

|                     |                           |
|---------------------|---------------------------|
| Date                | 09 November 2018          |
| Time                | 12:18:58                  |
| Test Number         | HRSG Test 21              |
| Mixture Composition | 60/40 H2/CH4              |
| Ambient Temperature | 11 °C                     |
| Ambient Pressure    | 980                       |
| Wind Speed          | 5 m/s                     |
| Wind direction      | NW                        |
| Relative Humidity   | 70.00%                    |
| Mass Flow           | <input type="text"/> kg/s |
| Equivalence Ratio   | 0.50                      |

**General Comments: (weather, rig configuration)**

Weather: Sunny and hot, light breeze

Rig configuration: 4 x 3m circular duct; expansion section and HRSG attached. End Plate attached. Igniter 258mm from beginning of 2nd circular duct section

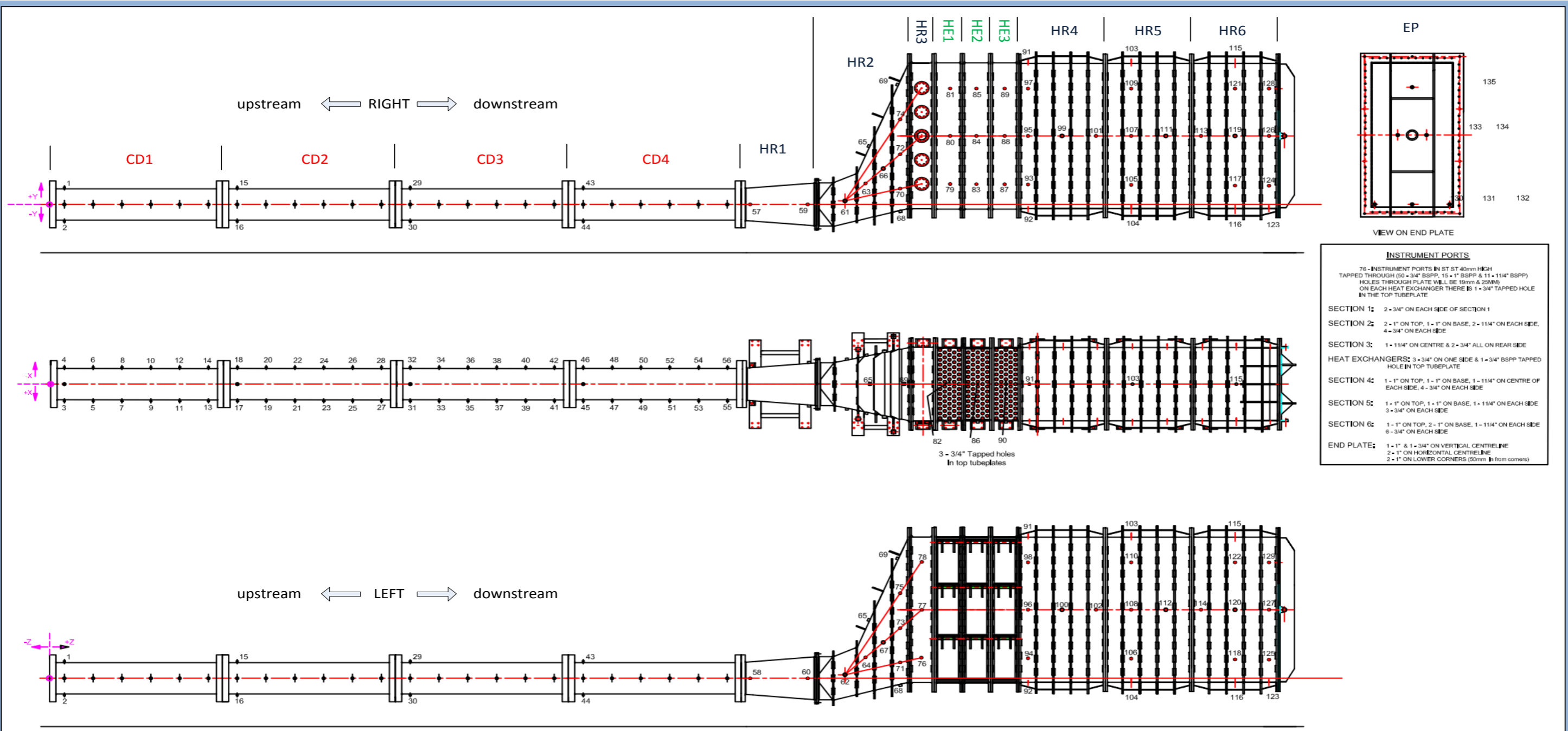
Engine Speed: 40%; 11,800 rpm

Test on 60% H2 40% H2 at an intended EQR of 0.55

The test gave a moderate combustion event and most sensors provided an identifiable response.

Maximum overpressure of 199 mbar was seen on KU2 ahead of the tube bundles. Maximum flame speed measurements from the IPs and OPs are consistent with the maximum velocities seen ahead of the tube bundles.

|                                       |                                       | Ionisation Probes                    |                                      | Ionisation Rakes                     |                                       | Optical Probes                       |                                       |
|---------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|
| Max overpressure                      |                                       | Max. gas temperature                 |                                      | Max. flame speed                     |                                       | Max. flame speed                     |                                       |
| <input type="text" value="199"/> mbar |                                       | <input type="text" value="1050"/> °C |                                      | <input type="text" value="154"/> m/s |                                       | <input type="text" value="164"/> m/s |                                       |
|                                       |                                       | Initial gas temperature              |                                      |                                      |                                       |                                      |                                       |
|                                       |                                       | <input type="text" value="443"/> °C  |                                      |                                      |                                       |                                      |                                       |
| Location of Max. Overpressure         |                                       | Location of Max. Temperature         |                                      | Location of Max. Flame Speed         |                                       | Location of Max. Flame Speed         |                                       |
| sensor                                | <input type="text" value="KU2"/>      | sensor                               | <input type="text" value="TC4"/>     | sensor                               | <input type="text" value="IP4"/>      | sensor                               | <input type="text" value="RA1"/>      |
| label                                 | <input type="text" value="HR2-T5"/>   | label                                | <input type="text" value="CD3-R3"/>  | label                                | <input type="text" value="HR3-R1L"/>  | label                                | <input type="text" value="HR2-R2M"/>  |
| distance                              | <input type="text" value="14745"/> mm | distance                             | <input type="text" value="7258"/> mm | distance                             | <input type="text" value="15140"/> mm | distance                             | <input type="text" value="13785"/> mm |
|                                       |                                       |                                      |                                      |                                      |                                       | ance                                 | <input type="text" value="OP2"/>      |
|                                       |                                       |                                      |                                      |                                      |                                       |                                      | <input type="text" value="HR1-R1"/>   |
|                                       |                                       |                                      |                                      |                                      |                                       |                                      | <input type="text" value="12152"/> mm |



**INSTRUMENT PORTS**

76 - INSTRUMENT PORTS IN ST ST 40mm HIGH TAPPED THROUGH (50 - 3/4" BSPP, 15 - 1" BSPP & 11 - 11/4" BSPP) HOLES THROUGH PLATE WILL BE 10mm & 25MM ON EACH HEAT EXCHANGER THERE IS 1 - 3/4" TAPPED HOLE IN THE TOP TUBEPLATE

SECTION 1: 2 - 3/4" ON EACH SIDE OF SECTION 1

SECTION 2: 2 - 1" ON TOP, 1 - 1" ON BASE, 2 - 11/4" ON EACH SIDE, 4 - 3/4" ON EACH SIDE

SECTION 3: 1 - 11/4" ON CENTRE & 2 - 3/4" ALL ON REAR SIDE

HEAT EXCHANGERS: 3 - 3/4" ON ONE SIDE & 1 - 3/4" BSPP TAPPED HOLE IN TOP TUBEPLATE

SECTION 4: 1 - 1" ON TOP, 1 - 1" ON BASE, 1 - 11/4" ON CENTRE OF EACH SIDE, 4 - 3/4" ON EACH SIDE

SECTION 5: 1 - 1" ON TOP, 1 - 1" ON BASE, 1 - 11/4" ON EACH SIDE 3 - 3/4" ON EACH SIDE

SECTION 6: 1 - 1" ON TOP, 2 - 1" ON BASE, 1 - 11/4" ON EACH SIDE 6 - 3/4" ON EACH SIDE

END PLATE: 1 - 1" & 1 - 3/4" ON VERTICAL CENTRELINE 2 - 1" ON HORIZONTAL CENTRELINE 2 - 1" ON LOWER CORNERS (50mm from corners)

**Naming Convention**

|  |                           |  |
|--|---------------------------|--|
| Section Identifier<br>i.e. HE, HR, CD or EP                  | <b>H R 1 - R 1 U</b>      | Vertical position in section (sides only) i.e. U, M or L. Absence of letter denotes centreline |
| Section Number (1-6)<br>Numbered from downstream to upstream | Side<br>i.e. R, L, T or B | Longitudinal position in section (numbered from 1)   |

**Key**

|                          |  |
|--------------------------|--|
| <b>CD</b> Circular duct  | <b>U</b> Upper   |
| <b>HR</b> HRSG           | <b>M</b> Middle  |
| <b>HE</b> Heat Exchanger | <b>L</b> Lower   |
| <b>EP</b> End Plate      | <b>R</b> Right Side (when viewed downstream from engine) |
|                          | <b>L</b> Left Side                                       |
|                          | <b>T</b> Top   |
|                          | <b>B</b> Bottom  |

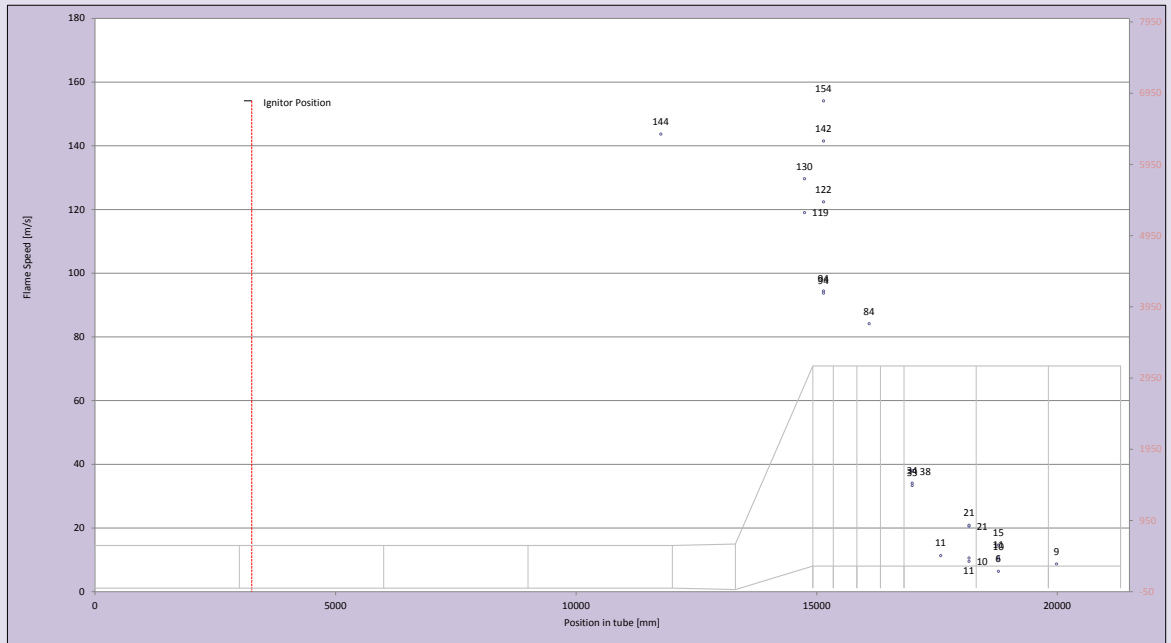
There are 13 sections on the rig

- 4 circular duct sections (CD1 to CD4)
- 6 HRSG sections (HR1 to HR6)
- 3 heat exchanger sections (HE1 to HE3) located between HR3 and HR4

Location of igniter 3258 mm Time of ignition 1.50768 seconds

| IP Number | Location label | Data Name       | Position in tube (mm) | Flame arrival time (s) | Avg Flame speed from last sensor (m/s) |
|-----------|----------------|-----------------|-----------------------|------------------------|--|
| IP0       | CD4-L6         | sation probe 0  | 11758                 | 1.56683                | 144                                    |
| IP1       | HR2-LSL        | sation probe 1  | 14745                 |                        |  |
| IP2       | HR2-L5M        | sation probe 2  | 14745                 | 1.59624                | 130                                    |
| IP3       | HR2-L5U        | sation probe 3  | 14745                 | 1.60415                | 119                                    |
| IP4       | HR3-R1L        | sation probe 4  | 15140                 | 1.58877                | 154                                    |
| IP5       | HR3-R1LM       | sation probe 5  | 15140                 | 1.59072                | 142                                    |
| IP6       | HR3-R1M        | sation probe 6  | 15140                 | 1.59445                | 122                                    |
| IP7       | HR3-R1U        | sation probe 7  | 15140                 | 1.60265                | 94                                     |
| IP8       | HR3-L1U        | sation probe 8  | 15140                 | 1.60290                | 94                                     |
| IP9       | HE2-R1M        | sation probe 9  | 16090                 | 1.60573                | 84                                     |
| IP10      | HR4-L1L        | sation probe 10 | 16985                 | 1.61503                |  |
| IP11      | HR4-L1M        | sation probe 11 | 16985                 | 1.65525                | 38                                     |
| IP12      | HR4-L1U        | sation probe 12 | 16985                 | 1.65694                | 34                                     |
| IP13      | HR4-R1U        | sation probe 13 | 16985                 | 1.65791                | 33                                     |
| IP14      | HR4-R3U        | sation probe 14 | 17575                 | 1.70965                | 11                                     |
| IP15      | HR4-LSL        | sation probe 15 | 18165                 | 1.67227                | 21                                     |
| IP16      | HR4-L5M        | sation probe 16 | 18165                 | 1.77866                | 10                                     |
| IP17      | HR4-L5U        | sation probe 17 | 18165                 | 1.76783                | 11                                     |
| IP18      | HR4-R5M        | sation probe 18 | 18165                 | 1.70506                | 21                                     |
| IP19      | HR5-L2L        | sation probe 19 | 18775                 | 1.73171                | 10                                     |
| IP20      | HR5-L2M        | sation probe 20 | 18775                 | 1.83491                | 11                                     |
| IP21      | HR5-L2U        | sation probe 21 | 18775                 | 1.80942                | 15                                     |
| IP22      | HR5-R2U        | sation probe 22 | 18775                 | 1.89607                | 6                                      |
| IP23      | HR6-L1M        | sation probe 23 | 19985                 | 1.97351                | 9                                      |

KEY: ND - not detected - sensor working but flame too weak to be picked up  
 NW - not working - sensor not working

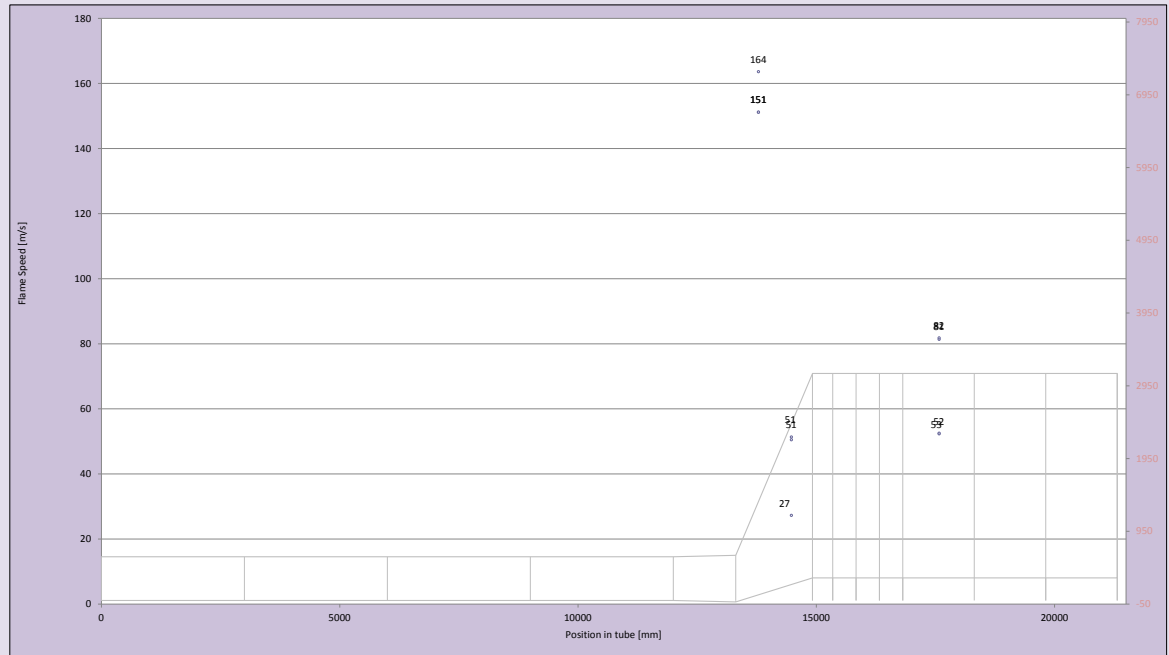


Location of igniter 3258 mm

Time of ignition 1.50768 seconds

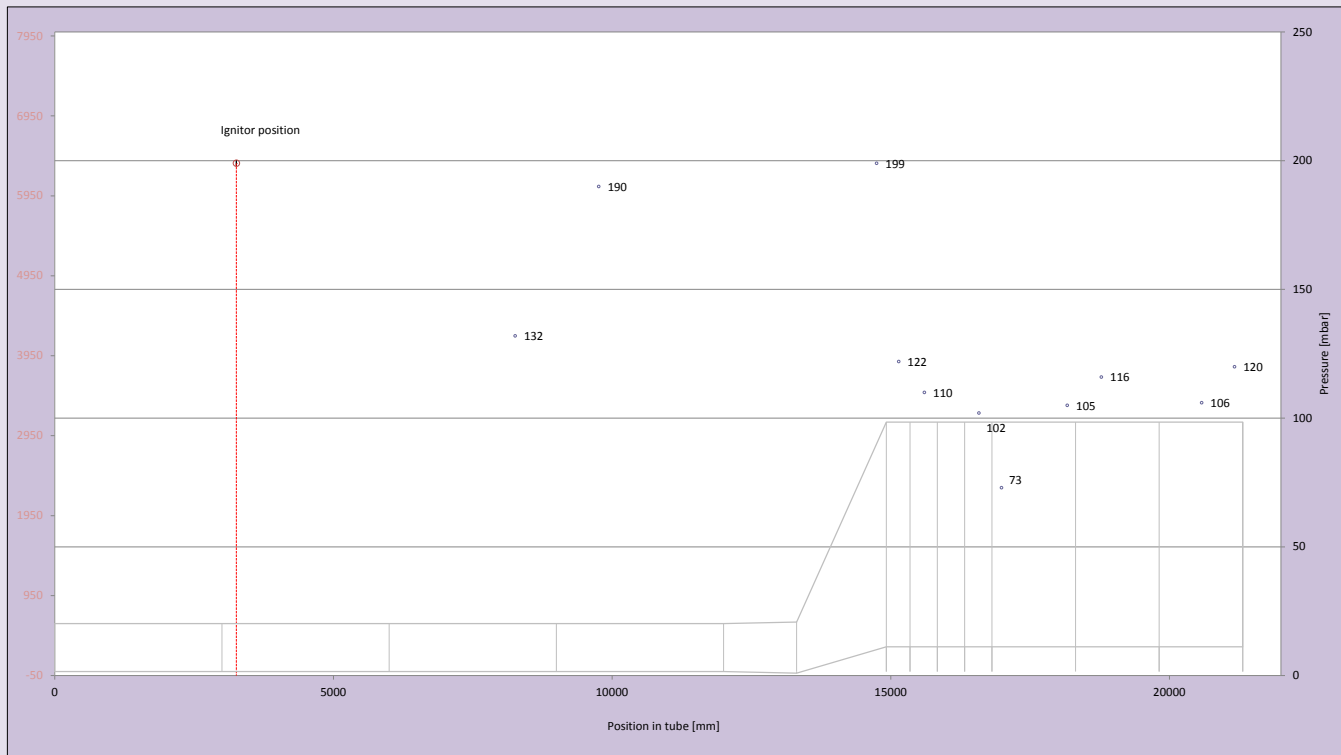
| Rake Number | IP Number | Location label | Data Name | Position in tube (mm) | Flame arrival time (s) | Avg Flame speed from last sensor (m/s) |
|-------------|-----------|----------------|-----------|-----------------------|------------------------|--|
| RA1         | IP24      | HR2-R2M        | IP24      | 13785                 | 1.5773                 | 151                                    |
| RA1         | IP25      | HR2-R2M        | IP25      | 13785                 | 1.5773                 | 151                                    |
| RA1         | IP26      | HR2-R2M        | IP26      | 13785                 | 1.5720                 | 164                                    |
| RA2         | IP27      | HR2-R4M        | IP27      | 14475                 | 1.5907                 | 51                                     |
| RA2         | IP28      | HR2-R4M        | IP28      | 14475                 | 1.5910                 | 51                                     |
| RA2         | IP29      | HR2-R4M        | IP29      | 14475                 | 1.5973                 | 27                                     |
| RA3         | IP30      | HR4-R3M        | IP30      | 17575                 | 1.6500                 | 52                                     |
| RA3         | IP31      | HR4-R3M        | IP31      | 17575                 | 1.6500                 | 53                                     |
| RA3         | IP32      | HR4-R3M        | IP32      | 17575                 | NW                     |  |
| RA4         | IP33      | HR4-R3L        | IP33      | 17575                 | 1.6288                 | 81                                     |
| RA4         | IP34      | HR4-R3L        | IP34      | 17575                 | 1.6288                 | 82                                     |
| RA4         | IP35      | HR4-R3L        | IP35      | 17575                 | NW                     |  |

KEY: ND - not detected - sensor working but flame too weak to be picked up  
 NW - not working - sensor not working



Location of igniter  mm

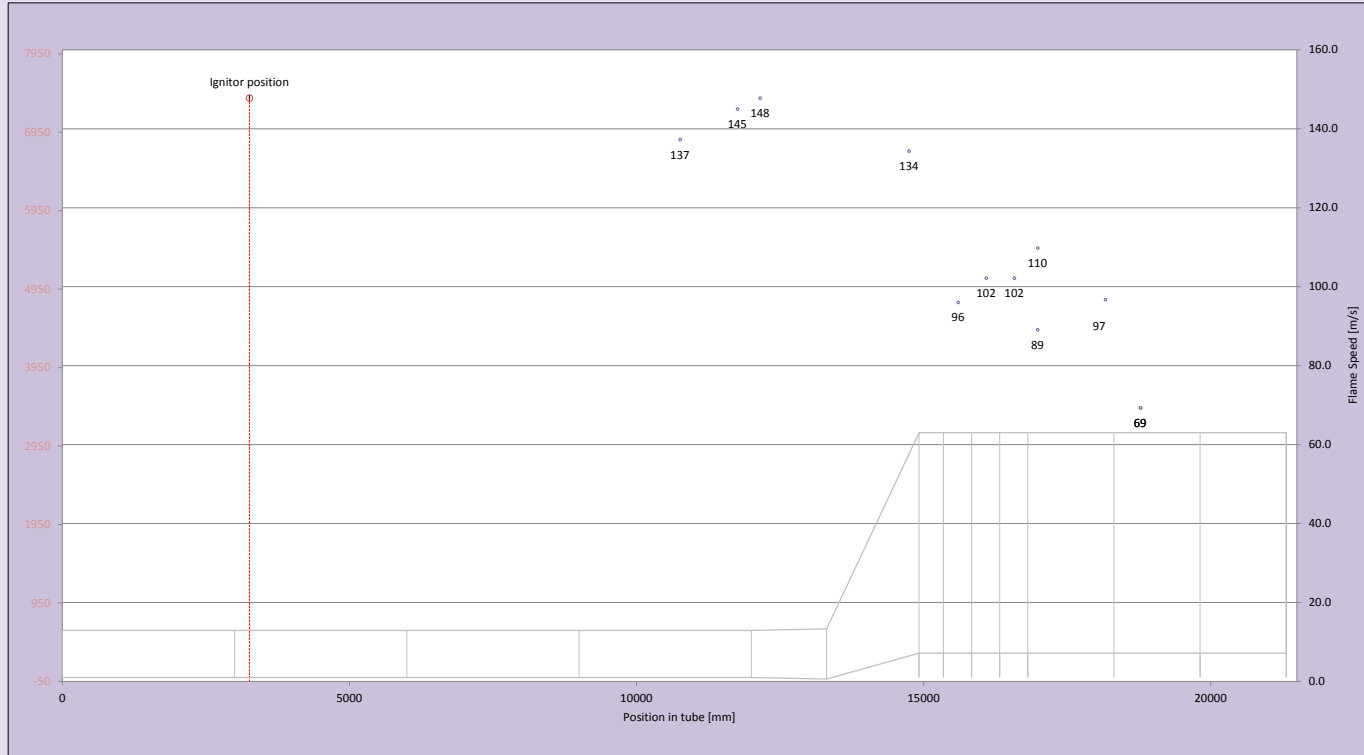
| Transducer number | Location | Position in tube [mm] | $\Delta P_{max}$ [mbar] | Time $\Delta P_{max}$ [sec] |
|-------------------|----------|-----------------------|-------------------------|-----------------------------|
| KU0               | CD3-R5   | 8258                  | 132                     | 1.6026                      |
| KU1               | CD4-R2   | 9758                  | 190                     | 1.6275                      |
| KU2               | HR2-T5   | 14745                 | 199                     | 1.5965                      |
| KU3               | HR3-L1L  | 15140                 | 122                     | 1.5958                      |
| KU4               | HE1-R1U  | 15600                 | 110                     | 1.5964                      |
| KU5               | HE3-R1L  | 16580                 | 102                     | 1.5946                      |
| KU6               | HR4-R1L  | 16985                 | 73                      | 1.5946                      |
| KU7               | HR4-R5U  | 18165                 | 105                     | 1.6111                      |
| KU8               | HR5-R2L  | 18775                 | 116                     | 1.6054                      |
| KU9               | HR6-R3L  | 20575                 | 106                     | 1.6085                      |
| KU10              | HR6-L5L  | 21165                 | 120                     | 1.6088                      |
|                   |          |                       |                         |                             |
|                   |          |                       |                         |                             |



Location of igniter  mm      Time of ignitio  seconds

| OP Number | Location label | Position in tube (mm) | Flame arrival time (s) | Average flame speed (m/s) |
|-----------|----------------|-----------------------|------------------------|---------------------------|
| OP0       | CD4-L4         | 10758                 | 1.5623                 | 137.3                     |
| OP1       | CD4-R6         | 11758                 | 1.5663                 | 145.0                     |
| OP2       | HR1-R1         | 12152                 | 1.5679                 | 147.8                     |
| OP3       | HR2-R5M        | 14745                 | 1.5931                 | 134.4                     |
| OP4       | HE1-T1         | 15600                 | 1.6362                 | 96.1                      |
| OP5       | HE2-T1         | 16090                 | 1.6332                 | 102.2                     |
| OP6       | HE3-T1         | 16580                 | 1.6380                 | 102.2                     |
| OP7       | HR4-T1         | 16985                 | 1.6617                 | 89.1                      |
| OP8       | HR4-R1M        | 16985                 | 1.6327                 | 109.8                     |
| OP9       | HR4-R5L        | 18165                 | 1.6617                 | 96.8                      |
| OP10      | HR5-T2         | 18775                 | 1.7315                 | 69.3                      |
| OP11      | HR5-R2M        | 18775                 | 1.7315                 | 69.3                      |
|           |                |                       |                        |                           |
|           |                |                       |                        |                           |
|           |                |                       |                        |                           |
|           |                |                       |                        |                           |

KEY: ND - not detected - sensor working but flame too weak to be picked up  
 NW - not working - sensor not working

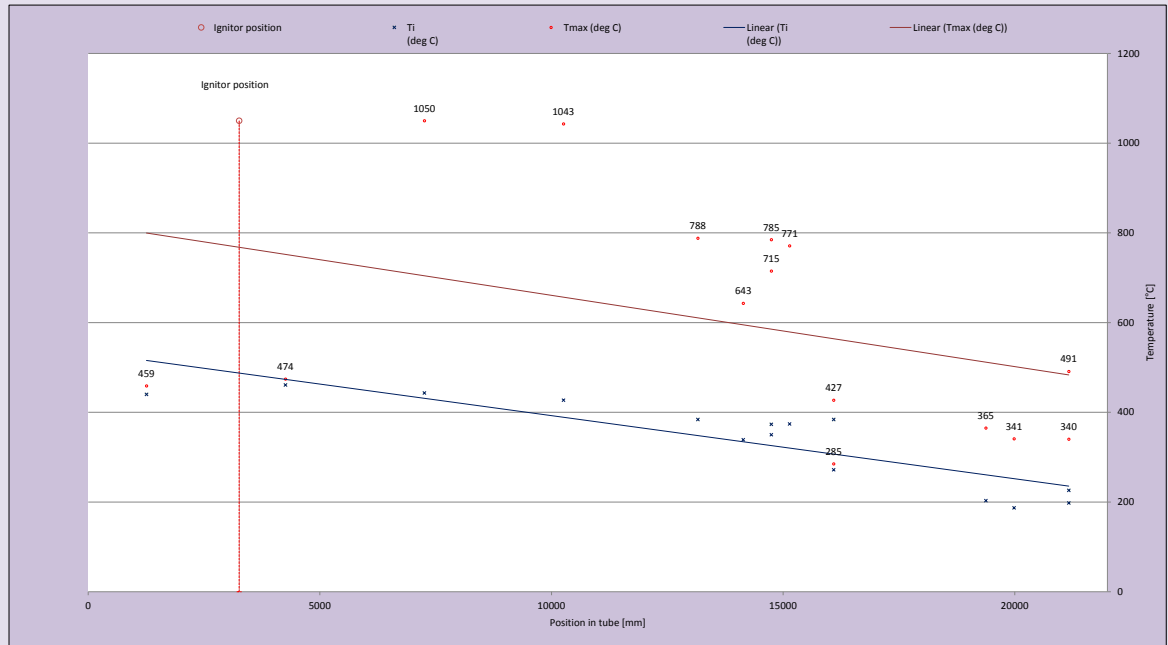


Location of igniter  mm      Time of ignition  seconds

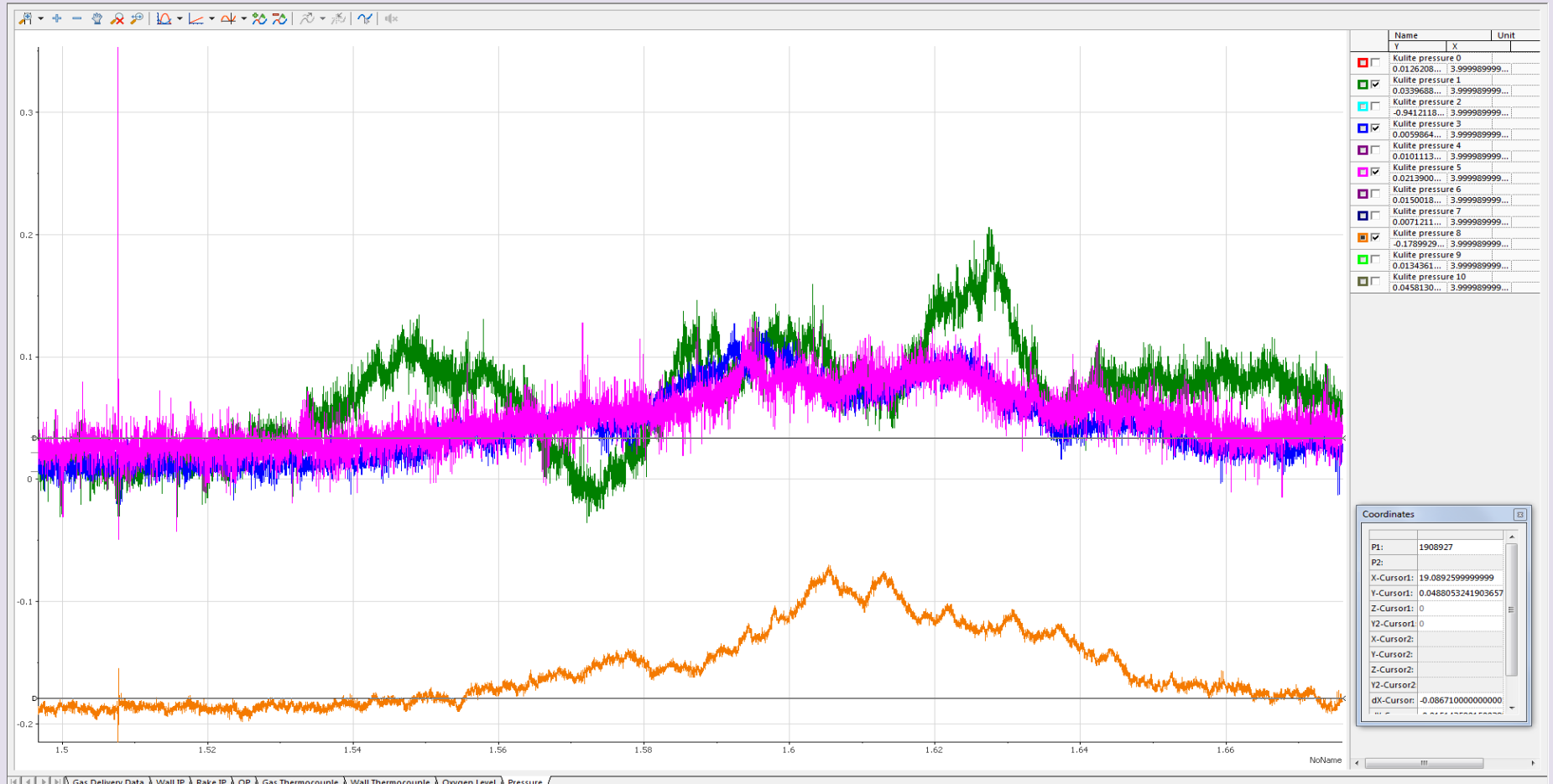
| Thermocouple number | Location | Position in tube (mm) | Flame arrival time (s) | Average flame speed (m/s) | T <sub>max</sub> (deg C) | T <sub>i</sub> (deg C) |
|---------------------|----------|-----------------------|------------------------|---------------------------|--------------------------|------------------------|
| TC0                 | CD1-R3   | 1258                  |                        |                           | 459                      | 440                    |
| TC2                 | CD2-R3   | 4258                  |                        |                           | 474                      | 461                    |
| TC4                 | CD3-R3   | 7258                  | 1.493                  |                           | 1050                     | 443                    |
| TC6                 | CD4-R3   | 10258                 | 1.501                  |                           | 1043                     | 427                    |
| TC8                 | HR1-R2   | 13160                 | 1.528                  | 107                       | 788                      | 384                    |
| TC16                | HR2-R3M  | 14140                 | 1.528                  | 144                       | 643                      | 339                    |
| TC17                | HR2-R5L  | 14745                 | 1.530                  |                           | 785                      | 373                    |
| TC18                | HR2-R5U  | 14745                 | 1.539                  | 163                       | 715                      | 350                    |
| TC19                | HR3-L1M  | 15140                 | 1.539                  |                           | 771                      | 374                    |
| TC20                | HE2-R1L  | 16090                 | 1.543                  | 103                       | 427                      | 384                    |
| TC21                | HE2-R1U  | 16090                 | 1.559                  | 67                        | 285                      | 272                    |
| TC22                | HR5-R4M  | 19375                 | 1.823                  | 28                        | 365                      | 203                    |
| TC23                | HR6-R1M  | 19985                 | 1.918                  | 15                        | 341                      | 187                    |
| TC24                | HR6-R5L  | 21165                 | 2.448                  | 6                         | 340                      | 198                    |
| TC25                | HR6-R5U  | 21165                 | 2.199                  | 8                         | 491                      | 226                    |

surface thermocouples [not plotted]

| TC  | Location | Position in tube (mm) | T <sub>max</sub> (deg C) | T <sub>i</sub> (deg C) |     |
|-----|----------|-----------------------|--------------------------|------------------------|-----|
| TC1 | CD1-T2   | 1508                  |                          | 219                    | 221 |
| TC3 | CD2-T2   | 4508                  |                          | 177                    | 183 |
| TC5 | CD3-T2   | 7508                  |                          | 77                     | 83  |
| TC7 | CD4-T2   | 10508                 |                          | 149                    | 152 |



# Pressure

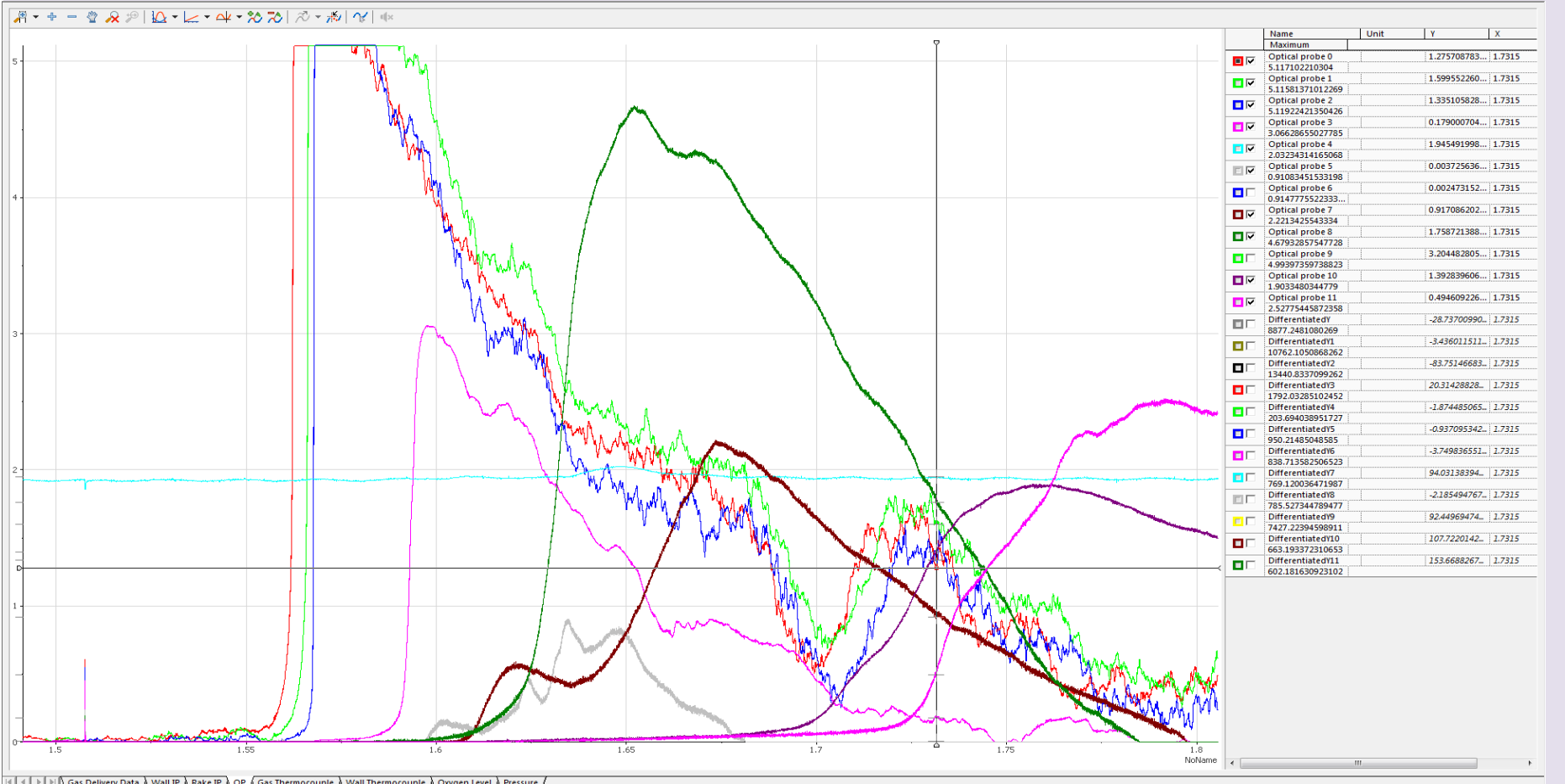


|                                     | Name                           | Unit |
|-------------------------------------|--------------------------------|------|
| <input type="checkbox"/>            | Kulite pressure 0              |      |
| <input type="checkbox"/>            | 0.0126208...   3.999989999...  |      |
| <input checked="" type="checkbox"/> | Kulite pressure 1              |      |
| <input type="checkbox"/>            | 0.0339668...   3.999989999...  |      |
| <input checked="" type="checkbox"/> | Kulite pressure 2              |      |
| <input type="checkbox"/>            | -0.9412118...   3.999989999... |      |
| <input checked="" type="checkbox"/> | Kulite pressure 3              |      |
| <input type="checkbox"/>            | 0.0059864...   3.999989999...  |      |
| <input type="checkbox"/>            | Kulite pressure 4              |      |
| <input type="checkbox"/>            | 0.0101113...   3.999989999...  |      |
| <input checked="" type="checkbox"/> | Kulite pressure 5              |      |
| <input type="checkbox"/>            | 0.0213900...   3.999989999...  |      |
| <input type="checkbox"/>            | Kulite pressure 6              |      |
| <input type="checkbox"/>            | 0.0150018...   3.999989999...  |      |
| <input type="checkbox"/>            | Kulite pressure 7              |      |
| <input checked="" type="checkbox"/> | Kulite pressure 8              |      |
| <input type="checkbox"/>            | -0.1789929...   3.999989999... |      |
| <input type="checkbox"/>            | Kulite pressure 9              |      |
| <input type="checkbox"/>            | 0.0134361...   3.999989999...  |      |
| <input type="checkbox"/>            | Kulite pressure 10             |      |
| <input type="checkbox"/>            | 0.0458130...   3.999989999...  |      |

| Coordinates |                    |
|-------------|--------------------|
| P1:         | 1908927            |
| P2:         |                    |
| X-Cursor1:  | 19.0892599999999   |
| Y-Cursor1:  | 0.0488053241903657 |
| Z-Cursor1:  | 0                  |
| Y2-Cursor1: | 0                  |
| X-Cursor2:  |                    |
| Y-Cursor2:  |                    |
| Z-Cursor2:  |                    |
| Y2-Cursor2: |                    |
| dX-Cursor:  | -0.086710000000000 |

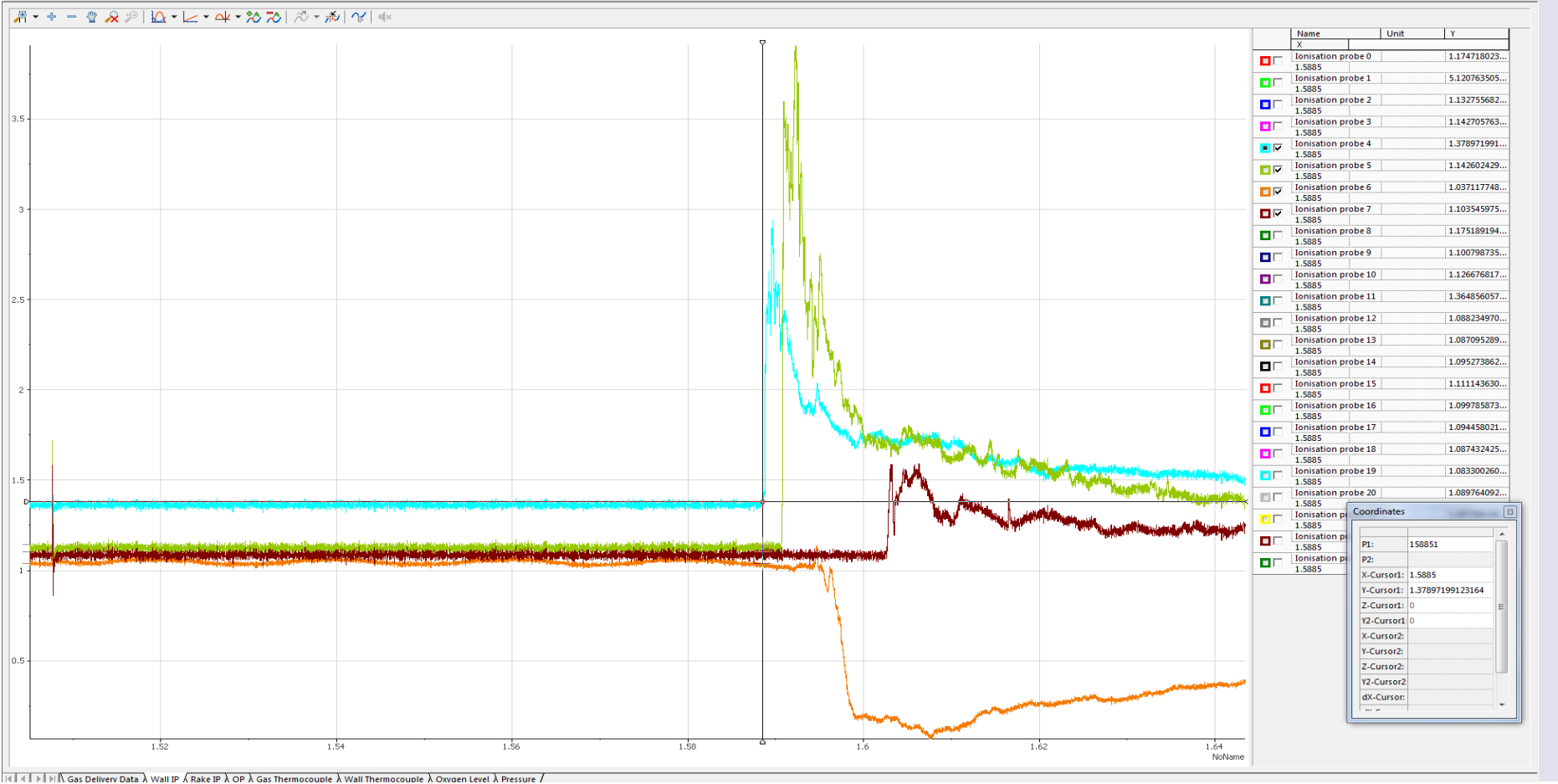


# Optical Probes

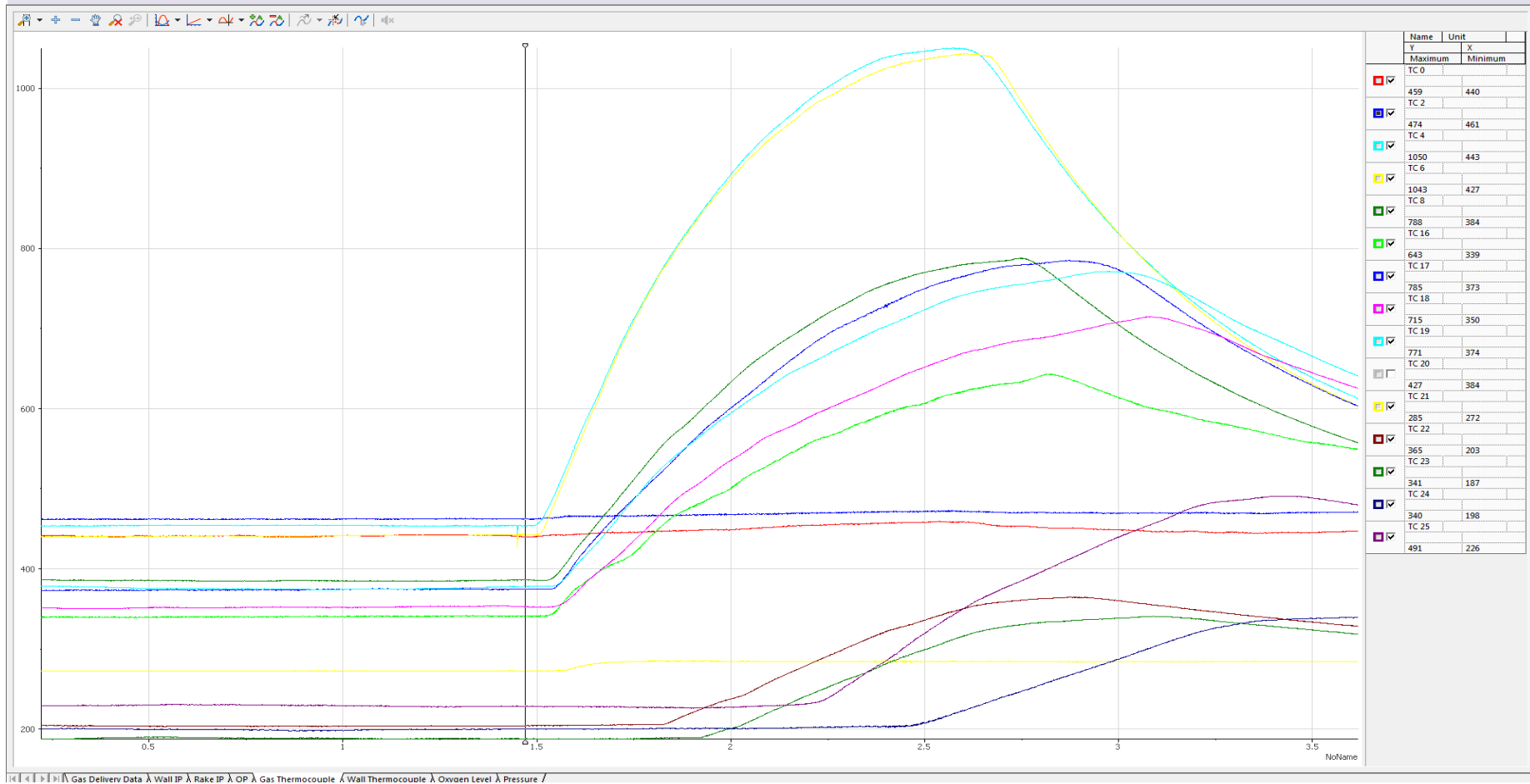


Gas Deliverv Data à Wall IP à Rake IP à OP / Gas Thermocouple à Wall Thermocouple à Oxvoen Level à Pressure /

# Ionisation Probes



# Temperature



| Sensor | OLD DESIGNATION | NEW DESIGNATION | Section | Section Number | Side | Horizontal Location | Vertical Location | PORT REF | SIZE      | "X"  | "Y"  | "Z"   |
|--------|-----------------|-----------------|---------|----------------|------|---------------------|-------------------|----------|-----------|------|------|-------|
| -      |                 | CD1-T1          | CD      | 1              | T    | 1                   |                   | 1        | 1" BSPP   | 0    | 298  | 258   |
| TC1    | TS1-1           | CD1-T2          | CD      | 1              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 1508  |
| -      |                 | CD1-B1          | CD      | 1              | B    | 1                   |                   | 2        | 1" BSPP   | 0    | -298 | 258   |
| -      | NS1-1           | CD1-R1          | CD      | 1              | R    | 1                   |                   | 3        | 3/4" BSPP | 298  | 0    | 258   |
| -      | FS1-1           | CD1-L1          | CD      | 1              | L    | 1                   |                   | 4        | 3/4" BSPP | -298 | 0    | 258   |
| -      | NS1-2           | CD1-R2          | CD      | 1              | R    | 2                   |                   | 5        | 3/4" BSPP | 298  | 0    | 758   |
| -      | FS1-2           | CD1-L2          | CD      | 1              | L    | 2                   |                   | 6        | 3/4" BSPP | -298 | 0    | 758   |
| TC0    | NS1-3           | CD1-R3          | CD      | 1              | R    | 3                   |                   | 7        | 3/4" BSPP | 298  | 0    | 1258  |
| -      | FS1-3           | CD1-L3          | CD      | 1              | L    | 3                   |                   | 8        | 3/4" BSPP | -298 | 0    | 1258  |
| -      | NS1-4           | CD1-R4          | CD      | 1              | R    | 4                   |                   | 9        | 3/4" BSPP | 298  | 0    | 1758  |
| -      | FS1-4           | CD1-L4          | CD      | 1              | L    | 4                   |                   | 10       | 3/4" BSPP | -298 | 0    | 1758  |
| -      | NS1-5           | CD1-R5          | CD      | 1              | R    | 5                   |                   | 11       | 3/4" BSPP | 298  | 0    | 2258  |
| -      | FS1-5           | CD1-L5          | CD      | 1              | L    | 5                   |                   | 12       | 3/4" BSPP | -298 | 0    | 2258  |
| -      | NS1-6           | CD1-R6          | CD      | 1              | R    | 6                   |                   | 13       | 3/4" BSPP | 298  | 0    | 2758  |
| -      | FS1-6           | CD1-L6          | CD      | 1              | L    | 6                   |                   | 14       | 3/4" BSPP | -298 | 0    | 2758  |
| IGN    |                 | CD2-T1          | CD      | 2              | T    | 1                   |                   | 15       | 1" BSPP   | 0    | 298  | 3258  |
| TC3    | TS2-1           | CD2-T2          | CD      | 2              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 4508  |
| -      |                 | CD2-B1          | CD      | 2              | B    | 1                   |                   | 16       | 1" BSPP   | 0    | -298 | 2358  |
| -      | NS2-1           | CD2-R1          | CD      | 2              | R    | 1                   |                   | 17       | 3/4" BSPP | 298  | 0    | 3258  |
| -      | FS2-1           | CD2-L1          | CD      | 2              | L    | 1                   |                   | 18       | 3/4" BSPP | -298 | 0    | 3258  |
| -      | NS2-2           | CD2-R2          | CD      | 2              | R    | 2                   |                   | 19       | 3/4" BSPP | 298  | 0    | 3758  |
| -      | FS2-2           | CD2-L2          | CD      | 2              | L    | 2                   |                   | 20       | 3/4" BSPP | -298 | 0    | 3758  |
| TC2    | NS2-3           | CD2-R3          | CD      | 2              | R    | 3                   |                   | 21       | 3/4" BSPP | 298  | 0    | 4258  |
| -      | FS2-3           | CD2-L3          | CD      | 2              | L    | 3                   |                   | 22       | 3/4" BSPP | -298 | 0    | 4258  |
| -      | NS2-4           | CD2-R4          | CD      | 2              | R    | 4                   |                   | 23       | 3/4" BSPP | 298  | 0    | 4758  |
| -      | FS2-4           | CD2-L4          | CD      | 2              | L    | 4                   |                   | 24       | 3/4" BSPP | -298 | 0    | 4758  |
| -      | NS2-5           | CD2-R5          | CD      | 2              | R    | 5                   |                   | 25       | 3/4" BSPP | 298  | 0    | 5258  |
| -      | FS2-5           | CD2-L5          | CD      | 2              | L    | 5                   |                   | 26       | 3/4" BSPP | -298 | 0    | 5258  |
| -      | NS2-6           | CD2-R6          | CD      | 2              | R    | 6                   |                   | 27       | 3/4" BSPP | 298  | 0    | 5758  |
| -      | FS2-6           | CD2-L6          | CD      | 3              | L    | 6                   |                   | 28       | 3/4" BSPP | -298 | 0    | 5758  |
| -      |                 | CD3-T1          | CD      | 3              | T    | 1                   |                   | 29       | 1" BSPP   | 0    | 298  | 6258  |
| TC5    | TS1-1           | CD3-T2          | CD      | 3              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 7508  |
| -      |                 | CD3-B1          | CD      | 3              | B    | 1                   |                   | 30       | 1" BSPP   | 0    | -298 | 6258  |
| -      | NS3-1           | CD3-R1          | CD      | 3              | R    | 1                   |                   | 31       | 3/4" BSPP | 298  | 0    | 6258  |
| -      | FS3-1           | CD3-L1          | CD      | 3              | L    | 1                   |                   | 32       | 3/4" BSPP | -298 | 0    | 6258  |
| -      | NS3-2           | CD3-R2          | CD      | 3              | R    | 2                   |                   | 33       | 3/4" BSPP | 298  | 0    | 6758  |
| -      | FS3-2           | CD3-L2          | CD      | 3              | L    | 2                   |                   | 34       | 3/4" BSPP | -298 | 0    | 6758  |
| TC4    | NS3-3           | CD3-R3          | CD      | 3              | R    | 3                   |                   | 35       | 3/4" BSPP | 298  | 0    | 7258  |
| -      | FS3-3           | CD3-L3          | CD      | 3              | L    | 3                   |                   | 36       | 3/4" BSPP | -298 | 0    | 7258  |
| -      | NS3-4           | CD3-R4          | CD      | 3              | R    | 4                   |                   | 37       | 3/4" BSPP | 298  | 0    | 7758  |
| -      | FS3-4           | CD3-L4          | CD      | 3              | L    | 4                   |                   | 38       | 3/4" BSPP | -298 | 0    | 7758  |
| KU0    | NS3-5           | CD3-R5          | CD      | 3              | R    | 5                   |                   | 39       | 3/4" BSPP | 298  | 0    | 8258  |
| -      | FS3-5           | CD3-L5          | CD      | 3              | L    | 5                   |                   | 40       | 3/4" BSPP | -298 | 0    | 8258  |
| -      | NS3-6           | CD3-R6          | CD      | 3              | R    | 6                   |                   | 41       | 3/4" BSPP | 298  | 0    | 8758  |
| -      | FS3-6           | CD3-L6          | CD      | 3              | L    | 6                   |                   | 42       | 3/4" BSPP | -298 | 0    | 8758  |
| -      |                 | CD4-T1          | CD      | 4              | T    | 1                   |                   | 43       | 1" BSPP   | 0    | 298  | 9258  |
| TC7    | TS1-1           | CD4-T2          | CD      | 4              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 10508 |
| -      |                 | CD4-B1          | CD      | 4              | B    | 1                   |                   | 44       | 1" BSPP   | 0    | -298 | 9258  |
| -      | NS4-1           | CD4-R1          | CD      | 4              | R    | 1                   |                   | 45       | 3/4" BSPP | 298  | 0    | 9258  |
| -      | FS4-1           | CD4-L1          | CD      | 4              | L    | 1                   |                   | 46       | 3/4" BSPP | -298 | 0    | 9258  |
| KU1    | NS4-2           | CD4-R2          | CD      | 4              | R    | 2                   |                   | 47       | 3/4" BSPP | 298  | 0    | 9758  |
| -      | FS4-2           | CD4-L2          | CD      | 4              | L    | 2                   |                   | 48       | 3/4" BSPP | -298 | 0    | 9758  |
| TC6    | NS4-3           | CD4-R3          | CD      | 4              | R    | 3                   |                   | 49       | 3/4" BSPP | 298  | 0    | 10258 |
| -      | FS4-3           | CD4-L3          | CD      | 4              | L    | 3                   |                   | 50       | 3/4" BSPP | -298 | 0    | 10258 |
| -      | NS4-4           | CD4-R4          | CD      | 4              | R    | 4                   |                   | 51       | 3/4" BSPP | 298  | 0    | 10758 |
| OPO    | FS4-4           | CD4-L4          | CD      | 4              | L    | 4                   |                   | 52       | 3/4" BSPP | -298 | 0    | 10758 |
| -      | NS4-5           | CD4-R5          | CD      | 4              | R    | 5                   |                   | 53       | 3/4" BSPP | 298  | 0    | 11258 |
| -      | FS4-5           | CD4-L5          | CD      | 4              | L    | 5                   |                   | 54       | 3/4" BSPP | -298 | 0    | 11258 |
| OP1    | NS4-6           | CD4-R6          | CD      | 4              | R    | 6                   |                   | 55       | 3/4" BSPP | 298  | 0    | 11758 |
| IPO    | FS4-6           | CD4-L6          | CD      | 4              | L    | 6                   |                   | 56       | 3/4" BSPP | -298 | 0    | 11758 |

| Sensor | OLD DESIGNATION | NEW DESIGNATION | Section | Section Number | Side | Horizontal Location | Vertical Location | PORT REF | SIZE           | "X"  | "Y"  | "Z"   |
|--------|-----------------|-----------------|---------|----------------|------|---------------------|-------------------|----------|----------------|------|------|-------|
| OP2    |                 | HR1-R1          | HR      | 1              | R    | 1                   |                   | 57       | 3/4" BSPP      | 308  | 0    | 12152 |
| -      |                 | HR1-L1          | HR      | 1              | L    | 1                   |                   | 58       | 3/4" BSPP      | -308 | 0    | 12152 |
| TC8    |                 | HR1-R2          | HR      | 1              | R    | 2                   |                   | 59       | 3/4" BSPP      | 393  | 0    | 13160 |
| -      |                 | HR1-L2          | HR      | 1              | L    | 2                   |                   | 60       | 3/4" BSPP      | -393 | 0    | 13160 |
| RA1    |                 | HR2-R2M         | HR      | 2              | R    | 2                   | M                 | 61       | 1 1/4" BSPP    | 448  | 70   | 13785 |
| RA1    |                 | HR2-L2M         | HR      | 2              | L    | 2                   | M                 | 62       | 1 1/4" BSPP    | -448 | 70   | 13785 |
| TC16   |                 | HR2-R3M         | HR      | 2              | R    | 3                   | M                 | 63       | 3/4" BSPP      | 528  | 410  | 14140 |
| -      |                 | HR2-L3M         | HR      | 2              | L    | 3                   | M                 | 64       | 3/4" BSPP      | -528 | 410  | 14140 |
| -      |                 | HR2-T3          | HR      | 2              | T    | 3                   |                   | 65       | 1" BSPP        | 0    | 1122 | 14215 |
| RA2    |                 | HR2-R4M         | HR      | 2              | R    | 4                   | M                 | 66       | 1 1/4" BSPP    | 598  | 700  | 14475 |
| RA2    |                 | HR2-L4M         | HR      | 2              | L    | 4                   | M                 | 67       | 1 1/4" BSPP    | -598 | 700  | 14475 |
| -      |                 | HR2-B5          | HR      | 2              | B    | 5                   |                   | 68       | 1" BSPP        | 0    | -100 | 14745 |
| KU2    |                 | HR2-T5          | HR      | 2              | T    | 5                   |                   | 69       | 1" BSPP        | 0    | 2315 | 14745 |
| TC17   |                 | HR2-R5L         | HR      | 2              | R    | 5                   | L                 | 70       | 3/4" BSPP      | 662  | 310  | 14745 |
| IP1    |                 | HR2-L5L         | HR      | 2              | L    | 5                   | L                 | 71       | 3/4" BSPP      | -662 | 310  | 14745 |
| OP3    |                 | HR2-R5M         | HR      | 2              | R    | 5                   | M                 | 72       | 3/4" BSPP      | 662  | 975  | 14745 |
| IP2    |                 | HR2-L5M         | HR      | 2              | L    | 5                   | M                 | 73       | 3/4" BSPP      | -662 | 975  | 14745 |
| TC18   |                 | HR2-R5U         | HR      | 2              | R    | 5                   | U                 | 74       | 3/4" BSPP      | 662  | 1660 | 14745 |
| IP3    |                 | HR2-L5U         | HR      | 2              | L    | 5                   | U                 | 75       | 3/4" BSPP      | -662 | 1660 | 14745 |
| KU3    |                 | HR3-L1L         | HR      | 3              | L    | 1                   | L                 | 76       | 3/4" BSPP      | -700 | 400  | 15140 |
| TC19   |                 | HR3-L1M         | HR      | 3              | L    | 1                   | M                 | 77       | 1 1/4" BSPP    | -700 | 1335 | 15140 |
| IP8    |                 | HR3-L1U         | HR      | 3              | L    | 1                   | U                 | 78       | 3/4" BSPP      | -700 | 2270 | 15140 |
| IP4    |                 | HR3-R1L         | HR      | 3              | R    | 1                   | L                 | 136      | 3/4" BSPP      | 700  | 400  | 15140 |
| IP5    |                 | HR3-R1LM        | HR      | 3              | R    | 1                   | LM                | 137      | 3/4" BSPP      | 700  | 868  | 15140 |
| IP6    |                 | HR3-R1M         | HR      | 3              | R    | 1                   | M                 | 138      | 3/4" BSPP      | 700  | 1335 | 15140 |
| -      |                 | HR3-R1UM        | HR      | 3              | R    | 1                   | UM                | 139      | 3/4" BSPP      | 700  | 1802 | 15140 |
| IP7    |                 | HR3-R1U         | HR      | 3              | R    | 1                   | U                 | 140      | 3/4" BSPP      | 700  | 2270 | 15140 |
| -      |                 | HE1-R1L         | HE      | 1              | R    | 1                   | L                 | 79       | 3/4" BSPP      | 700  | 400  | 15600 |
| -      |                 | HE1-R1M         | HE      | 1              | R    | 1                   | M                 | 80       | 3/4" BSPP      | 700  | 1335 | 15600 |
| KU4    |                 | HE1-R1U         | HE      | 1              | R    | 1                   | U                 | 81       | 3/4" BSPP      | 700  | 2270 | 15600 |
| TC20   |                 | HE2-R1L         | HE      | 2              | R    | 1                   | L                 | 83       | 3/4" BSPP      | 700  | 400  | 16090 |
| IP9    |                 | HE2-R1M         | HE      | 2              | R    | 1                   | M                 | 84       | 3/4" BSPP      | 700  | 1335 | 16090 |
| TC21   |                 | HE2-R1U         | HE      | 2              | R    | 1                   | U                 | 85       | 3/4" BSPP      | 700  | 2270 | 16090 |
| KU5    |                 | HE3-R1L         | HE      | 3              | R    | 1                   | L                 | 87       | 3/4" BSPP      | 700  | 400  | 16580 |
| -      |                 | HE3-R1M         | HE      | 3              | R    | 1                   | M                 | 88       | 3/4" BSPP      | 700  | 1335 | 16580 |
| -      |                 | HE3-R1U         | HE      | 3              | R    | 1                   | U                 | 89       | 3/4" BSPP      | 700  | 2270 | 16580 |
| OP4    |                 | HE1-T1          | HE      | 1              | T    | 1                   |                   | 82       | 3/4" BSPP HOLE | -47  | 2735 | 15600 |
| OP5    |                 | HE2-T1          | HE      | 2              | T    | 1                   |                   | 86       | 3/4" BSPP HOLE | 0    | 2735 | 16090 |
| OP6    |                 | HE3-T1          | HE      | 3              | T    | 1                   |                   | 90       | 3/4" BSPP HOLE | -47  | 2735 | 16580 |
| OP7    |                 | HR4-T1          | HR      | 4              | T    | 1                   |                   | 91       | 1" BSPP        | 0    | 2735 | 16985 |
| -      |                 | HR4-B1          | HR      | 4              | B    | 1                   |                   | 92       | 1" BSPP        | 0    | -65  | 16985 |
| KU6    |                 | HR4-R1L         | HR      | 4              | R    | 1                   | L                 | 93       | 3/4" BSPP      | 700  | 400  | 16985 |
| IP10   |                 | HR4-L1L         | HR      | 4              | L    | 1                   | L                 | 94       | 3/4" BSPP      | -700 | 400  | 16985 |
| OP8    |                 | HR4-R1M         | HR      | 4              | R    | 1                   | M                 | 95       | 3/4" BSPP      | 700  | 1335 | 16985 |
| IP11   |                 | HR4-L1M         | HR      | 4              | L    | 1                   | M                 | 96       | 3/4" BSPP      | -700 | 1335 | 16985 |
| IP13   |                 | HR4-R1U         | HR      | 4              | R    | 1                   | U                 | 97       | 3/4" BSPP      | 700  | 2270 | 16985 |
| IP12   |                 | HR4-L1U         | HR      | 4              | L    | 1                   | U                 | 98       | 3/4" BSPP      | -700 | 2270 | 16985 |
| RA3    |                 | HR4-R3M         | HR      | 4              | R    | 3                   | M                 | 99       | 1 1/4" BSPP    | 700  | 1335 | 17575 |
| RA3    |                 | HR4-L3M         | HR      | 4              | L    | 3                   | M                 | 100      | 1 1/4" BSPP    | -700 | 1335 | 17575 |
| RA4    |                 | HR4-R3L         | HR      | 4              | R    | 3                   | L                 | 141      | 1 1/4" BSPP    | 700  | 400  | 17575 |
| IP14   |                 | HR4-R3U         | HR      | 4              | R    | 3                   | U                 | 142      | 3/4" BSPP      | 700  | 2270 | 17575 |
| RA4    |                 | HR4-L3L         | HR      | 4              | L    | 3                   | L                 | 143      | 1 1/4" BSPP    | -700 | 400  | 17575 |
| -      |                 | HR4-L3U         | HR      | 4              | L    | 3                   | U                 | 144      | 3/4" BSPP      | -700 | 2270 | 17575 |
| IP18   |                 | HR4-R5M         | HR      | 4              | R    | 5                   | M                 | 101      | 3/4" BSPP      | 700  | 1335 | 18165 |
| IP16   |                 | HR4-L5M         | HR      | 4              | L    | 5                   | M                 | 102      | 3/4" BSPP      | -700 | 1335 | 18165 |
| OP9    |                 | HR4-R5L         | HR      | 4              | R    | 5                   | L                 | 145      | 3/4" BSPP      | 700  | 400  | 18165 |
| KU7    |                 | HR4-R5U         | HR      | 4              | R    | 5                   | U                 | 146      | 3/4" BSPP      | 700  | 2270 | 18165 |
| IP15   |                 | HR4-L5L         | HR      | 4              | L    | 5                   | L                 | 147      | 3/4" BSPP      | -700 | 400  | 18165 |
| IP17   |                 | HR4-L5U         | HR      | 4              | L    | 5                   | U                 | 148      | 3/4" BSPP      | -700 | 2270 | 18165 |
| -      |                 | HR5-R1M         | HR      | 5              | R    | 1                   | M                 | NA       | SURFACE        | 700  | 1200 | 18455 |

| Sensor | OLD DESIGNATION | NEW DESIGNATION | Section | Section Number | Side | Horizontal Location | Vertical Location | PORT REF | SIZE        | "X"  | "Y"  | "Z"   |
|--------|-----------------|-----------------|---------|----------------|------|---------------------|-------------------|----------|-------------|------|------|-------|
| OP10   |                 | HR5-T2          | HR      | 5              | T    | 2                   |                   | 103      | 1" BSPP     | 0    | 2735 | 18775 |
| -      |                 | HR5-B2          | HR      | 5              | B    | 2                   |                   | 104      | 1" BSPP     | 0    | -65  | 18775 |
| KU8    |                 | HR5-R2L         | HR      | 5              | R    | 2                   | L                 | 105      | 3/4" BSPP   | 700  | 400  | 18775 |
| IP19   |                 | HR5-L2L         | HR      | 5              | L    | 2                   | L                 | 106      | 3/4" BSPP   | -700 | 400  | 18775 |
| OP11   |                 | HR5-R2M         | HR      | 5              | R    | 2                   | M                 | 107      | 3/4" BSPP   | 700  | 1335 | 18775 |
| IP20   |                 | HR5-L2M         | HR      | 5              | L    | 2                   | M                 | 108      | 3/4" BSPP   | -700 | 1335 | 18775 |
| IP22   |                 | HR5-R2U         | HR      | 5              | R    | 2                   | U                 | 109      | 3/4" BSPP   | 700  | 2270 | 18775 |
| IP21   |                 | HR5-L2U         | HR      | 5              | L    | 2                   | U                 | 110      | 3/4" BSPP   | -700 | 2270 | 18775 |
| TC22   |                 | HR5-R4M         | HR      | 5              | R    | 4                   | M                 | 111      | 1 1/4" BSPP | 700  | 1335 | 19375 |
| -      |                 | HR5-L4M         | HR      | 5              | L    | 4                   | M                 | 112      | 1 1/4" BSPP | -700 | 1335 | 19375 |
| TC23   |                 | HR6-R1M         | HR      | 6              | R    | 1                   | M                 | 113      | 3/4" BSPP   | 700  | 1335 | 19985 |
| IP23   |                 | HR6-L1M         | HR      | 6              | L    | 1                   | M                 | 114      | 3/4" BSPP   | -700 | 1335 | 19985 |
| -      |                 | HR6-T3          | HR      | 6              | T    | 3                   |                   | 115      | 1" BSPP     | 0    | 2735 | 20575 |
| -      |                 | HR6-B3          | HR      | 6              | B    | 3                   |                   | 116      | 3/4" BSPP   | 0    | -65  | 20575 |
| KU9    |                 | HR6-R3L         | HR      | 6              | R    | 3                   | L                 | 117      | 3/4" BSPP   | 700  | 400  | 20575 |
| -      |                 | HR6-L3L         | HR      | 6              | L    | 3                   | L                 | 118      | 3/4" BSPP   | -700 | 400  | 20575 |
| -      |                 | HR6-R3M         | HR      | 6              | R    | 3                   | M                 | 119      | 1 1/4" BSPP | 700  | 1335 | 20575 |
| -      |                 | HR6-L3M         | HR      | 6              | L    | 3                   | M                 | 120      | 1 1/4" BSPP | -700 | 1335 | 20575 |
| -      |                 | HR6-R3U         | HR      | 6              | R    | 3                   | U                 | 121      | 3/4" BSPP   | 700  | 2270 | 20575 |
| -      |                 | HR6-L3U         | HR      | 6              | L    | 3                   | U                 | 122      | 3/4" BSPP   | -700 | 2270 | 20575 |
| -      |                 | HR6-B5          | HR      | 6              | B    | 5                   |                   | 123      | 1" BSPP     | 0    | -65  | 21165 |
| TC24   |                 | HR6-R5L         | HR      | 6              | R    | 5                   | L                 | 124      | 3/4" BSPP   | 700  | 400  | 21165 |
| KU10   |                 | HR6-L5L         | HR      | 6              | L    | 5                   | L                 | 125      | 3/4" BSPP   | -700 | 400  | 21165 |
| -      |                 | HR6-R5M         | HR      | 6              | R    | 5                   | M                 | 126      | 3/4" BSPP   | 700  | 1335 | 21165 |
| -      |                 | HR6-L5M         | HR      | 6              | L    | 5                   | M                 | 127      | 3/4" BSPP   | -700 | 1335 | 21165 |
| TC25   |                 | HR6-R5U         | HR      | 6              | R    | 5                   | U                 | 128      | 3/4" BSPP   | 700  | 2270 | 21165 |
| -      |                 | HR6-L5U         | HR      | 6              | L    | 5                   | U                 | 129      | 3/4" BSPP   | -700 | 2270 | 21165 |
| -      |                 | EP-1L           | EP      |                |      | 1                   | L                 | 130      | 1" BSPP     | 650  | -15  | 21330 |
| -      |                 | EP-2L           | EP      |                |      | 2                   | L                 | 131      | 1" BSPP     | 0    | -15  | 21330 |
| -      |                 | EP-3L           | EP      |                |      | 3                   | L                 | 132      | 1" BSPP     | -650 | -15  | 21330 |
| -      |                 | EP-1M           | EP      |                |      | 1                   | M                 | 133      | 1" BSPP     | 250  | 1335 | 21330 |
| -      |                 | EP-2M           | EP      |                |      | 2                   | M                 | 134      | 1" BSPP     | -250 | 1335 | 21330 |
| -      |                 | EP-1U           | EP      |                |      | 1                   | U                 | 135      | 3/4" BSPP   | 0    | 2270 | 21330 |

