



Vanguard WirelessHART® Fixed Point Gas Detector



Annex A

Please read all instructional literature carefully and thoroughly before starting.
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| | Methane (CH ₄) | Propane (C ₃ H ₈) | Hydrogen Sulfide (H ₂ S) | Carbon Monoxide (CO) | Ammonia (NH ₃) |
|-------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|
| Sensor Type | NDIR | NDIR | Electrochemical | Electrochemical | Electrochemical |
| Storage Temp | 72 °F (22 °C) Recommended | | | | |
| Storage Life | 5 years | 5 years | 1 year | 6 months | 6 months |
| Service Life ^[i] | 10 years | 10 years | 2 years | 2 years | 2 years |
| Min Op. Temp | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -4 °F (-20 °C) |
| Max Op. Temp | 149 °F (65 °C) | 149 °F (65 °C) | 149 °F (65 °C) | 131 °F (55 °C) | 105 °F (40 °C) |
| Range | 0 to 100% LEL | 0 to 100% LEL | 0 – 100 ppm | 0 – 500 ppm | 0 – 100 ppm |
| Resolution | 1% LEL | 1% LEL | 1 ppm | 1 ppm | 1 ppm |
| Accuracy ^[ii] | ±2 LEL or ±5% of indication ^[iii] | ±2 LEL or ±5% of indication ^[iii] | ±2 ppm or ±5% of indication ^[iii] | ±5 ppm or ±5% of indication ^[iii] | ±2 ppm or ±5% of indication ^[iii] |
| Response Time ^[iv] (T90) | 30 sec | 30 sec | <30 sec | <30 sec | <5 min |
| Stabilization Time | 2 min | 2 min | 1 min | 1 min | 5 min |

[i] Expected operational life varies with environmental conditions and gas exposure

[ii] At standard conditions: 68 °F (20 °C) and 1.0 atm. Accuracy may vary with frequency, accuracy of calibration, and environmental conditions

[iii] Whichever is greater

[iv] Excludes latency due to burst rate

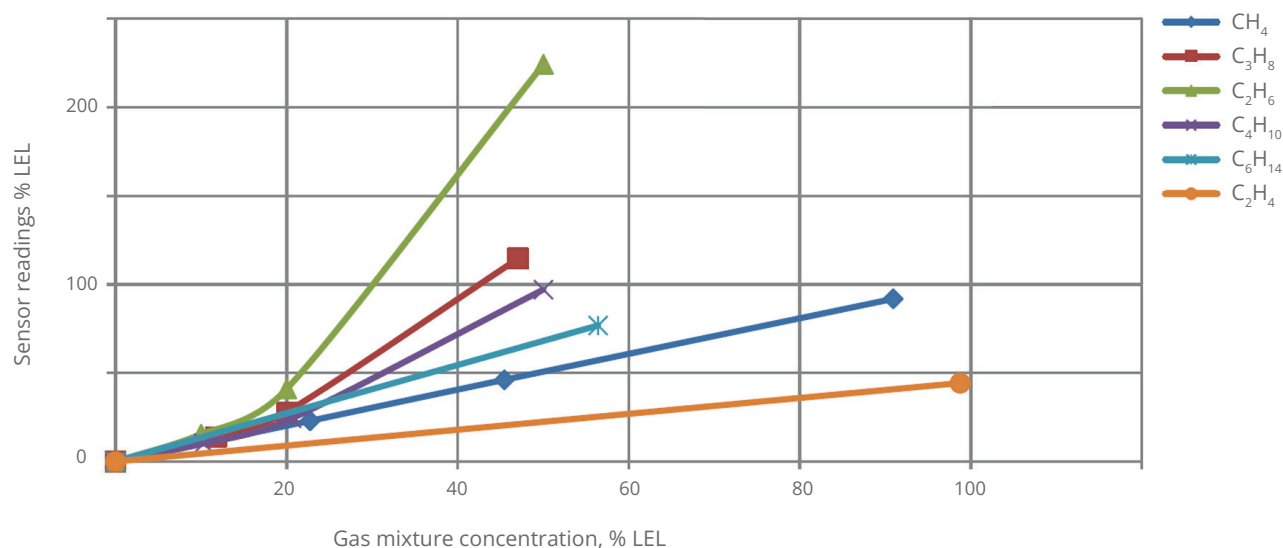
Methane (CH₄) Gas Sensors

| | |
|--------------------------------------------------------------------------------------|---------------------------------------------------------|
| Operating principle | Non-Dispersive Infra-Red (NDIR) |
| Gas sampling method | Diffusion |
| Measurement range | 0-100% LEL CH ₄ (0 to 4.0% Vol) |
| Target Gas | CH ₄ |
| Operating humidity | 0 to 98% non-condensing |
| Operating temperature [□] | -40 to 60 °C |
| Operating pressure | 1 atm +/- 20% |
| Response time T90 | 30 sec |
| Readings variability within temperature range +20 to +25 °C | ± 0.1% vol. or ± 5% of readings (whichever is greater) |
| Readings variability within temperature range -10 to +20 °C and +25 to +40 °C | ± 0.2% vol. or ± 10% of readings (whichever is greater) |
| Readings variability within temperature range -40 to -10 °C and +40 to +60 °C | ± 0.4% vol. or ± 20% of readings (whichever is greater) |

| | |
|------------------------|-------------------|
| Linearity | +/- 3% full scale |
| Repeatability | 1.2% of range |
| Long term drift | < 1% per year |
| Life expectancy | > 10 years |
| Shelf life | > 5 years |
| Filter | Dust |

[□] Term "operating temperature" refers to ambient temperature, at which sensor operates and its intrinsic safety is ensured

Typical sensor cross-sensitivity to Methane (CH₄)



NOTES:

- Interference factors may differ from sensor to sensor and with life time. It is not advisable to calibrate with interference gases.
- This data does not claim to be complete. The sensor might also be sensitive to other gases.

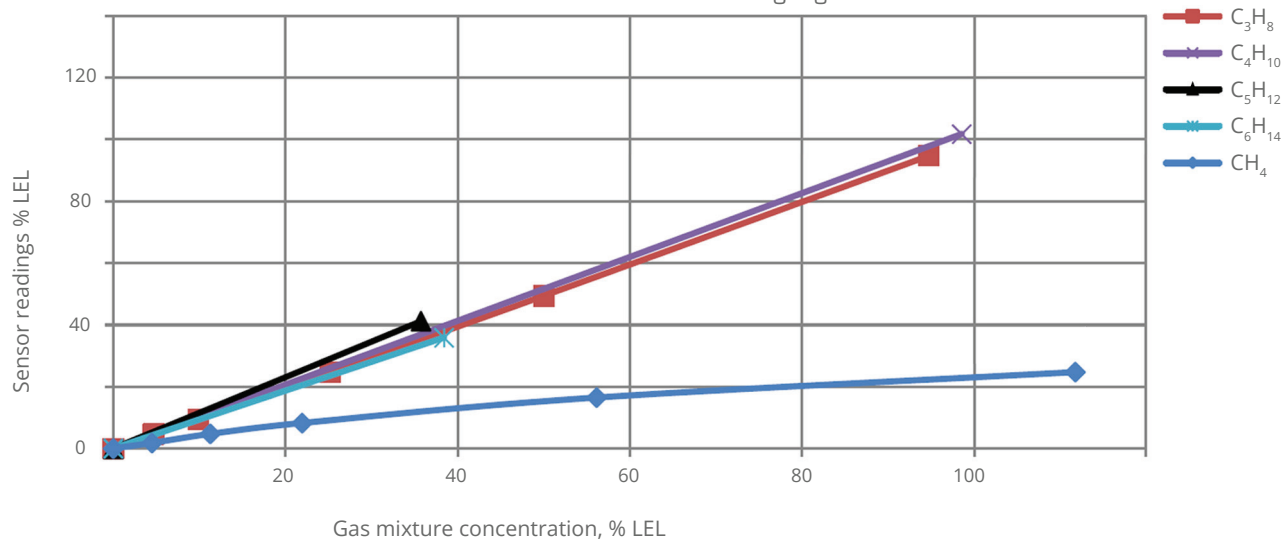
Propane (C_3H_8) Gas Sensors

| | |
|--------------------------------------------------------------------------------------|---------------------------------------------------------|
| Operating principle | Non-Dispersive Infra-Red (NDIR) |
| Gas sampling method | Diffusion |
| Measurement range | 0-100% LEL C_3H_8 (0 to 2.5% Vol) |
| Target Gas | C_3H_8 |
| Operating humidity | 0 to 98% non-condensing |
| Operating temperature [¶] | -40 to 60 °C |
| Operating pressure | 1 atm +/- 20% |
| Response time T90 | 30 sec |
| Readings variability within temperature range +20 to +25 °C | ± 0.05% vol. or ± 5% of readings (whichever is greater) |
| Readings variability within temperature range -10 to +20 °C and +25 to +40 °C | ± 0.1% vol. or ± 10% of readings (whichever is greater) |
| Readings variability within temperature range -40 to -10 °C and +40 to +60 °C | ± 0.2% vol. or ± 20% of readings (whichever is greater) |

| | |
|------------------------|-------------------|
| Linearity | +/- 3% full scale |
| Repeatability | 1.2% of range |
| Long term drift | < 1% per year |
| Life expectancy | > 10 years |
| Shelf life | > 5 years |
| Filter | Dust |

[¶] Term "operating temperature" refers to ambient temperature, at which sensor operates and its intrinsic safety is ensured

Typical sensor cross-sensitivity to Propane (C_3H_8)



NOTES:

- Interference factors may differ from sensor to sensor and with life time. It is not advisable to calibrate with interference gases.
- This data does not claim to be complete. The sensor might also be sensitive to other gases.

Hydrogen Sulfide (H₂S) Gas Sensor

| | |
|--------------------------------------|-----------------------------|
| Operating principle | Electrochemical |
| Gas sampling method | Diffusion |
| Measurement range | 0 - 100 ppm |
| Target Gas | H ₂ S |
| Operating humidity | 15 to 90% RH non-condensing |
| Operating temperature ⁽¹⁾ | -40 to 65 °C |
| Operating pressure | 1 atm +/- 10% |
| Reponse time T90 | <30 sec |

| | |
|-----------------------------|----------------|
| Baseline shift -20 to 65 °C | < 1 ppm |
| Repeatability | +/- 2% |
| Long term drift | < 2% per month |
| Life expectancy | 2 years |
| Shelf life | 6 months |
| Overrange | 500 ppm |

⁽¹⁾ * Variability in the whole operating temperature range for any sensor modification is presented below.

⁽²⁾ Term "operating temperature" refers to ambient temperature, at which sensor operates and its intrinsic safety is ensured

Typical sensor cross-sensitivity to Hydrogen Sulfide (H₂S)

While sensors are designed to be highly specific to the gas they are intended to measure, they will still respond to some degree to various other gases. The table below is not exclusive and other gases not included in the table may still cause a sensor to react.

IMPORTANT NOTE :

The cross sensitivity data shown below does not form part of the product specification and is supplied for guidance only. Values quoted are based on tests conducted on a small number of sensors and any batch may show significant variation. For the most accurate measurements, an instrument should be calibrated using the gas under investigation.

| Gas | Test Gas Concentration | Typical Hydrogen Sulfide Concentration Equivalent |
|------------------|------------------------|---------------------------------------------------|
| Hydrogen Sulfide | 10 ppm | 10 |
| Carbon Monoxide | 300 ppm | 1 |
| Carbon Dioxide | 5000 ppm | 0 |
| Hydrogen | 1000 ppm | 4 |
| Sulphur Dioxide | 5 ppm | 0.5 |

| Gas | Test Gas Concentration | Typical Hydrogen Sulfide Concentration Equivalent |
|------------------|------------------------|---------------------------------------------------|
| Nitric Oxide | 30 ppm | 0.3 |
| Nitrogen Dioxide | 5 ppm | -1 |
| Ammonia | 100 ppm | 0 |
| Ethanol | 1000 ppm | 1 |

Ammonia (NH₃) Gas Sensor

| | | | |
|---------------------------------------|-----------------------------|---------------------|-------------------|
| Operating principle | Electrochemical | Resolution at 20 °C | < 1 ppm |
| Gas sampling method | Diffusion | Long term drift | < 5% per 6 months |
| Measurement range | 0 - 100 ppm | Life expectancy | 2 years |
| Target Gas | NH ₃ | Shelf life | 6 months |
| Operating humidity | 15 to 90% RH non-condensing | | |
| Operating temperature ⁽ⁱⁱ⁾ | -20 to 40 °C | | |
| Operating pressure | 1 atm +/- 10% | | |
| Response time T90 | <5 min | | |

⁽ⁱⁱ⁾ At higher carbon dioxide concentration (approx. > 5%) there can be a negative reading

Typical sensor cross-sensitivity to Ammonia (NH₃)

While sensors are designed to be highly specific to the gas they are intended to measure, they will still respond to some degree to various other gases. The table below is not exclusive and other gases not included in the table may still cause a sensor to react.

IMPORTANT NOTE :

The cross sensitivity data shown below does not form part of the product specification and is supplied for guidance only. Values quoted are based on tests conducted on a small number of sensors and any batch may show significant variation. For the most accurate measurements, an instrument should be calibrated using the gas under investigation.

| Gas | Test Gas Concentration | Typical Ammonia Concentration Equivalent |
|-----------------|------------------------|------------------------------------------|
| Alcohols | 1000 ppm | 0 |
| Carbon Dioxide | 5000 ppm | 0 ⁽ⁱⁱ⁾ |
| Carbon Monoxide | 100 ppm | 0 |

| Gas | Test Gas Concentration | Typical Ammonia Concentration Equivalent |
|------------------|------------------------|------------------------------------------|
| Hydrogen | 10000 ppm | 0 |
| Hydrogen Sulfide | 20 ppm | 2 |

Carbon Monoxide (CO) Gas Sensor

| | |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Operating Principle | 3-electrode electrochemical |
| Target Gas | CO |
| Detection Range | 0 to 2000 ppm |
| Filter | To remove acid gases ^[1] |
| Filter Capacity | > +20 °C to +55 °C |
| Response Time (T90) ^[1] (for concentrations up to 500 ppm) | ≤10 sec. at 20 °C |
| Recovery Time ^[1] (from 100ppm down to <2 ppm) | < 90 sec. (typically < 30 sec.) |
| Baseline Offset (clean air) ^[1] | < ±2 ppm CO equivalent |
| Baseline Shift | -40 °C to -20 °C: ±3 ppm CO equivalent -20 °C to +20 °C: < ±2 ppm CO equivalent +20 °C to +55 °C : Typically < +4 ppm (+9 ppm max.) |

| | |
|----------------------------------------------|---------------------------------|
| Repeatability | < ±2% CO equivalent |
| Operating Temperature | -40 °C to +55 °C |
| Operating Humidity | 15% RH to 95% RH non-condensing |
| Operating Pressure Range | 800 to 1200 mbar |
| Long Term Output Drift ^[1] | < 5% per year |
| Expected Operating Life | 24 months in air |
| Storage Life | 6 months in original packaging |
| Standard Warranty | 24 months from date of despatch |

^[1] Specifications are valid at 20 °C, 50% RH and 1013 mBar. Performance characteristics outline the performance of sensors supplied within the first 3 months. Output signal can drift below the lower limit over time.

Filter information

Activated carbon cloth filter with high surface area:

- Removes acid gases such as SO₂, NO₂ & H₂S
- Protects from short-term (<1000 ppm hours) exposure to alcohols such as Methanol, Ethanol, & IPA

Typical sensor cross-sensitivity to Carbon Monoxide (CO)

While sensors are designed to be highly specific to the gas they are intended to measure, they will still respond to some degree to various other gases. The table below is not exclusive and other gases not included in the table may still cause a sensor to react.

IMPORTANT NOTE :

The cross sensitivity data shown below does not form part of the product specification and is supplied for guidance only. Values quoted are based on tests conducted on a small number of sensors and any batch may show significant variation. For the most accurate measurements, an instrument should be calibrated using the gas under investigation.

| Gas | Concentration | Reading (ppm) |
|--------------------------------------------|---------------|---------------|
| Acetylene (C ₂ H ₂) | 100 ppm | 88 |
| Ethylene (C ₂ H ₄) | 100 ppm | 97 |
| Hydrogen (H ₂) | 100 ppm | <28 |
| Nitric Oxide (NO) | 48.6 ppm | 14 |
| Nitrogen Dioxide (NO ₂) | 19.5 ppm | <0.5 |

| Gas | Concentration | Reading (ppm) |
|--------------------------------------------|---------------|---------------|
| Chlorine (Cl ₂) | 13.7 ppm | <0.5 |
| Ethanol (C ₂ H ₅ OH) | 200 ppm | 0 |
| Hydrogen Sulfide (H ₂ S) | 50 ppm | 0 |
| Sulfur Dioxide (SO ₂) | 20 ppm | 0 |
| Ammonia (NH ₃) | 20 ppm | 0 |

Poisoning

Sensors are designed for operation in a wide range of environments and harsh conditions. However, it is important that exposure to high concentrations of solvent vapours is avoided, during storage, fitting into instruments, and operation.

Antenna Tape (TCD 60 only)

To ensure a watertight protection of the antenna, United Electric recommends protecting the connector as indicated below using sealant tape provided in the shipment.

Directions:

- 1 Make sure antenna and adapter are clean and dry.
- 2 Apply between 40°F and 110°F
- 3 Peel COAX-SEAL from the paper backing. Start winding from antenna to antenna adapter, with one half overlap for each winding, making sure the antenna joint is well covered (See Figure 1)
- 4 When entire antenna joint is covered with a layer of COAX-SEAL, mold with fingers to form a smooth surface and force out any air.
- 5 Carefully inspect seal to make certain the antenna joint is covered and sealed.



Figure 1

Diagnostic information

Purpose

This annex is to provide configuration and diagnostic information associated with the Vanguard wireless gas detector using WirelessHART® protocol. This should be used as supplementary to the instruction manual for commissioning and servicing.

Default settings

When the Vanguard is shipped, the following settings are standard:

| | |
|----|-------------------------------------------------------------------|
| 1. | Network ID ^[iv] : 3477 |
| 2. | Network Key ^[iv] : 42410610 00000000 00000000 00000000 |
| 3. | Burst message 0: Command 9 and active |
| 4. | Burst message 1: Command 48 and active |
| 5. | Burst message 2: Command 9 and inactive |

^[iv] Vanguard sales option M207 allows the Network ID and Key to be programmed in the transmitter during production. If the unit is not found using the default network, ensure this option was not selected. If selected, please contact your purchasing department for the network programmed or our customer service group.

Connecting to your network

During commissioning of the Vanguard gas detector, program the Network ID and Join Key using a handheld communicator, computer with a hart modem and PACTware with our DTM, or by connecting a gateway using the default network settings above. The final gateway should have a different ID and key than the default settings in the Vanguard.

For more specific information on using the 475 communicator, and getting the DD for the host system, go to <https://www.ueonline.com/all-products/vanguard-wirelesshart-fixed-point-gas-detector/>

For connecting with a gateway, use the instructions from the manufacturer. Set the Network ID and Key in the gateway to match the default network settings. Then use the gateway to reprogram the Vanguard units to the new settings.

Parameters and diagnostics

Command 9

| | Combustion Sensor | Toxic Sensor |
|----|-----------------------------|-----------------------------|
| PV | % LEL | ppm |
| SV | Not used | Temperature |
| TV | Days since last calibration | Days since last calibration |
| QV | Battery voltage | Battery voltage |

Command 48

Toxic sensor diagnostic information

| Sensor Fault Description | Bit | Rosemount Gateway Indication | Recommended Action |
|--------------------------------|-----|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Device Specific Status Byte 3 | | | |
| Sensor Element Defect | 7 | ✗ | Ensure that sensor is properly plugged into the sensor receiver on the base of the Vanguard detector and the sensor type is displayed on the Vanguard screen. Verify sensor operation with a bump test. If error persists, return sensor to factory. |
| Reserved | 6 | - | |
| ADC Readings Too Low | 5 | ? | Perform bump test to check sensor response. If sensor does not respond or response is out of tolerance, return sensor to factory. |
| Sensor Expired | 4 | ? | Sensor has been installed longer than recommended and sensor should be replaced. Perform a bump test to verify sensor is still performing. Consider replacing soon, or if failed bump test. |
| Power Supply Out of Range | 3 | ✗ | Check that battery voltage is above 6V. If battery voltage is low, replace the battery. If battery voltage OK, but error persists, return sensor to factory. |
| Reference Voltage Out of Range | 2 | ✗ | Check that battery voltage is above 6V. If battery voltage is low, replace the battery. If battery voltage OK, but error persists, return sensor to factory. |
| Gain Fault | 1 | ✗ | Return sensor to factory. |
| Sensor Over Exposure | 0 | ✗ | Sensor performance may have been compromised due to gas exposure beyond sensor range. Perform a bump test to check sensor performance. Recommendation is to replace sensor if out of specification. |
| Device Specific Status Byte 4 | | | |
| Temperature Out of Range | 7 | ✗ | Sensor performance may have been compromised due to temperature exposure outside of operating range. Perform a bump test to check sensor performance. Recommendation is to replace sensor if out of specification. |
| Sensor Negative | 6 | ✓ | Sensor has drifted negative. Perform a zero calibration and check sensor response with a bump test. |
| Sensor under range | 5 | ? | Sensor signal has drifted below its normal operating range. Consider performing a zero calibration and check sensor response with a bump test. |
| Sensor over range | 4 | ? | Sensor has detected a gas concentration outside its normal operating range. Take necessary precautions and assume a lethal presence of gas is present. If no gas is present, return sensor to factory. |
| Stack or Watchdog Fault | 3 | ✗ | Sensor has been reset due to a timeout of the internal watchdog. Verify sensor functionality with a bump test. If the problem re-occurs consult the factory. |
| Reserved | 2 | - | |
| Sensor Not Zeroed | 1 | ✓ | Indicates sensor has not had zero set since power-up. Perform a zero calibration. |
| CRC Error | 0 | ✗ | This error indicates that an internal software error has occurred. Return sensor to factory. |

Troubleshooting

Combustion sensor diagnostic information

| Sensor Fault Description | Bit | Rosemount Gateway Indication | Recommended Action |
|--------------------------------------------------------------|-----|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Device Specific Status Byte 3 | | | |
| Reserved | 7 | - | |
| Reserved | 6 | - | |
| Reserved | 5 | - | |
| Reserved | 4 | - | |
| Technological failure | 3 | ✗ | Return sensor to factory. |
| Sensor operates in low power mode | 2 | ✓ | Normal operation is low power mode. High power mode will impact battery life (Bit = 0). Return to factory if in high power mode. |
| Zero shifts to negative | 1 | ? | It is recommended to perform a zero calibration. Follow up with a bump test to verify proper operation. |
| Data request rate is more than 1 Hz | 0 | ✓ | No action |
| Device Specific Status Byte 4 | | | |
| Firmware failure (flash memory) | 7 | ✓ | Return sensor to factory. |
| Exceeding temperature limits | 6 | ✓ | Sensor performance may have been compromised from being exposed to an operating temperature that exceeds sensor limits. Perform a bump test to verify operation of the sensor. It is recommended to replace the sensor as soon as possible. |
| Dynamic temperature mode temp. change > 2°C / minute | 5 | ? | Rate of temperature change is too fast. Reading may be out of specification until temperature stabilizes. |
| Dynamic temperature mode temp. change > 0.6°C / minute | 4 | ? | Rate of temperature change is too fast. Reading may be out of specification until temperature stabilizes. |
| Reserved | 3 | - | Reserved |
| One of the signal values is lower than allowed | 2 | ? | Condensation could be present on the sensor. Indication may have poor accuracy. Rely on secondary means to verify gas concentrations should this error persist. |
| An abrupt signal change due to feeding gas mixture to sensor | 1 | ✓ | Wait for the gas reading to stabilize before performing any calibration. |
| Sensor is warming up | 0 | ✓ | This is typically set during sensor power up. Wait for this indication to clear before performing any bump test or calibration. |
| Sensor reading > 100% of range | - | ? | Sensor has detected a gas concentration outside its normal operating range. Take necessary precautions and assume an explosive mixture of gas is present. If no gas is present, return sensor to factory. |



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