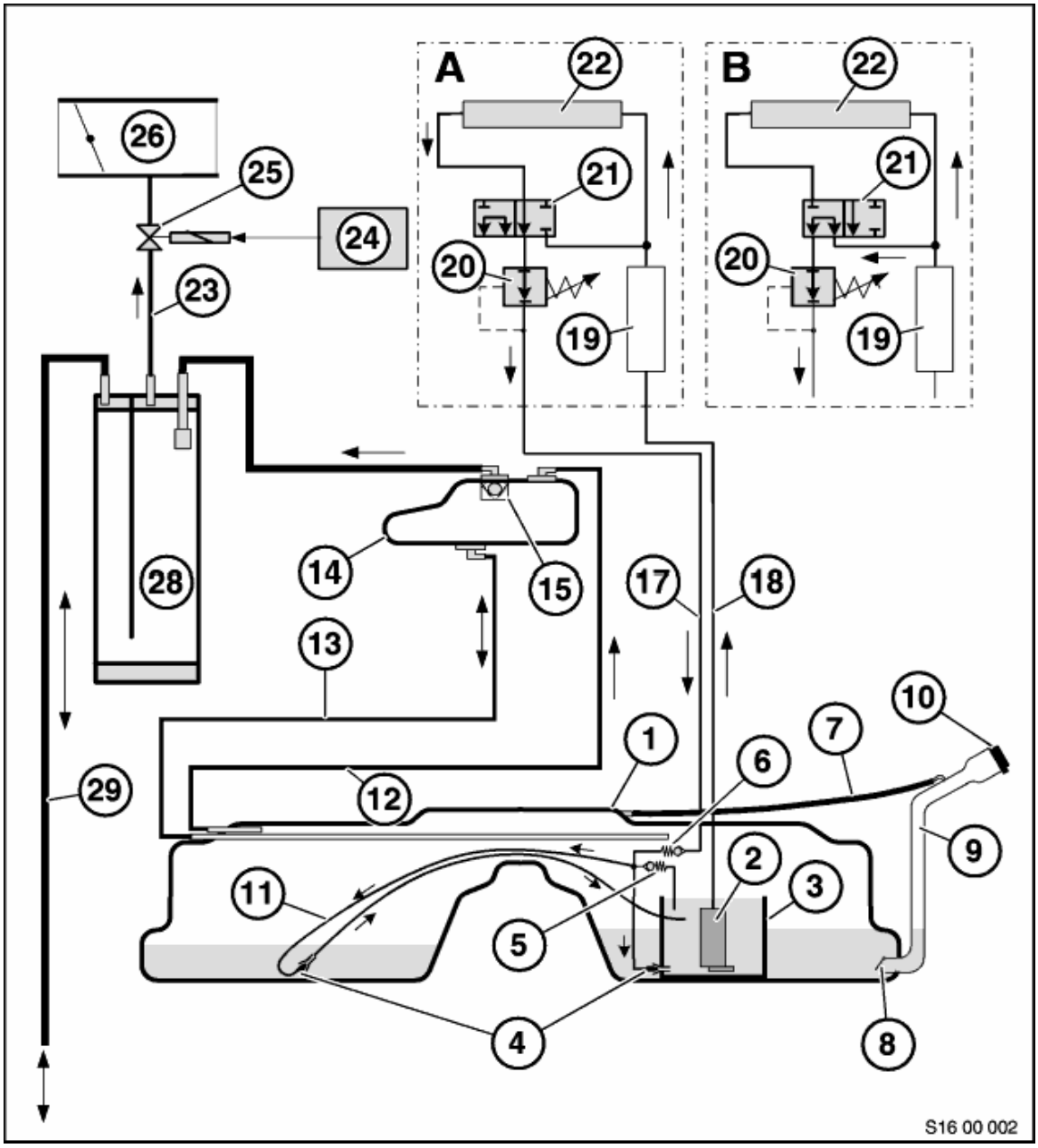
1.3 Fuel system operating data

Pressure regulator: 3.5 bar (S62: 5 bar)

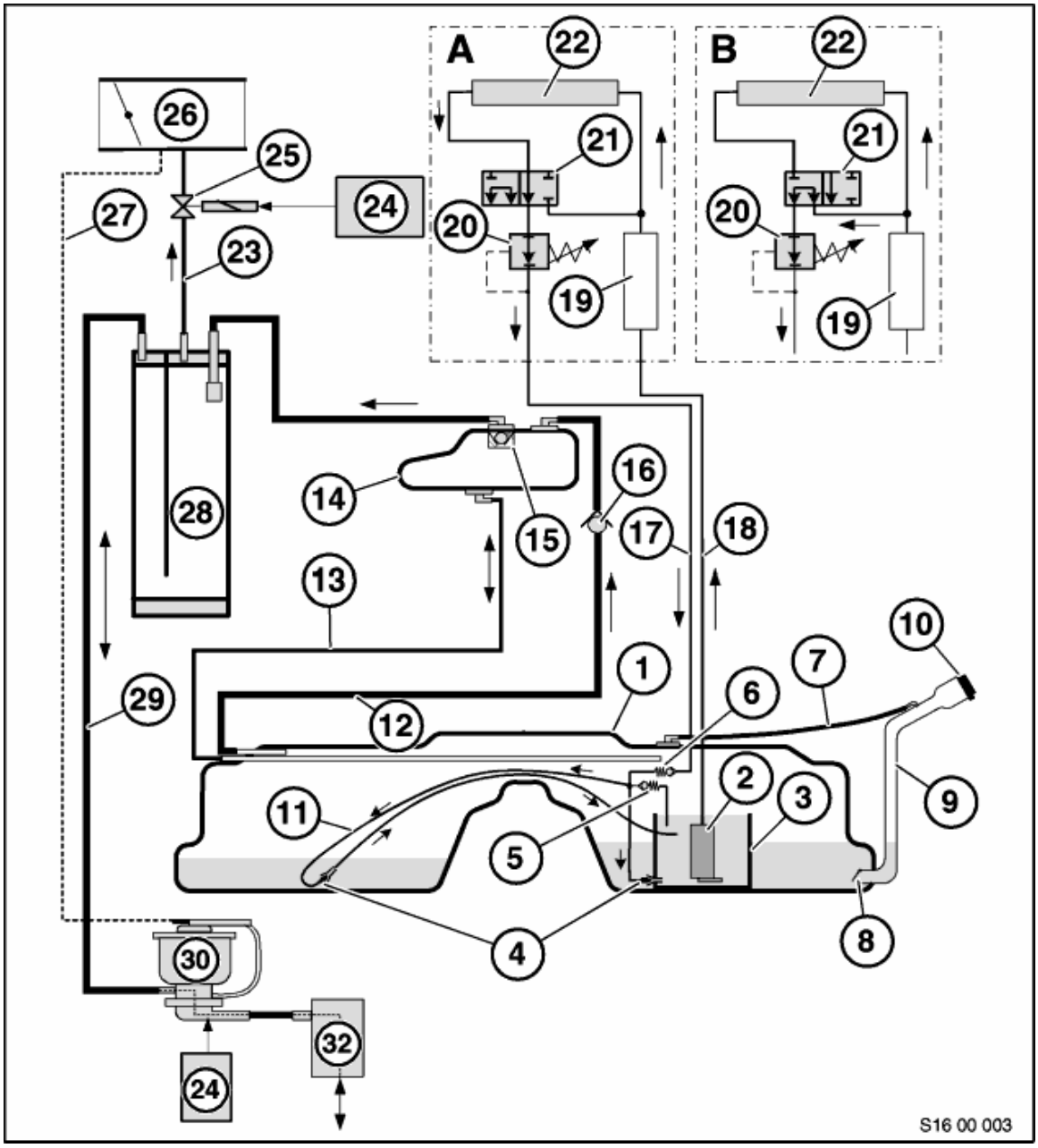
Operating pressure of suction jet pumps: 1 - 1.3 bar



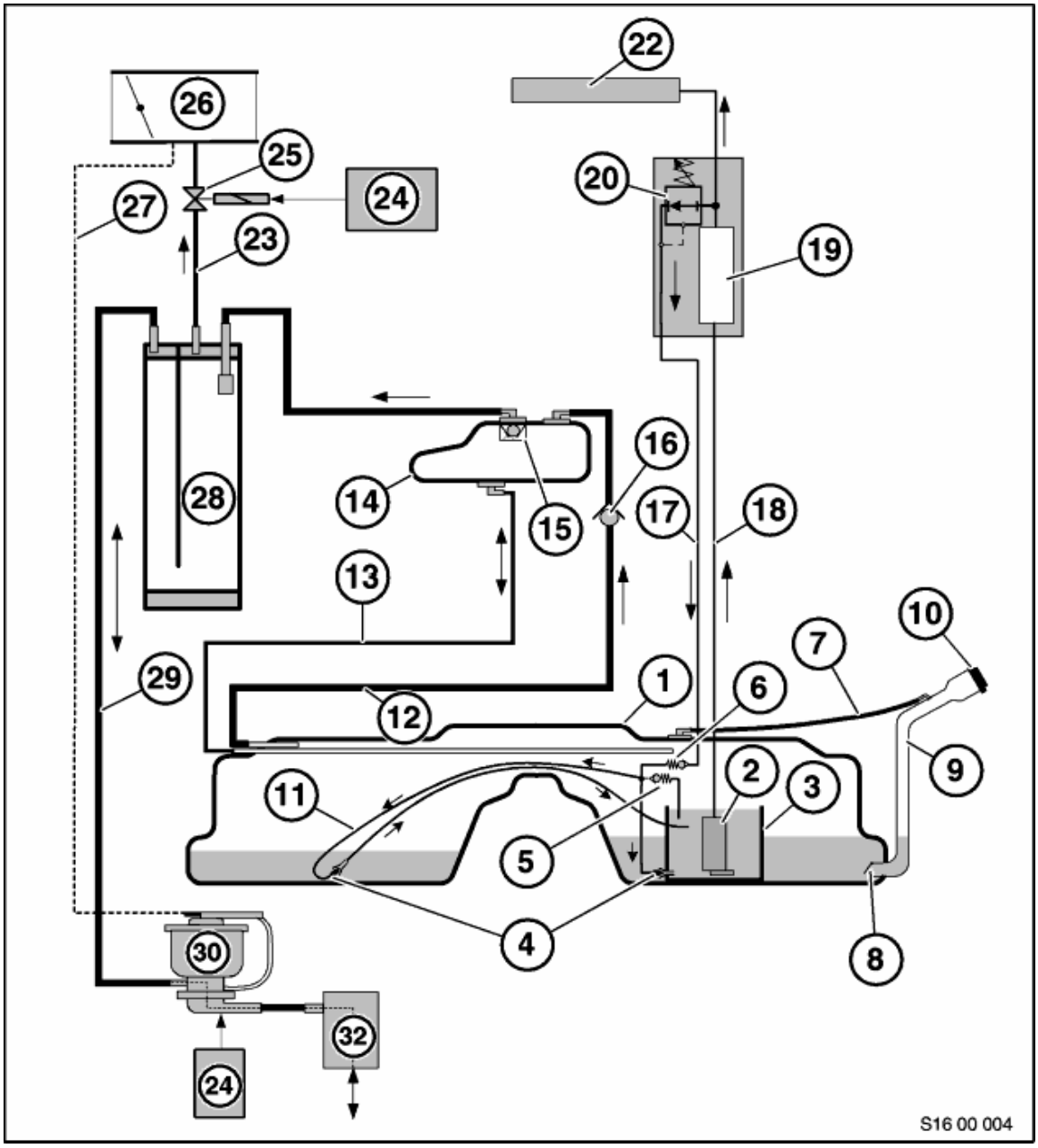
1.4 Fuel supply system E38/39 M52TU/M54/M62TU



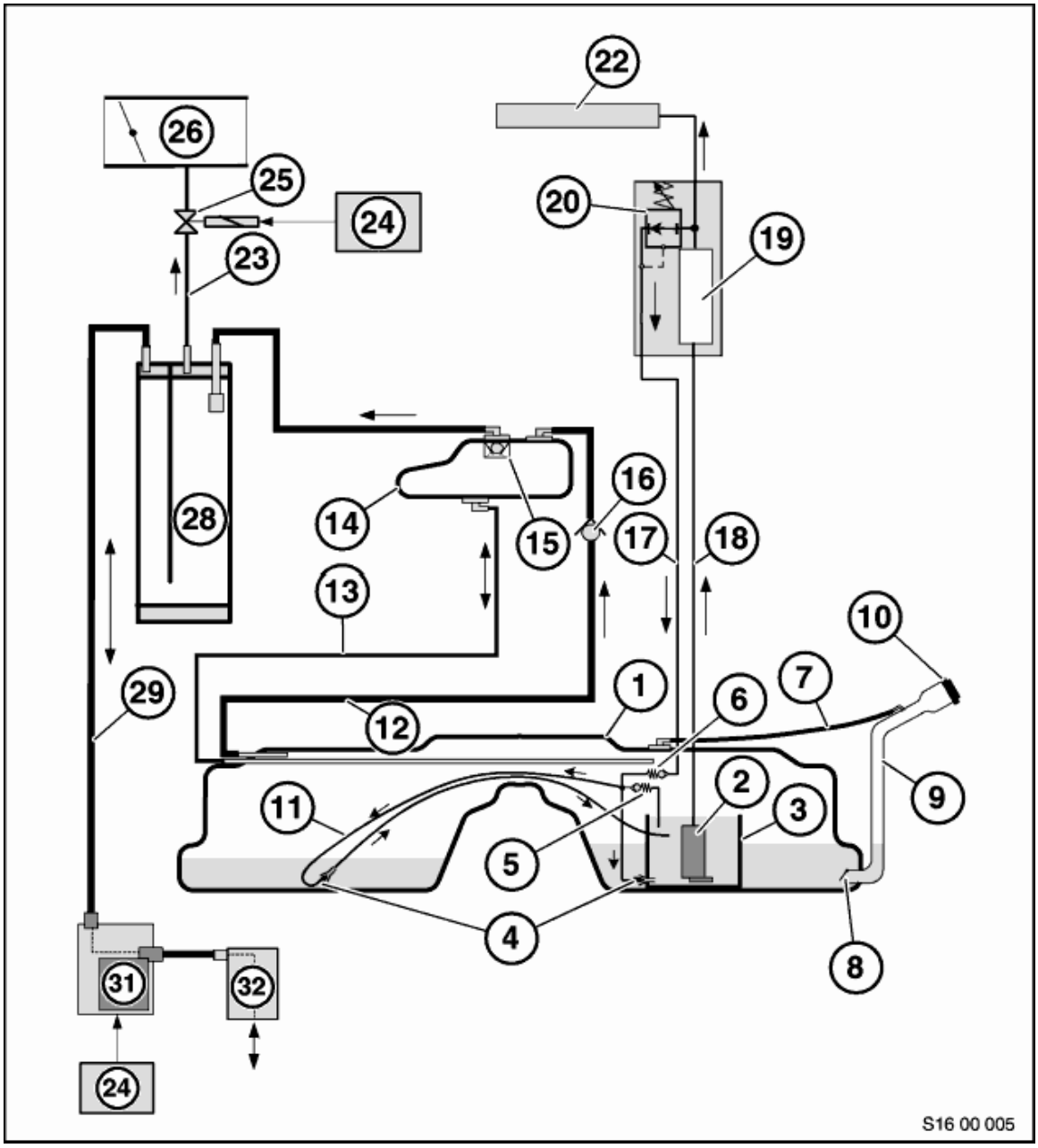
1.5 Fuel supply system E38 M73



1.6 Fuel supply system E38/39 M52/73 USA



1.7 Fuel supply system E38/39, M62 USA (leak diagnosis pump)



1.8 Fuel supply system E39, M54/62 USA (tank leak diagnosis module)

2. Fuel supply system E46

2.1 Description of parts

1. Fuel tank (plastic)	18. Rollover valve
2. Electric fuel delivery pump	19. Float valve (USA only)
3. Surge chamber	20. Fuel filter
4. Pressure relief valve	21. Pressure regulator
5. Overflow protection valve	22. 3/2-way valve (M52 USA only, M73)
6. Suction jet pump	23. Fuel rail
7. Tank expansion line	24. Engine control unit
8. Non-return flap	25. Intake manifold

9. Filler neck	26. Fuel evaporation control valve
10. Fuel filler cap	27. Flush line
11. Pressure check line (USA only)	28. Vent line
11. Refuelling vent line (all countries)	29. Vacuum line (leak diagnosis pump USA only)
12. Fuel feed line	30. Breather pipe
13. Fuel return line	31. Activated carbon filter
14. Operating vent line	32. Activated carbon filter (USA only)
15. Refuelling vent line (USA only)	33. Leak diagnosis pump (USA only)
15. Auxiliary vent line (Japan)	34. Dust filter (USA only)
16. Operating vent line	35. Tank leak diagnosis module (USA only)
17. Expansion tank	

2.2 Functional description (please refer to drawing 2.4/2.5/2.6/2.7)

Fuel system

The right-hand side of the saddle-shaped fuel tank has a surge chamber with the electric fuel delivery pump. The surge chamber guarantees correct fuel supply from the fuel delivery pump in all operating states of the vehicle.
Fuel is transferred from the right-hand side of the fuel tank to the surge chamber by the suction jet pump integrated in the tank expansion line. The suction jet pump is driven by the fuel return line.

The pressure relief valve controls the pressure required for the suction jet pump to operate. The overflow protection valve protects the fuel return line. Should the pressure drop in the event of damage or the fuel return line becoming separated, the valve will close.
This prevents the fuel from overflowing from the fuel tank in extreme vehicle positions (rollover, inclination). The non-return flap prevents the fuel from sloshing back in the fuel filler neck when the fuel pump nozzle cuts off.

Fuel supply to the engine

M43TU/52TU (please refer to drawing 2.4, view A)

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel supply system for engine M52TU".

M52 USA and M73 (please refer to drawing 1.5/1.6)

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel supply system for engine M52 USA and M73".

M54 (please refer to drawing 1.4, view B and drawing 1.7/1.8)

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel supply system for engine M54/62TU".

Ventilation system USA (please refer to drawing 2.6/2.7)

When refuelling, the fuel tank is ventilated through the refuelling vent line.
Due to its large cross-sectional area, the refuelling vent line quickly feeds the displayed volume (fuel vapours) via the expansion tank to the activated carbon filter.
The activated carbon absorbs the fuel contained in the fuel vapours. The purified air is then fed into the atmosphere through the breather pipe, the leak diagnosis pump or the tank leak diagnosis module and dust filter.
Ventilation during operation of the vehicle is maintained in the same manner through the refuelling vent line and operating vent line.
The condensed components of the fuel vapours are fed back from the expansion tank into the fuel tank through the left-hand operating vent line.

In the event of overfilling, the float valve in the expansion tank will be closed by the rising fuel level. This prevents the expansion tank from filling.
The rollover valve on the top of the expansion tank will close in the event of the vehicle turning over. This prevents the fuel from escaping into the activated carbon filter.
The activated carbon filter is regenerated by flushing out with fresh air.
The engine control unit opens the fuel evaporation control valve. This applies the vacuum generated in the engine intake manifold to the flush line.
In this way, the activated carbon filter is flushed out. The required fresh air is fed through the leak diagnosis pump or the tank leak diagnosis module and dust filter. The components of fuel gathered by the activated carbon filter are fed into the engine's combustion through the air supply and the flush line.
This process is only possible with the engine running.

Ventilation system - all countries (please refer to drawing 2.4)

Please refer to ventilation system USA with the following differences:

1. When refuelling, the fuel tank is ventilated through the refuelling vent line, which feeds the displaced volume into the fuel filler neck. Instead of the refuelling vent line (USA) with a large cross-sectional area, there is a second operating vent line with a smaller cross-sectional area. The float valve is eliminated.
2. The activated carbon filter has a smaller capacity.
3. The leak diagnosis pump or tank leak diagnosis module and dust filter are eliminated.
4. For Japan vehicles, an auxiliary vent line with a float valve in the expansion tank is installed in place of the refuelling vent line (USA). This is connected to the refuelling vent line (all countries).
   This modification is necessary due to the higher level of gas emissions of the fuel available in Japan (please refer to drawing 2.5).

Leak detection for tank ventilation system USA (please refer to drawing 2.6/2.7)

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, leak detection for tank ventilation system USA".

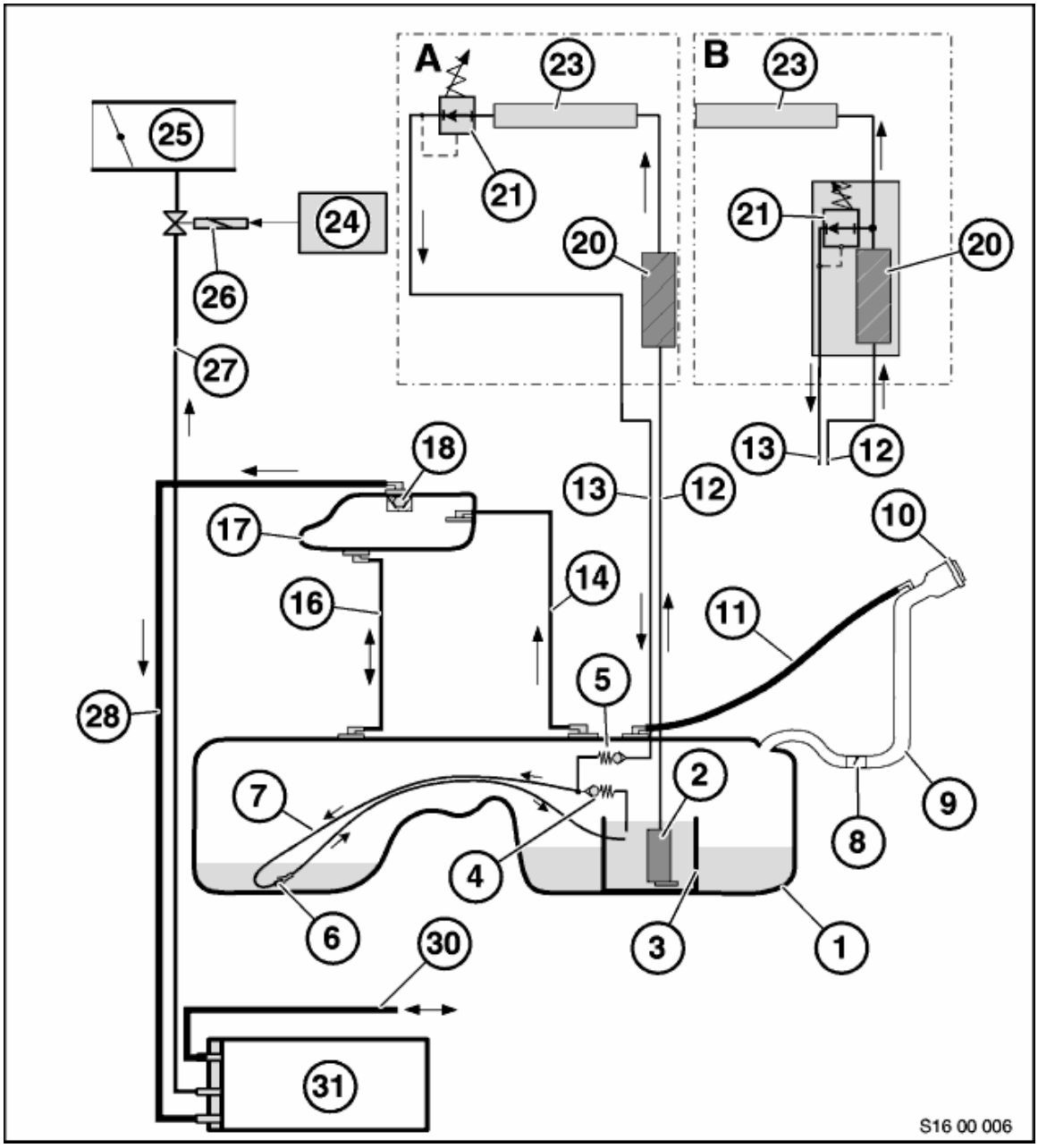
Fuel level measurement in the fuel tank

The fuel level is measured by a lever-type sensor on each side of the fuel tank. The right-hand lever-type sensor is integrated into the fuel delivery unit. The left-hand lever-type sensor is located in the left-hand sensor unit. The actual fuel level in the tank is determined by linking the ohm values of the left and right-hand lever-type sensors.

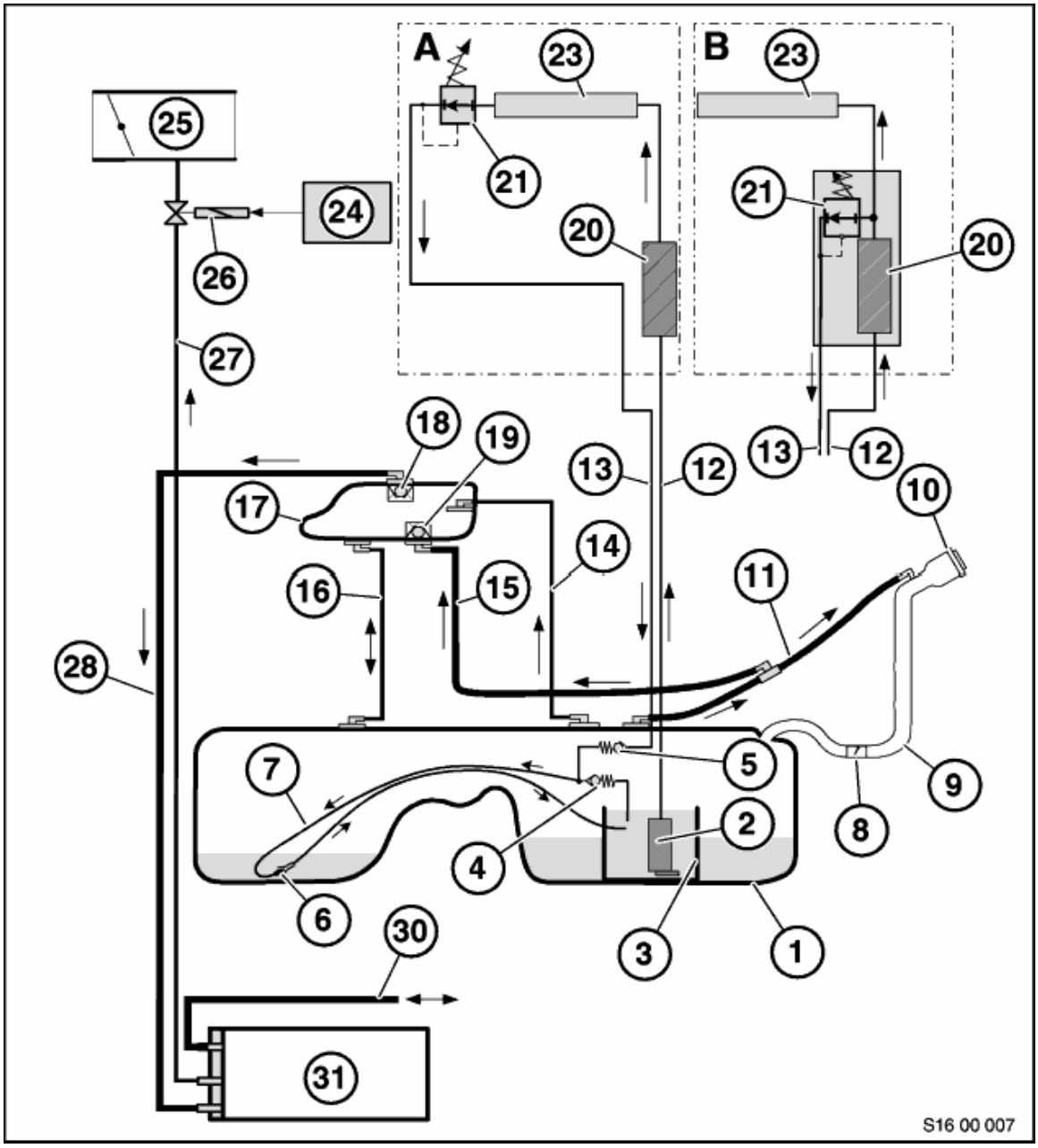
2.3 Fuel system operating data

Pressure regulator: 3.5 bar

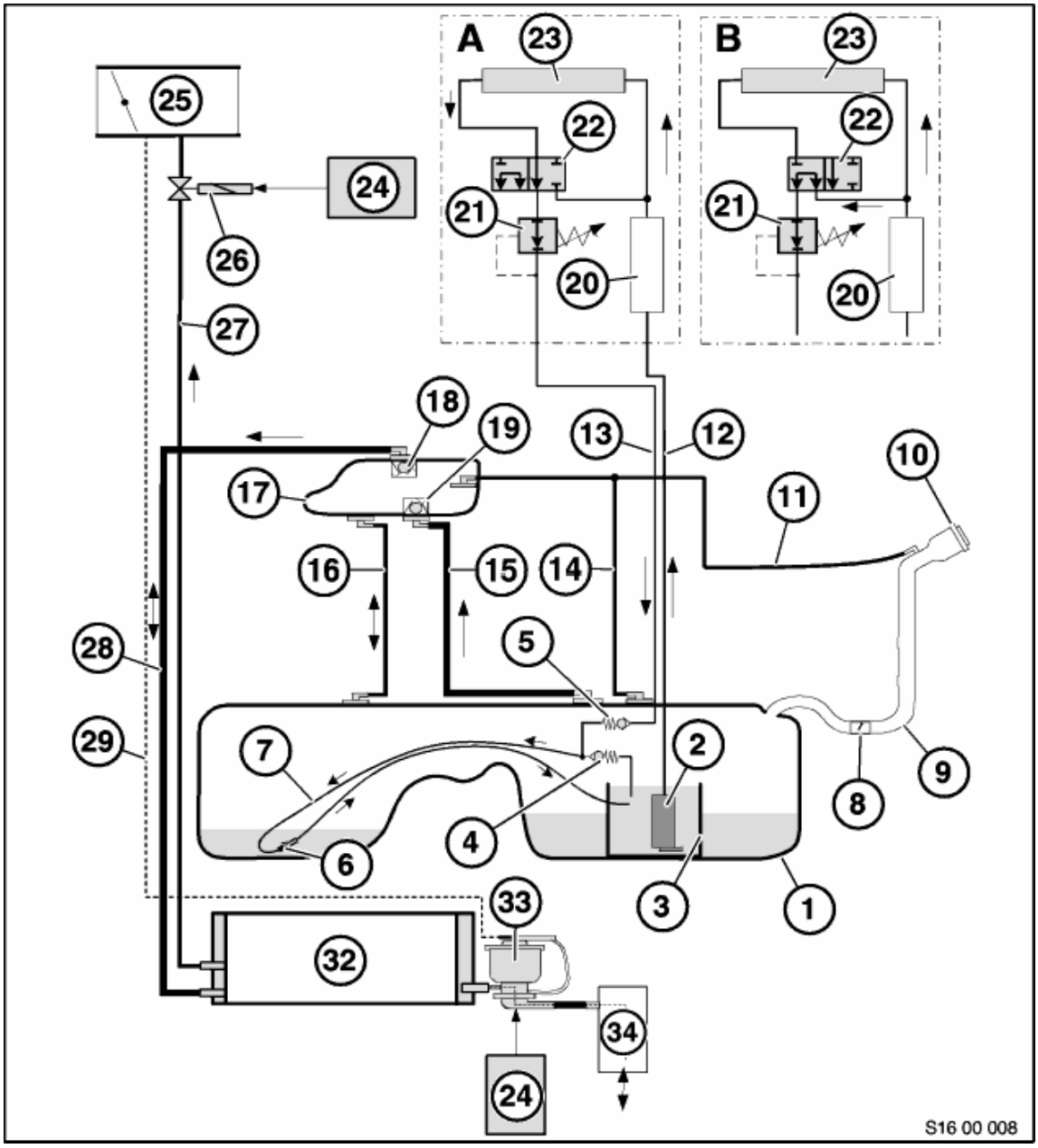
Operating pressure of suction jet pumps: 1 - 1.3 bar



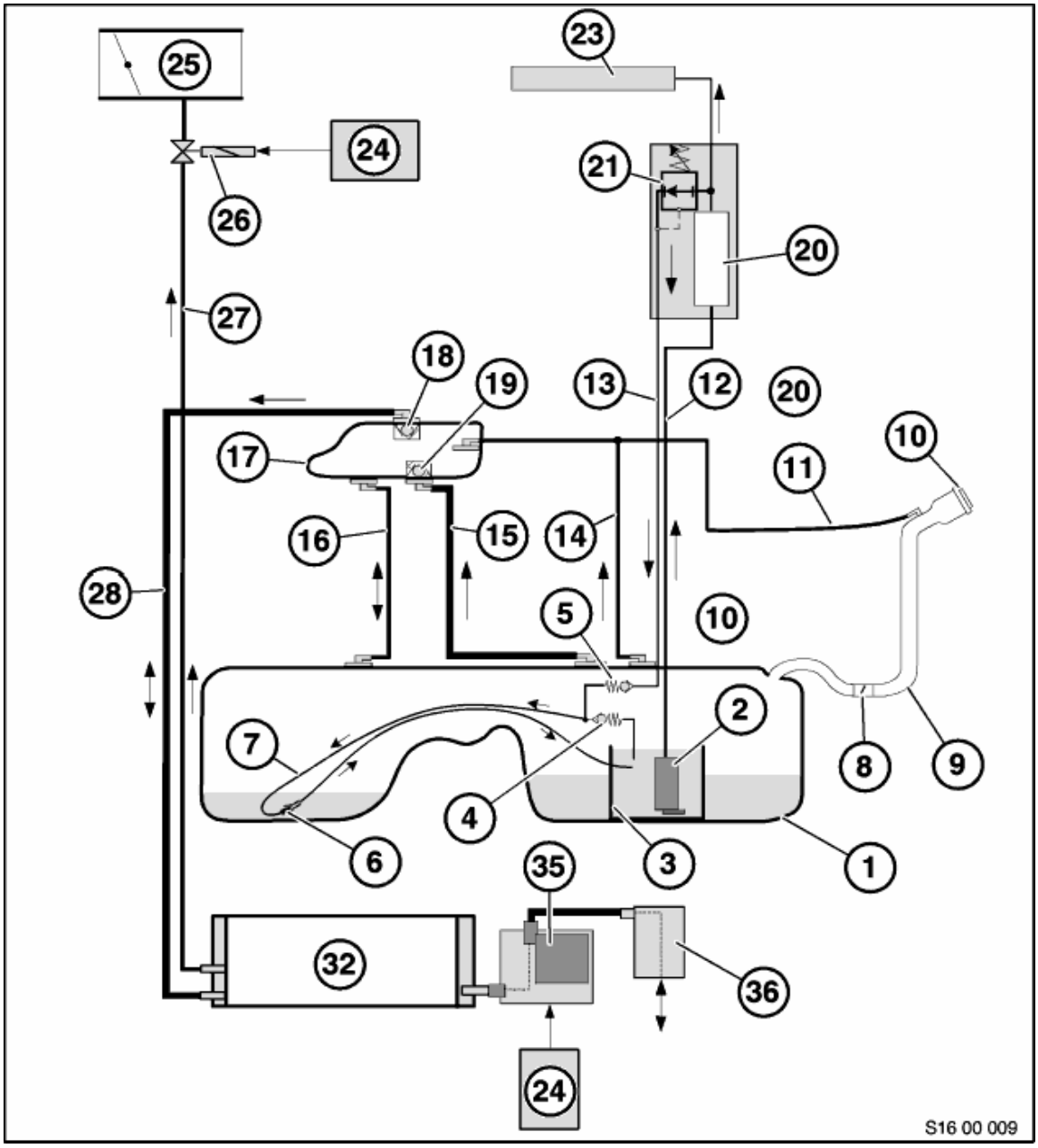
2.4 Fuel supply system E46 M43TU/M52TU/M54



2.5 Fuel supply system E46 M43TU/M52TU/M54 Japan



2.6 Fuel supply system E46 M52 USA



2.7 Fuel supply system E46, M54 USA

3. Fuel supply system E52

3.1 Description of parts

1. Fuel tank (plastic)	16. Condensation reservoir
2. Electric fuel delivery pump	17. Fuel return line
3. Surge chamber	18. Fuel feed line
4. Suction jet pump	19. Pressure regulator
5. Check valve	20. Fuel filter
6. Filler neck	21. Fuel rail
7. Pressure check line (USA only)	22. Engine control unit
8. Fuel filler cap	23. Fuel evaporation control valve

9. Pressure relief valve	24. Intake manifold
10. Overflow protection valve	25. Flush line
11. Rollover valve	26. Vent line
12. Operating vent line	27. Activated carbon filter
13. Refuelling vent line	28. Breather pipe
14. Pressure-maintenance valve	29. Dust filter
15. Throttle	30. Tank leak diagnosis module (USA only)

3.2 Functional description (please refer to drawing 3.4)

Fuel system

The fuel tank is equipped with a surge chamber with electric fuel delivery pump.
The surge chamber guarantees correct fuel supply from the fuel delivery pump in all operating states of the vehicle.
The suction jet pump installed in the base of the surge chamber supplies the surge chamber with fuel.
The pressure relief valve controls the pressure required for the suction jet pump to operate. The overflow protection valve protects the fuel return line. Should the pressure drop in the event of damage or the fuel return line becoming separated, the valve will close.
This prevents the fuel from overflowing from the fuel tank in extreme vehicle positions (rollover, inclination).
The filler neck is divided into two in the fuel tank. This ensures that the tank can be filled quickly. The two check valves prevent the fuel from sloshing back in the fuel filler neck when the fuel pump nozzle cuts off.

Fuel supply to the engine

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel supply system for engine M54/62".

Ventilation system USA

When refuelling, the fuel tank is ventilated through the refuelling vent line.
Due to its large cross-sectional area, the refuelling vent line quickly feeds the displayed volume (fuel vapours) via the condensation reservoir to the activated carbon filter.
The activated carbon absorbs the fuel contained in the fuel vapours. The purified air is then fed into the atmosphere through the breather pipe, the tank leak diagnosis module and dust filter.
Ventilation during operation of the vehicle is maintained in the same manner through the refuelling vent line and operating vent line.
The condensed components of the fuel vapours are fed back from the condensation reservoir into the fuel tank through the operating vent lines.
The rollover valves in the vent lines prevent fuel from reaching the condensation reservoir in extreme vehicle conditions and positions.
The throttle in the right-hand operating vent line prevents the fuel tank from being overfilled when refuelling.
When the specified volume has been reached, the rollover valve will close the refuelling vent line. The system is then only vented through the operating vent lines. If you then continue refuelling, the throttle will generate overpressure in the fuel tank. This will create an obstacle to continued refuelling. The pressure-maintenance valve in the left-hand operating vent line limits the overpressure in the fuel tank.
The activated carbon filter is regenerated by flushing out with fresh air.
The engine control unit opens the fuel evaporation control valve. This applies the vacuum generated in the engine intake manifold to the flush line.
In this way, the activated carbon filter is flushed out with a supply of fresh air through the tank leak diagnosis module and the dust filter. The components of fuel gathered by the activated carbon filter are fed into the engine's combustion through the air supply and the flush line.
This process is only possible with the engine running.

Ventilation system - all countries

Please refer to ventilation system USA with the following differences:

1. The activated carbon filter has a smaller capacity.
2. The tank leak diagnosis module (please refer to drawing 3.4, view A) is eliminated.

Leak detection for tank ventilation system USA

The tank leak diagnosis module (please refer to drawing 3.4, view A) serves to detect leaks in the tank ventilation system as part of the legally specified on-board diagnosis system.

The tank ventilation system is charged with pressure and the pressure loss caused by a leak is detected. The tank leak diagnosis module is controlled by the engine control unit and detects the pressure loss through the current consumption of the integrated pump. The air required for this is fed through the dust filter. The pressure check line connects the fuel tank and the fuel filler neck. This allows a leak in the area of the fuel filler neck / fuel filler cap to be detected.

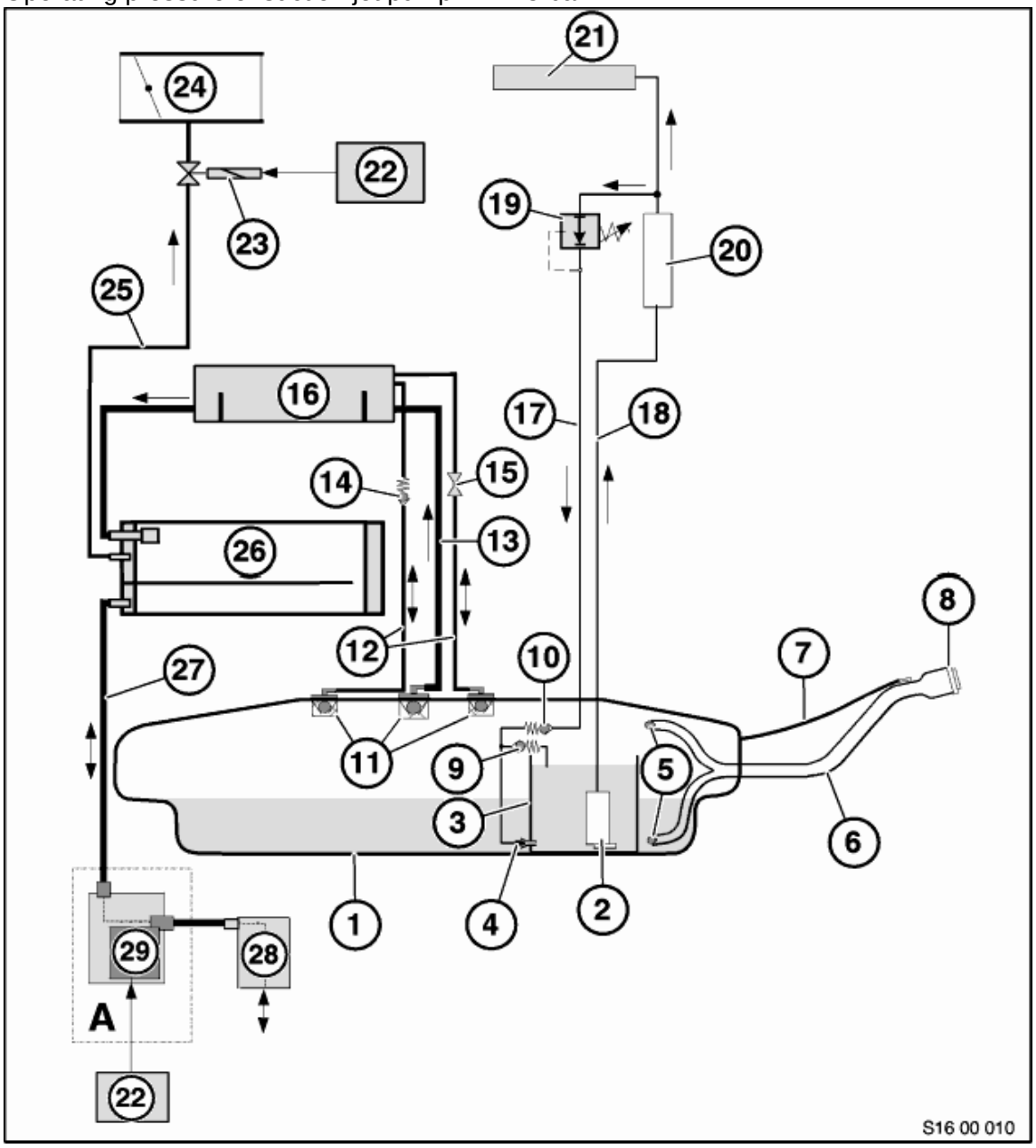
Fuel level measurement in the fuel tank

The fuel level is measured by a lever-type sensor. This sensor is fixed to the surge chamber.

3.3 Fuel system operating data

Pressure regulator: 5.0 bar

Operating pressure of suction jet pump: 1 - 1.3 bar



4. Fuel supply system E53

4.1 Description of parts

1. Fuel tank (plastic)	15. Expansion tank
2. Electric fuel delivery pump	16. Flood valve
3. Pressure relief valve	17. Rollover valve
4. Non-return flap	18. Pressure regulator
5. Filler neck	19. Fuel filter
6. Tank expansion line	20. Fuel rail
7. Suction jet pump	21. Fuel evaporation control valve
8. Overflow protection valve	22. Engine control unit
9. Fuel filler cap	23. Intake manifold
10. Fuel feed line	24. Flush line
11. Fuel return line	25. Activated carbon filter
12. Refuelling vent line	26. Breather pipe
13. Operating vent line	27. Tank leak diagnosis module
14. Pressure check line (USA only)	28. Dust filter

4.2 Functional description (please refer to drawing 4.4)

Fuel system

The saddle-shaped fuel tank is equipped with an electric fuel delivery pump in the smaller, right-hand side.
The suction jet pump in the left-hand side of the fuel tank transfers fuel via the tank expansion line to the right-hand side of the fuel tank.
The suction jet pump is driven by the fuel return line.
The pressure relief valve controls the pressure required for the suction jet pump to operate. The overflow protection valve protects the fuel return line. Should the pressure drop in the event of damage or the fuel return line becoming separated, the valve will close.
This prevents the fuel from overflowing from the fuel tank in extreme vehicle positions (rollover, inclination).
The non-return flap prevents the fuel from sloshing back in the fuel filler neck when the fuel pump nozzle cuts off.
The flood valve on the underside of the expansion tank protects the system against overfilling when refuelling.
The rising fuel level in the refuelling vent line closes the flood valve and so creates an overpressure in the fuel tank, which prevents the tank from being filled any further.

Fuel supply to the engine

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel supply system for engine M54/62".

Ventilation system USA

When refuelling, the fuel tank is ventilated through the refuelling vent line.
Due to its large cross-sectional area, the refuelling vent line quickly feeds the displayed volume (fuel vapours) via the expansion tank to the activated carbon filter.
The activated carbon absorbs the fuel contained in the fuel vapours. The purified air is then fed into the atmosphere through the breather pipe, the tank leak diagnosis module and dust filter.
Ventilation during operation of the vehicle is maintained in the same manner through the refuelling vent line and operating vent lines.

The condensed components of the fuel vapours are fed back from the expansion tank into the fuel tank through the vent lines.
The rollover valve on the top of the expansion tank will close in the event of the vehicle turning over. This prevents fuel from draining out into the activated carbon filter.
The activated carbon filter is regenerated by flushing out with fresh air.
The engine control unit opens the fuel evaporation control valve. This applies the vacuum generated in the engine intake manifold to the flush line.
In this way, the activated carbon filter is flushed out with a supply of fresh air through the tank leak diagnosis module and the dust filter. The components of fuel gathered by the activated carbon filter are fed into the engine's combustion through the air supply and the flush line.
This process is only possible with the engine running.

Ventilation system - all countries

Please refer to ventilation system USA with the following differences:

1. The activated carbon filter has a smaller capacity.
2. The tank leak diagnosis module and dust filter (please refer to drawing 4.4, view A) are eliminated.
3. The pressure check line is eliminated.

Leak detection for tank ventilation system USA

For description, please refer to "Fuel supply system E52,
1.2 Functional description, leak detection in tank ventilation system USA".

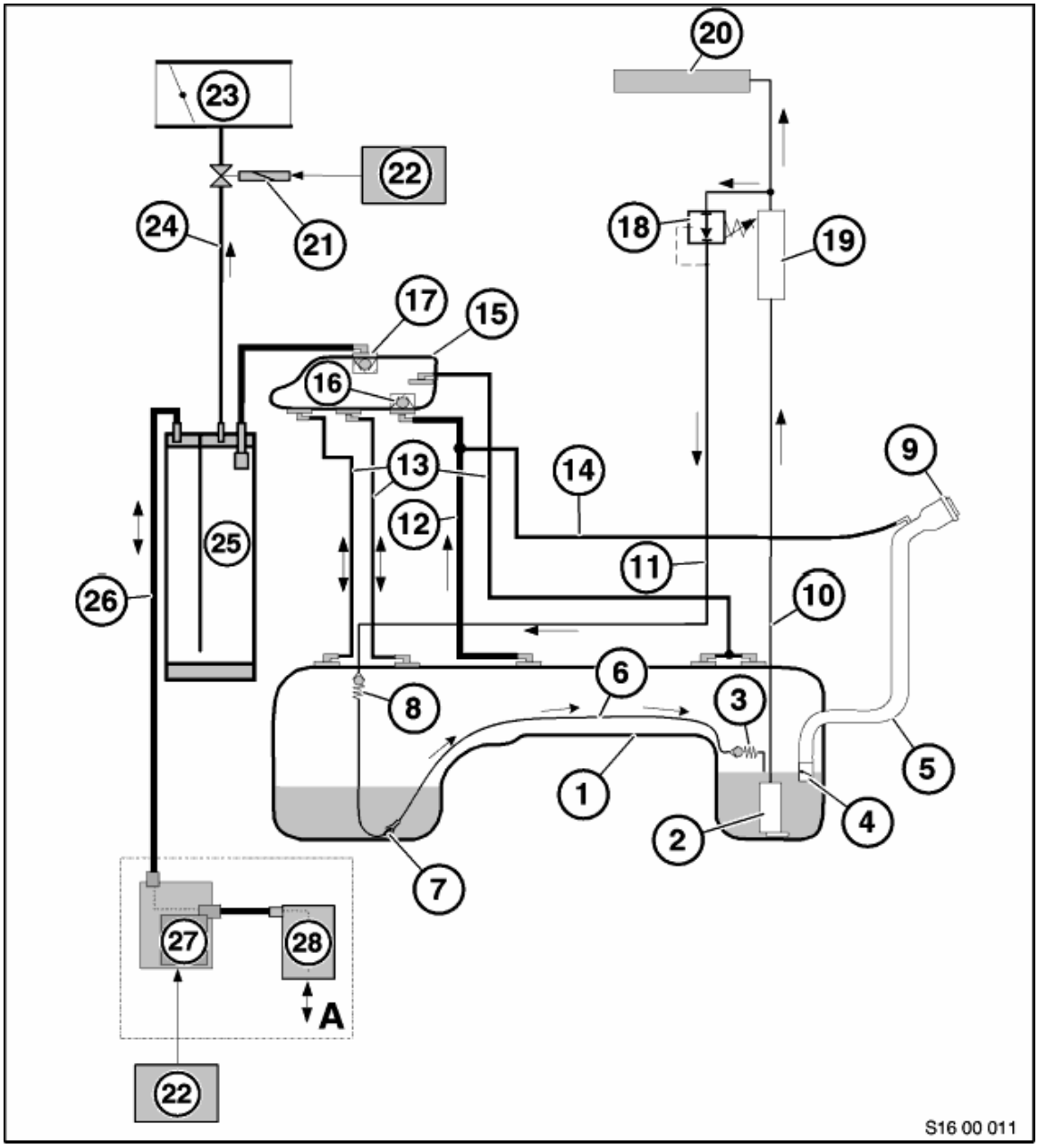
Fuel level measurement in the fuel tank

The fuel level is measured by a lever-type sensor on each side of the fuel tank. The right-hand lever-type sensor is integrated into the fuel delivery unit. The left-hand lever-type sensor is located in the left-hand sensor unit. The actual fuel level in the tank is determined by linking the ohm values of the left and right-hand lever-type sensors.

4.3 Fuel system operating data

Pressure regulator: 3.5 bar

Operating pressure of suction jet pump: 1 - 1.3 bar



4.4. Fuel supply system E53

5 Fuel supply system E38/39 diesel

5.1 Description of parts

1. Fuel tank (E38 steel, E39 plastic)	17. Dust filter
2. Electric fuel delivery pump	18. Fuel return line
3. Surge chamber	19. Fuel feed line
4. Suction jet pump	20. H-piece (M47/67)
5. Overflow protection valve	20A. 5-section distributor (M57)
6. Pressure relief valve	21. Distributor injection pump (M47)
7. Refuelling vent line	21A. High-pressure pump (M57/67)
8. Non-return flap	22. Gear pump (M67)
9. Filler neck	22A. Inline pump (E38/39 M57)

10. Fuel filler cap	23. Fuel filter
11. Tank expansion line	24. Fuel rail (M57/67)
12. Operating vent line	25. Injector
13. Operating vent line	26. Distributor block (M67)
14. Heater booster	27. Bimetal valve
15. Expansion tank	28. Fuel cooler
16. Rollover valve	29. Pressure relief valve (M57)

5.2 Functional description (please refer to drawing 5.4/5.5/5.6/5.7)

Fuel system (please refer to drawing 5.4/5.5/5.6/5.7)

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel system".

With the following differences:

1. Both suction jet pumps are driven by the fuel feed line.
2. Additional heater boosters with independent supply line from fuel tank.
3. Elimination of non-return flap in fuel filler neck (E38 only)

Fuel supply to the engine

M47 (please refer to drawing 5.4)

The fuel is fed from the electric fuel delivery pump to the distributor injection pump via the fuel feed line and the fuel filter.
The distributor injection pump feeds fuel to the respective injector.
The return from the injectors and the distributor injection pump is fed into the bimetal valve. The bimetal valve separates the fuel in the fuel return line according to the fuel temperature.
At low fuel temperatures, the larger proportion of the fuel is returned to the fuel feed line at a point in front of the fuel filter. In this way, the fuel is warmed up more rapidly at low ambient temperatures.
At high fuel temperatures, the larger proportion of the fuel flows back to the fuel tank via the fuel cooler and the fuel return line. This prevents the fuel from being warmed up too much at high ambient temperatures.
Large quantities of heated fuel occur in the return line in extreme operating conditions, for example, in mountainous terrain or when towing a trailer. For this reason, the throttle in the H-piece diverts a portion of the fuel directly into the fuel feed line. This process also has the effect of countering an excessive heating of the fuel in the fuel tank.

M57 (please refer to drawing 5.5/5.6)

The fuel is fed from the electric fuel delivery pump to the high-pressure pump via the fuel feed line, the inline pump and the fuel filter.
The high-pressure pump supplies the injectors with fuel through the fuel rail.
The inline pump generates the necessary fuel delivery pressure for the high-pressure pump. This delivery pressure is maintained at a constant level by the pressure relief valve in the engine circuit.
The return from the injectors and the high-pressure pump is fed into the bimetal valve. The bimetal valve separates the fuel in the fuel return line according to the fuel temperature.
At low fuel temperatures, the larger proportion of the fuel is returned through the 5-section distributor to the fuel feed line at a point in front of the inline pump. In this way, the fuel is warmed up more rapidly at low ambient temperatures.
At high fuel temperatures, the larger proportion of the fuel flows back to the fuel tank via the fuel cooler and the fuel return line. This prevents the fuel from being warmed up too much at high ambient temperatures.
Large quantities of heated fuel occur in the return line in extreme operating conditions, for example, in mountainous terrain or when towing a trailer. For this reason, the throttle in the 5-section distributor diverts a portion of the fuel directly into the fuel feed line. This process also has the effect of countering an excessive

heating of the fuel in the fuel tank.

M67 (please refer to drawing 5.7)

The fuel is fed from the electric fuel delivery pump to the high-pressure pump via the fuel feed line, the fuel filter and the gear pump.
The high-pressure pump supplies fuel to the injectors via the distributor block and the fuel rails.
The gear pump, which is flange-mounted directly on the high-pressure pump, generates the necessary fuel delivery pressure for the high-pressure pump.
The fuel return from the injectors and from the high-pressure pump is fed into the bimetal valve (for functional description of bimetal valve and H-piece, see M47).
The check valve in the H-piece isolates the fuel feed from the fuel return. This prevents a loss of pressure when large quantities of fuel are required.

Ventilation system

When refuelling, the fuel tank is vented through the refuelling vent line in the fuel filler neck.
While driving, the fuel tank is ventilated through the operating vent lines, the expansion tank and the dust filter.

The condensed components of the fuel vapours are fed back from the expansion tank into the fuel tank through the left-hand operating vent line.

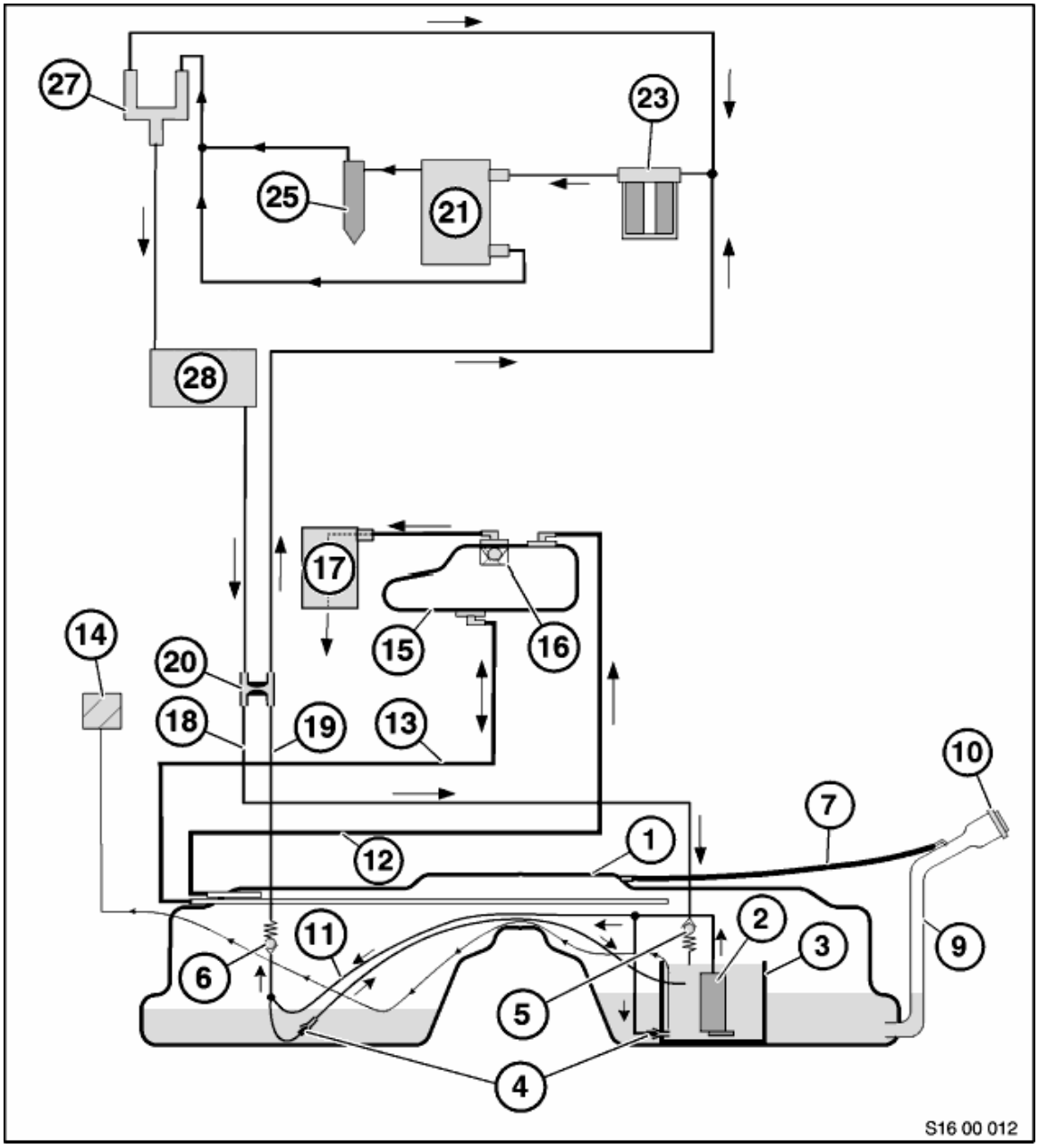
Fuel level measurement in the fuel tank

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel level measurement in the fuel tank".

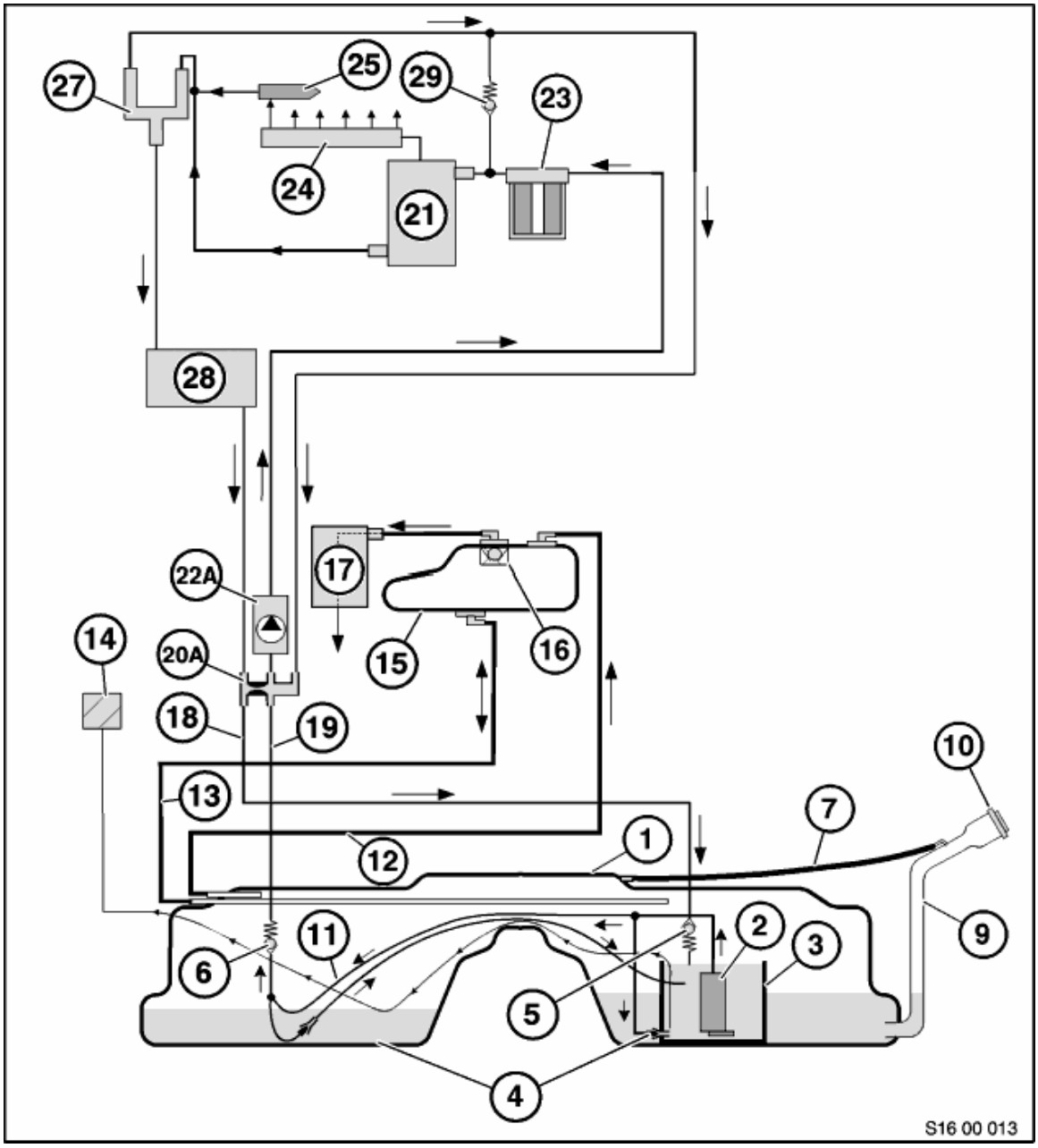
5.3 Fuel system operating data

Operating pressure of fuel delivery pump: 0.4 bar

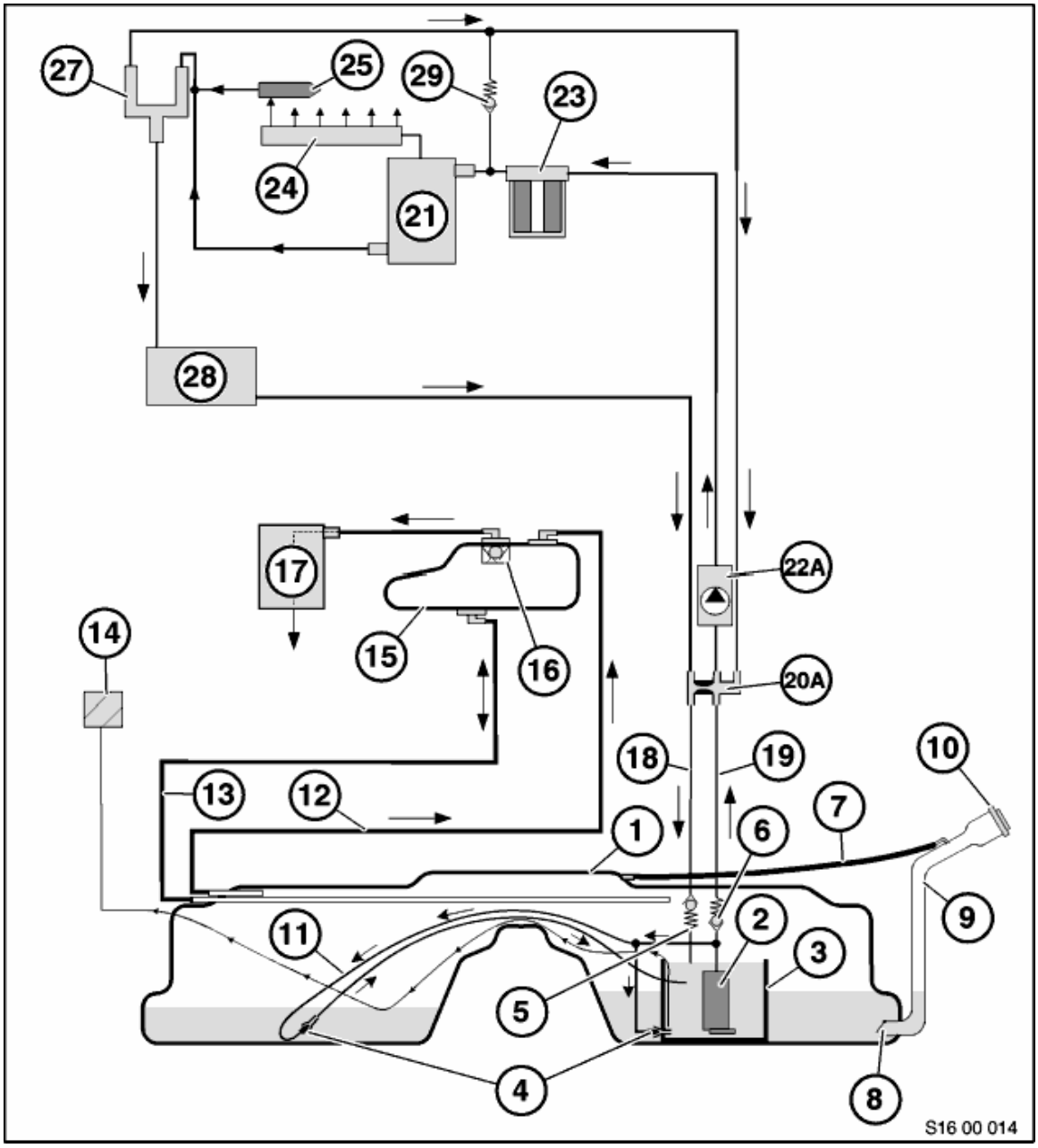
Operating pressure of suction jet pumps: 1 - 1.3 bar



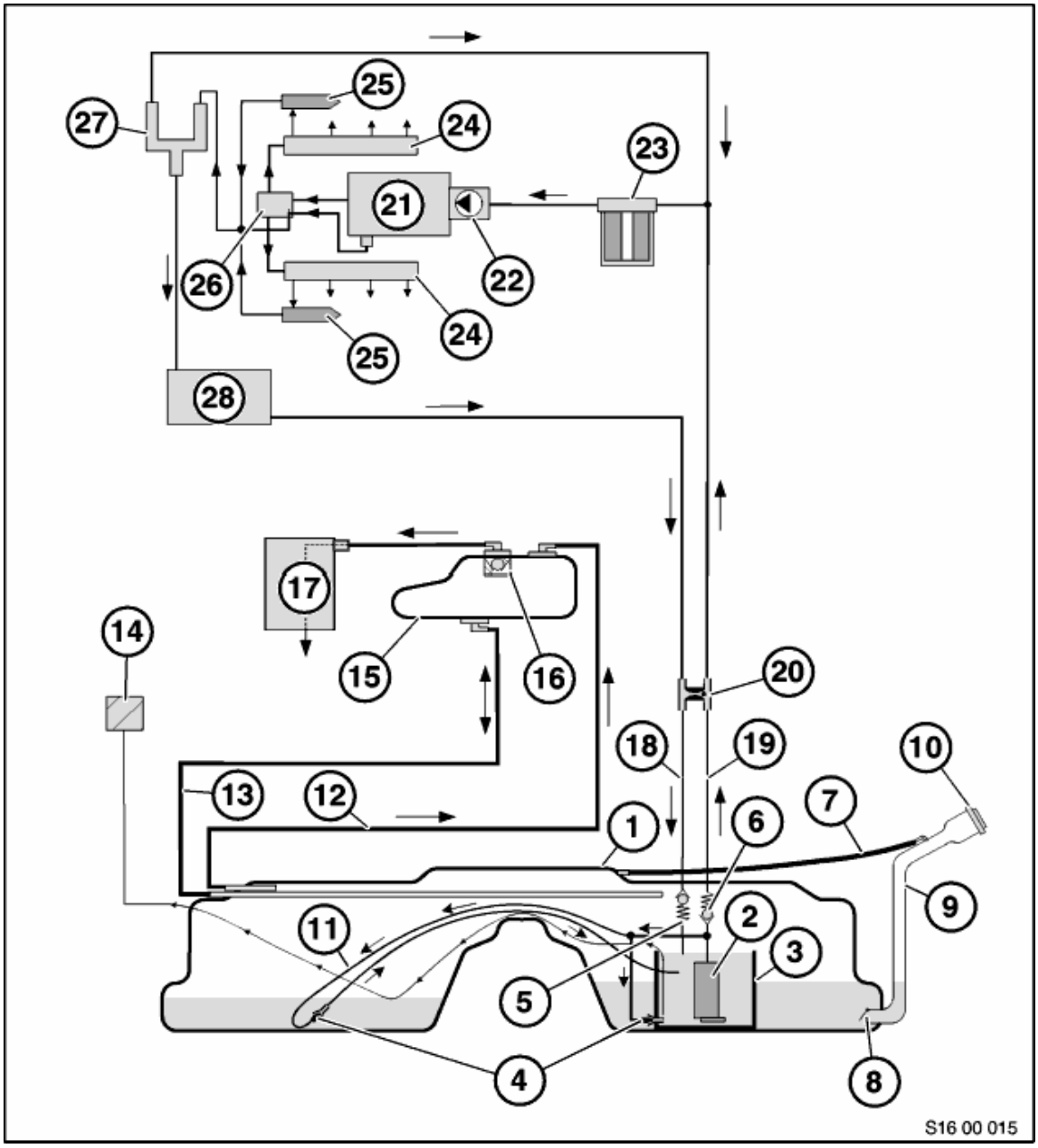
5.4 Fuel supply system E39 M47



5.5 Fuel supply system E39 M57



5.6 Fuel supply system E38 M57



5.7 Fuel supply system E38, M67

6. Fuel supply system E46 diesel

6.1 Description of parts

1. Fuel tank (E38 steel, E39 plastic)	14. Operating vent line
2. Electric fuel delivery pump	15. Expansion tank
3. Surge chamber	16. Rollover valve
4. Suction jet pump	17. Distributor injection pump (M47)
5. Tank expansion line	High-pressure pump (M57)
6. Overflow protection valve	18. Inline pump (E38/39 M57)
7. Filler neck	19. Fuel filter
8. Fuel filler cap	20. Fuel rail (M57)

9. Refuelling vent line	21. Injector
10. Fuel return line	22. Bimetal valve
11. Fuel feed line	23. Fuel cooler
12. H-piece (M47)	24. Pressure relief valve (M57)
13. Operating vent line	

6.2 Functional description (please refer to drawing 6.4/6.5)

Fuel system (please refer to drawing 6.4/6.5)

For description, please refer to "Fuel supply system E46,
2.2 Functional description, fuel system".

With the following differences:

1. The suction jet pump is driven by the fuel return line.
2. Elimination of non-return flap in fuel filler neck.
3. Elimination of pressure relief valve in fuel tank.

Fuel supply to the engine

M47 (please refer to drawing 6.4)

For description, please refer to "Fuel supply system E38/39 diesel M47,
2.2 Functional description, fuel supply to engine".

M57 (please refer to drawing 6.5)

For description, please refer to "Fuel supply system E38/39, diesel M57,
2.2 Functional description, fuel supply to engine".

With the following differences:

1. The H-piece replaces the 5-section distributor.
2. The fuel return from the bimetal valve is fed to a point directly in front of the inline pump.

Ventilation system (please refer to drawing 6.4/6.5)

For description, please refer to "Fuel supply system E38/39, diesel M57,
2.2 Functional description, fuel supply to engine".

With the following difference:
- The dust filter is eliminated.

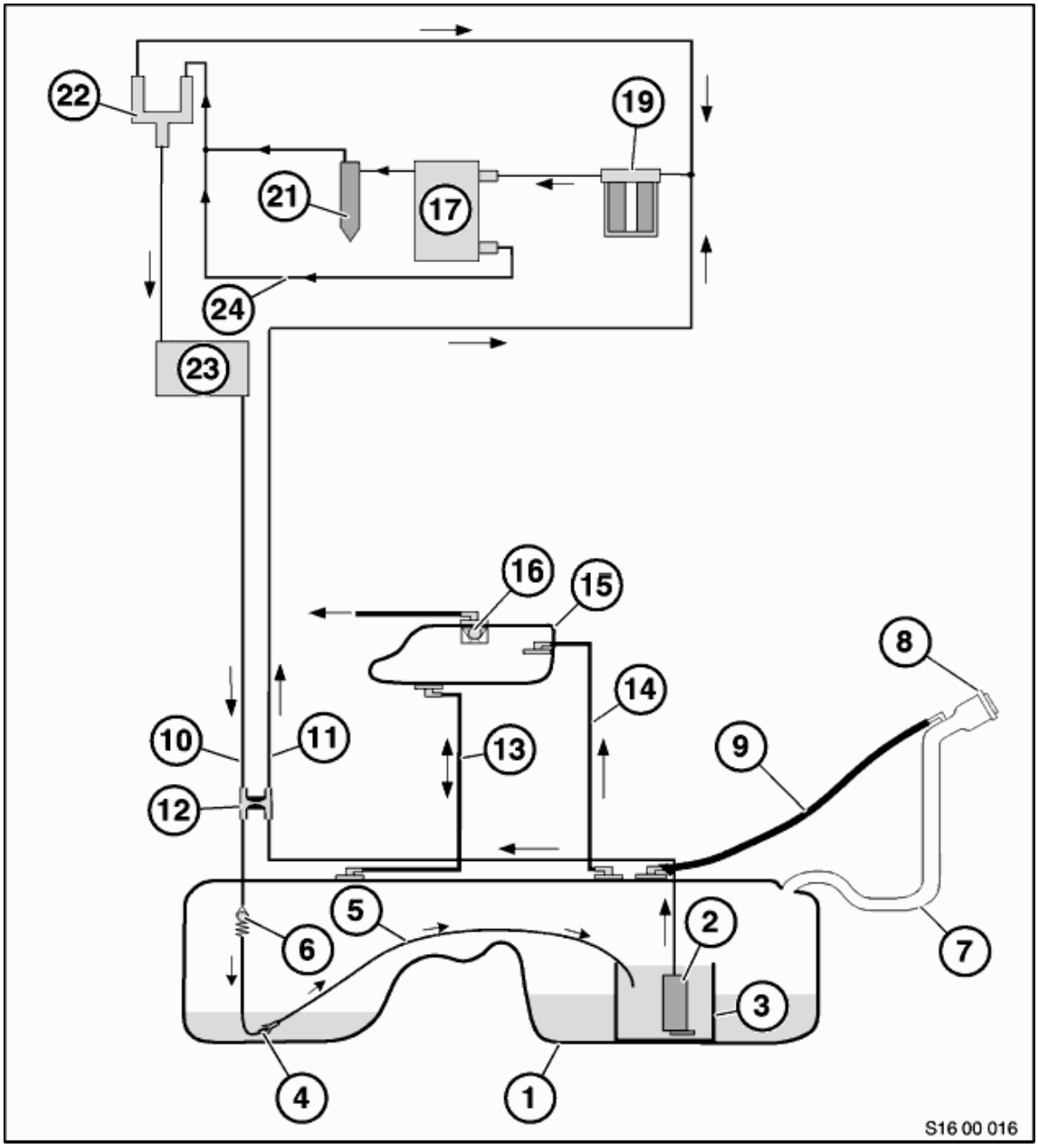
Fuel level measurement in the fuel tank

For description, please refer to "Fuel supply system E38/39,
1.2 Functional description, fuel level measurement in the fuel tank".

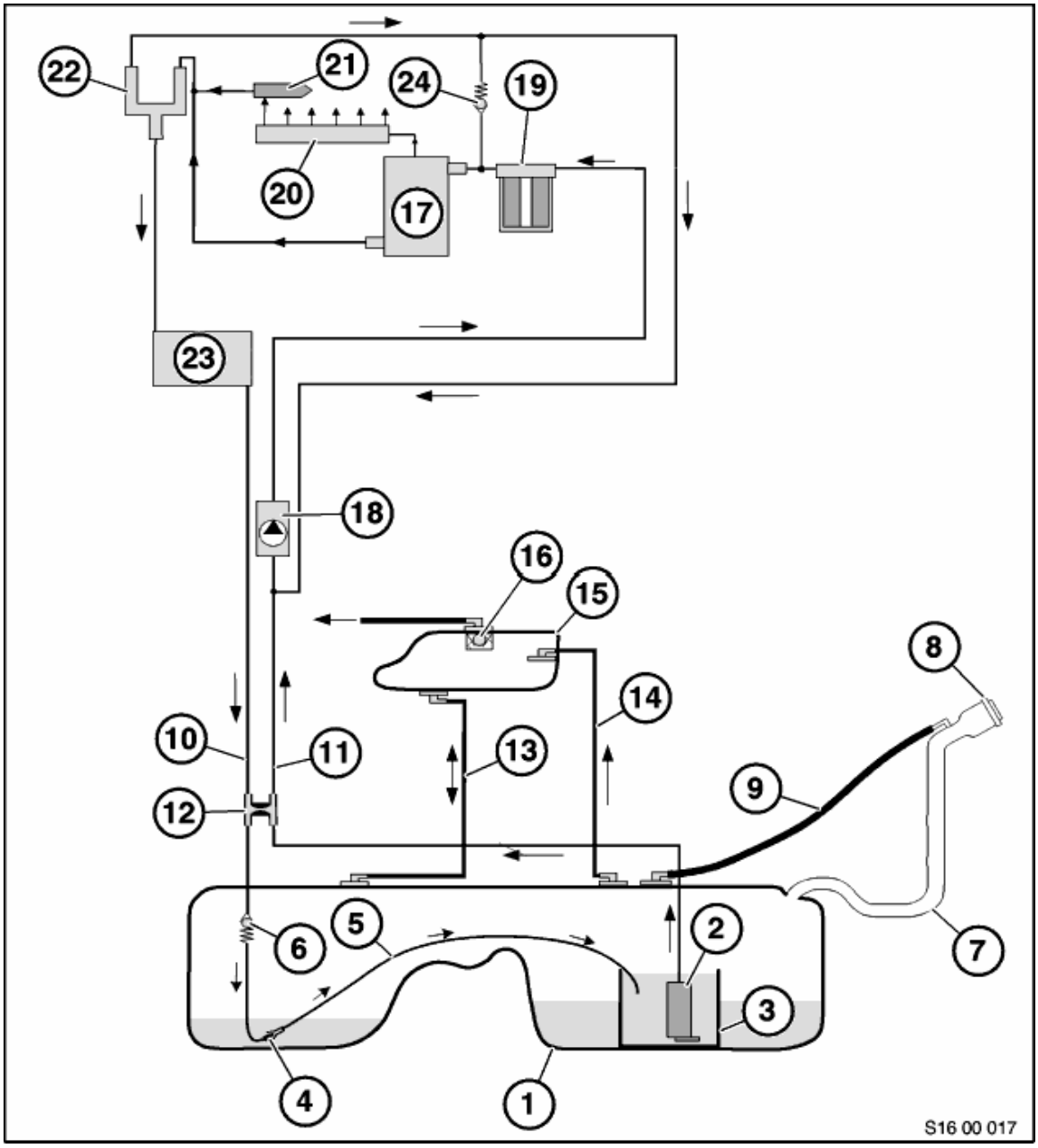
6.3 Fuel system operating data

Operating pressure of fuel delivery pump: 0.4 bar

Operating pressure of suction jet pump: 1 - 1.3 bar



6.4 Fuel supply system E46 M47



6.5 Fuel supply system E46 M57