

# Diesel Particulate Filters' Feasibility Study Report

Report's Period:

2015/11/01 - 2015/11/30

Tehran - Iran



شرکت کنترل کیفیت هوا  
وابسته به شهرداری تهران



معاونت حمل و  
نقل و ترافیک  
شهرداری تهران  
دفتر محیط زیست



هسته پژوهشی سوخت،  
احتراق و آلودگی



## Abstract

Iran's big cities air pollution is one of the major challenges to authorities in view of public health. Tehran City, with about 12 Million resident, has been facing more and more air quality problems over the last decade. The criteria pollutants in Tehran are PM<sub>2.5</sub>, PM<sub>10</sub> and NO<sub>2</sub>. Particulates and especially ultrafine particles have been identified as the most toxic component of the polluting mixture. Considering diesel engine operation concepts, these types of engines are one of the main source emission of ultrafine particles in urban areas. So controlling particulates emitted from these sources, is one of the first steps to improve air quality. Diesel Particulate Filters (DPFs) are well-known and effective way to reduce particles number and mass. Lately, the Iranian government decided to legislate DPF installation for High Duty diesel Vehicles (HDV). Both, national and international engine industries and experts are now challenged to comply according to the new upcoming standards.

Tehran city bus Company with more than 3500 diesel engine buses is one of the organization that can play important role in improving air quality. In January 2014, the City Council of Tehran decided to order the retrofit of the public bus fleet of the capital. So DPFs' feasibility study project is organized by Tehran Air Quality Control Company (AQCC). The project consists of two phases. Phase 1 is particle filter tests on engine lab was provided in Tabriz for approval of DPFs in Iran. During this phase different types of DPFs from various companies were tested according to VTF1<sup>1</sup> test procedure, by FCE<sup>2</sup> under supervision of VERT association. Table 1 gives some information about phase 1.

Table 1. Phase 1 test procedures

Test Process	Evaluated data	Measurements devices
Engine baseline test – 4PTS <sup>3</sup>	<ul style="list-style-type: none"> <li>Exhaust Gas mixture.</li> <li>emitted PM, PN during test points</li> <li>Temperature and pressure analysis before and after DPF</li> </ul>	<ul style="list-style-type: none"> <li>MRU (Gas Analyzer)</li> <li>NM3 (Particle counter)</li> <li>AVL sampling unit (particle mass collector)</li> <li>Pressure and Temperature sensors</li> </ul>
Engine Equipped with DPF		
Regeneration test		
PM and PN efficiency test		

<sup>1</sup> . VERT filtration test

<sup>2</sup> . Fuel ,Combustion and Emissions group

<sup>3</sup> . Stationary 4-points-test cycle

After analyzing phase 1 results, approved DPFs were sent to Tehran, for fieldwork tests. 18 BRT<sup>4</sup> from different lines with various working paths, were selected and equipped with data logger by ASA<sup>5</sup> Company. By the time, 8 DPFs were installed on these samples and their data have been collected and analyzed from installation date. Analyzed data were published as monthly reports, including separated reports for first and second half of the months, and specified DPFs' operation status. Table 2 shows summary information about installed DPFs until 31/Oct/2015.

Table 2. Installed DPFs

DPF Producer Company	Operation Report			Maintenance and Cleaning History
	Installation date	Working days	Bus mileage	
<b>HJS_01</b> (Passive system with FBC) V. ID: 78514 (line 4)	10/Sep/2014	446 days	70679 km	DPF core was cleaned on Jun 13th after about 36000 km for the first time.
<b>Dinex_01</b> (Passive system with FBC) V. ID: 78515 (line 4)	22/Oct/2014	405 days	49616 km	Filter core was changed on Feb 15th after 13253 km working. (High K-value and low additive dosage were reasons of the early cleaning.)
<b>PURltech</b> (Passive system with FBC) V. ID: 78524 (line 4)	28/Jan/2015	307 days	43765 km	DPF core was cleaned on Aug 12th after about 26500 km, for the first time. Considering system high backpressure, filter isolation defect, DPF core was removed on Sep 16 <sup>th</sup> and installed on Nov 17 <sup>th</sup> . The third cleaning was unavoidable after only 6 days working and was done on 29 <sup>th</sup> Nov. System worked for two days and DPF was replaced by muffler on Nov 30 th .

<sup>4</sup> . Bus rapid transient

<sup>5</sup> . Azmoon Sanat Arvin

<p><b>HJS_02</b> (Active system with FBC - Electrical Heater) V.ID: 85423 (line 4)</p>	19/Feb/2015	285 days	47931 km	DPF has been working from installation date until now without any cleaning.
<p><b>HJS_03</b> (Active system with FBC - Electrical Heater) V.ID: 33572 (line 2)</p>	19/Feb/2015	285 days	38979 km	DPF core was cleaned on Oct 5th after about 30801 km, for the first time.
<p><b>HJS_04</b> (Passive system with FBC) V.ID:85476 (line 10)</p>	23/Feb/2015	281 days	42066 km	DPF was cleaned on Jul 22nd after 23644 km for the first time.
<p><b>Dinex_02</b> (Passive system with FBC) V.ID: 33637 (line 2)</p>	02/Jun/2015	This system works with DPF only for 21 days.	-	DPF had been removed after two weeks working on Jun 17th. After receiving cleaning machine, DPF was cleaned on Aug 10th and installed on Aug 22nd but worked only for ten days. The last cleaning was done on Sep 24th but cleaning issue was unavoidable after only three days working. Finally DPF was replaced by muffler on Sep 8th and system has been working from that date without DPF.
<p><b>Tehag_01</b> (Catalyzed DPF) V.ID: 85182 (line 2)</p>	24/Sep/2015	49 days	5132 km	DPF has been working from installation date until now without any cleaning.

Table 3 represents DPFs' operation status during November. DPFs detailed information could be found in the next section.

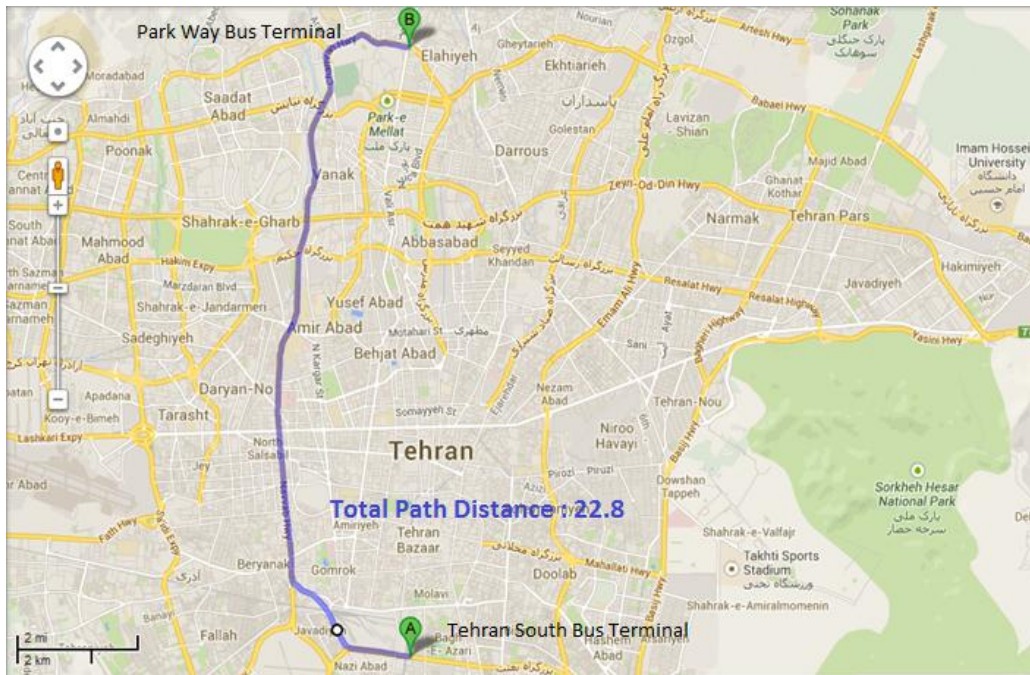
Table 3. DPFs' operation status during Oct

Vehicle ID	DPF Producer Company	Operation Status	
		Nov/01/2015 - Nov/15/2015	Nov/16/2015 - Nov/30/2015
78514 (line 4)	HJS_01	1	1
85423 (line 4)	HJS_02	1	1
78515 (line 4)	Dinex_01	6	6
78524 (line 4)	PURItch	5	3
33572 (line 2)	HJS_03	1	1
33637 (line 2)	Dinex_02	5	5
85476 (line 10)	HJS_04	1 or 2*	1 or 2
85182 (line 10)	Tehag_01	1	1

- Exact DPF evaluation was not possible due to pressure sensor problem.

Status Number	Operation Status	Description
1	Excellent	Pressure above 200 mbar < 0.1% ( $P_{200} \sim 0$ )
2	Good	$0.1\% \leq P_{200} \leq 3\%$
3	Maintenance required	$P_{200} > 3\%$ or DPF system blocking
4	Failed	DPF defect, black smoke, holes in the filter element
5	NO DPF	DPF was removed for cleaning or other issues
6	Bus was stationary	Bus related problems

Vehicle plate number	78514
Bus line	Number 4 (south to north bus line)
DPF producer company	HJS_01 (Passive system with FBC)



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## Overall Information

*Table1- Overall Information*

Vehicle plate number	78514
CPK data logger number	LN: 001496, DN: 1914, Sim +989218355923
Bus line	Number 4 (south to north bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	HJS_01 (Passive system with FBC)
Installation date	10/Sep/2014
Report period	01/Nov/2015 – 15/Nov/2015 (fifteen days)
K value - DPF upstream	1.80 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF core was cleaned on Jun 13 <sup>th</sup> .
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	67756 km
Bus mileage over the period	2436 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	157 hours56 minutes
Average working hours per day (including stop days)	10 hours31 minutes
Bus average speed	15.42 km/hr
idle speed time to all working time ration	52.62 %
Total Bus fuel consumption over the period	1291 lit
Fuel consumption per hour	8.17 lit/hr
Average fuel consumption	0.53 lit/km
Total Bus additive consumption over the period	0.55 lit
Average additive consumption	226 cc/km
Additive consumption to fuel ration	426 cc/1000lit



## Temperature, Pressure and Engine Speed Overview

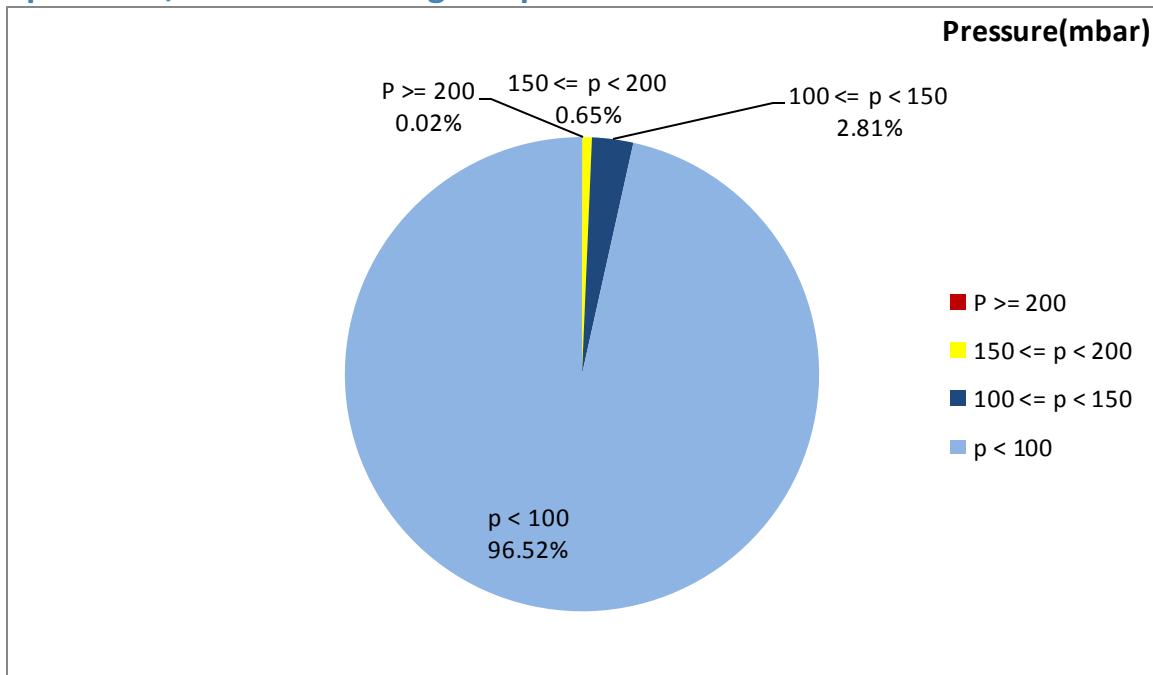


Figure 1- Pressure distribution over the working hours

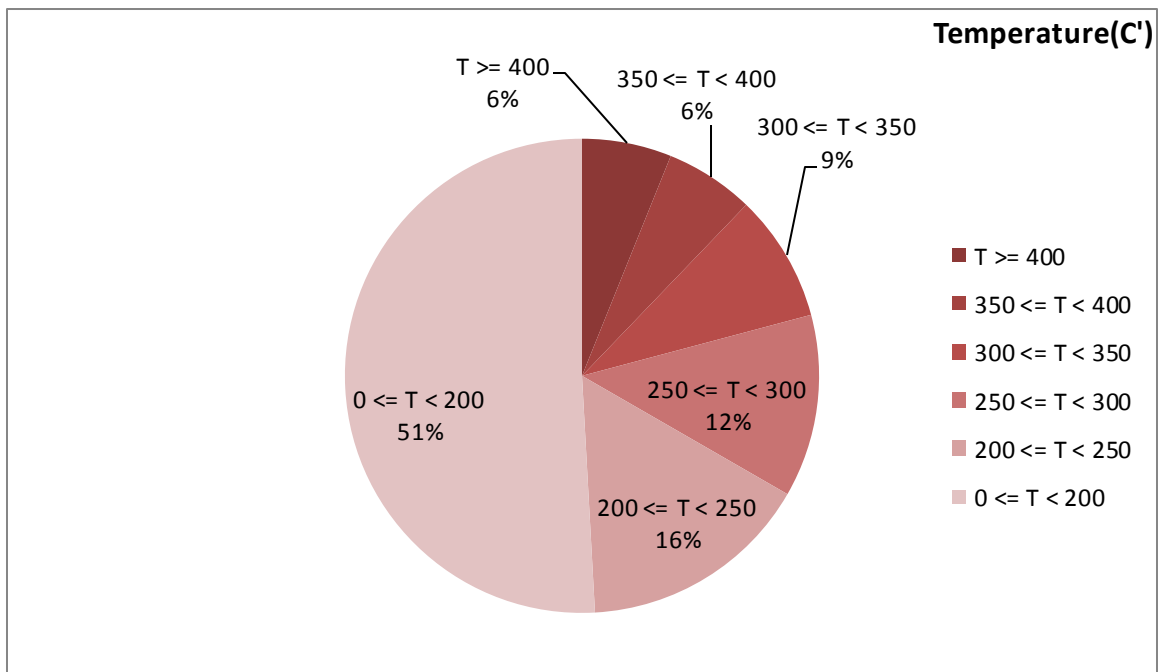


Figure 2-Temperature distribution over the working hours

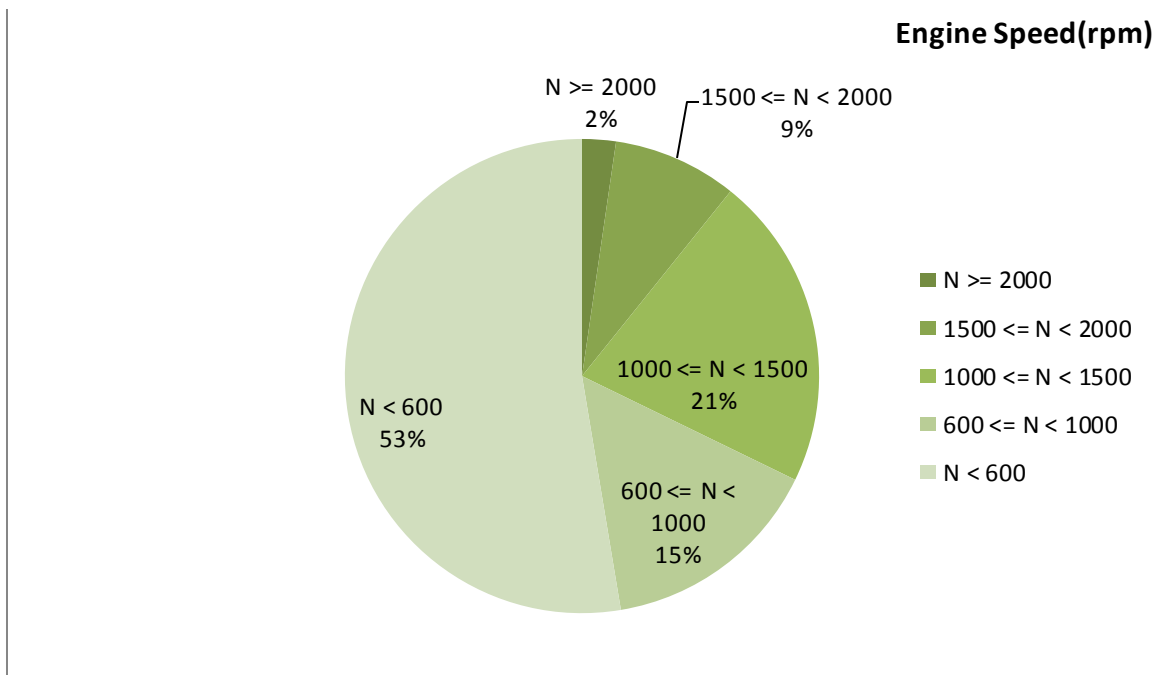


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
224.68	22.81	862

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
276.27	39.72	1213

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
506-50	204-0	2624-384

## Detailed Pressure Analysis

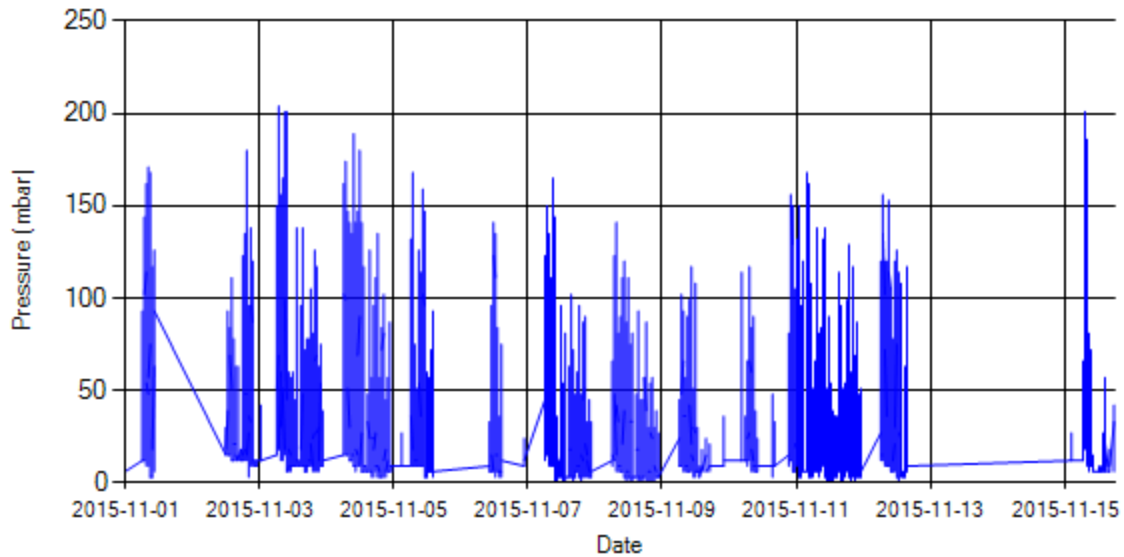


Figure 4- Pressure distribution over the period

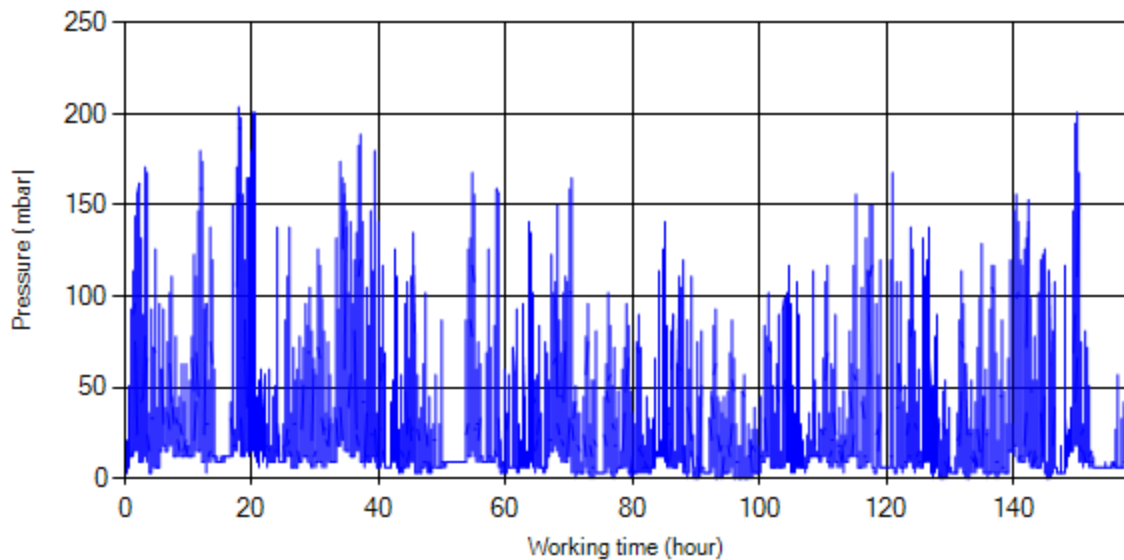


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

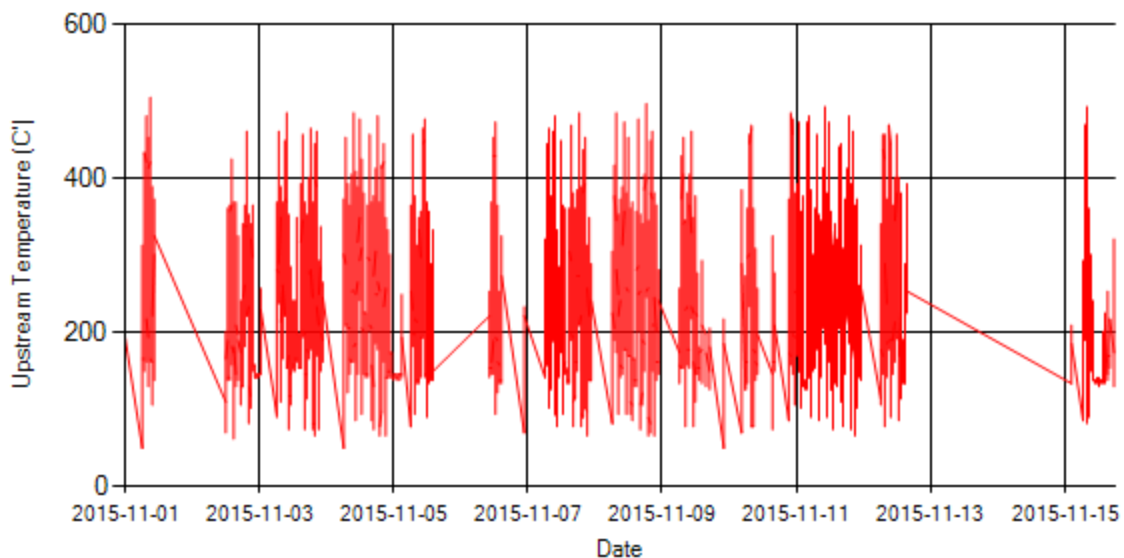


Figure 6- Temperature distribution over the period

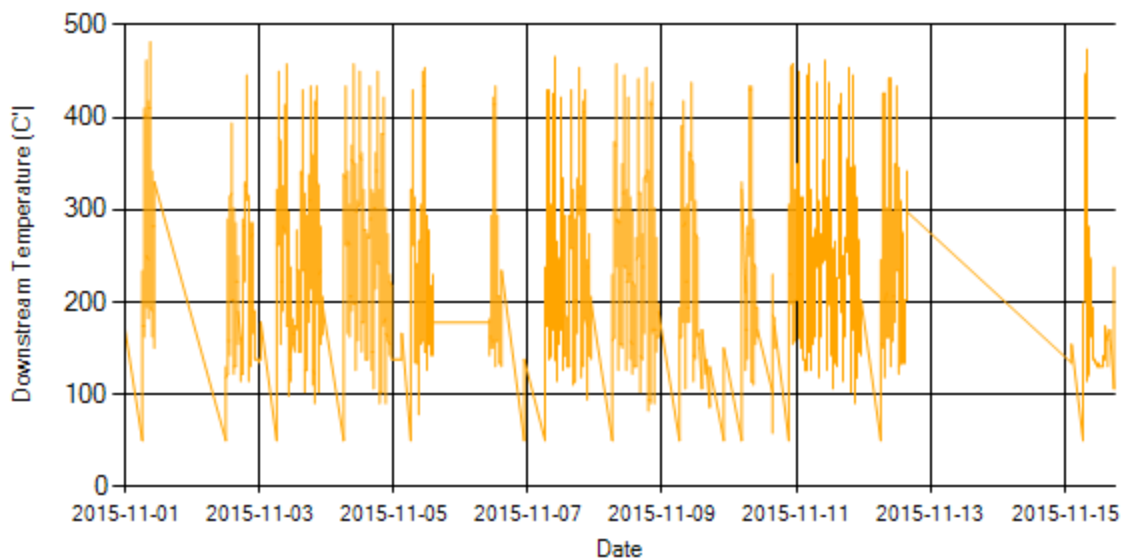
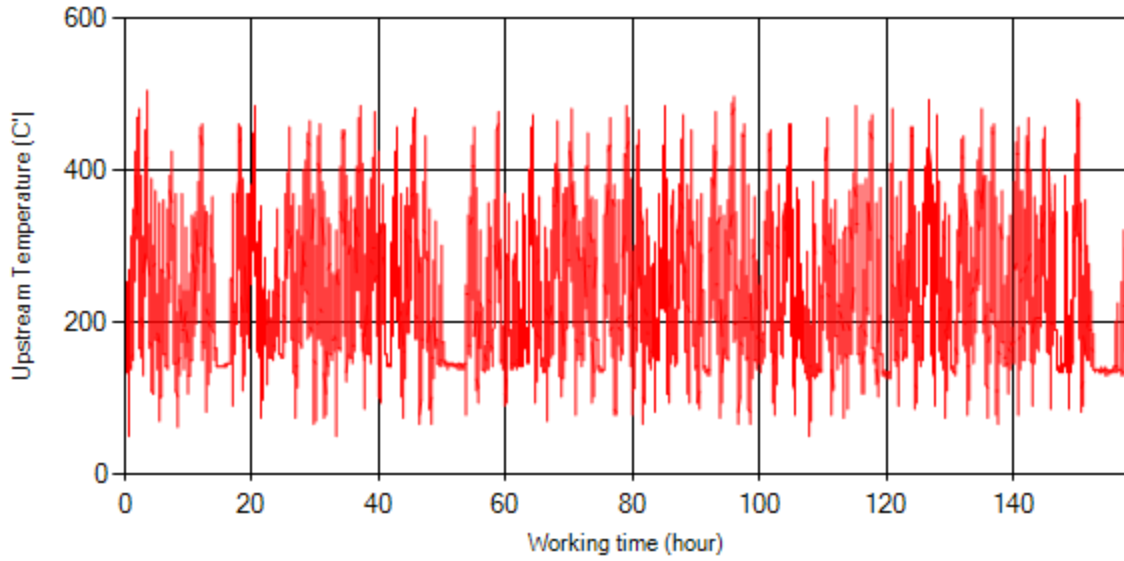
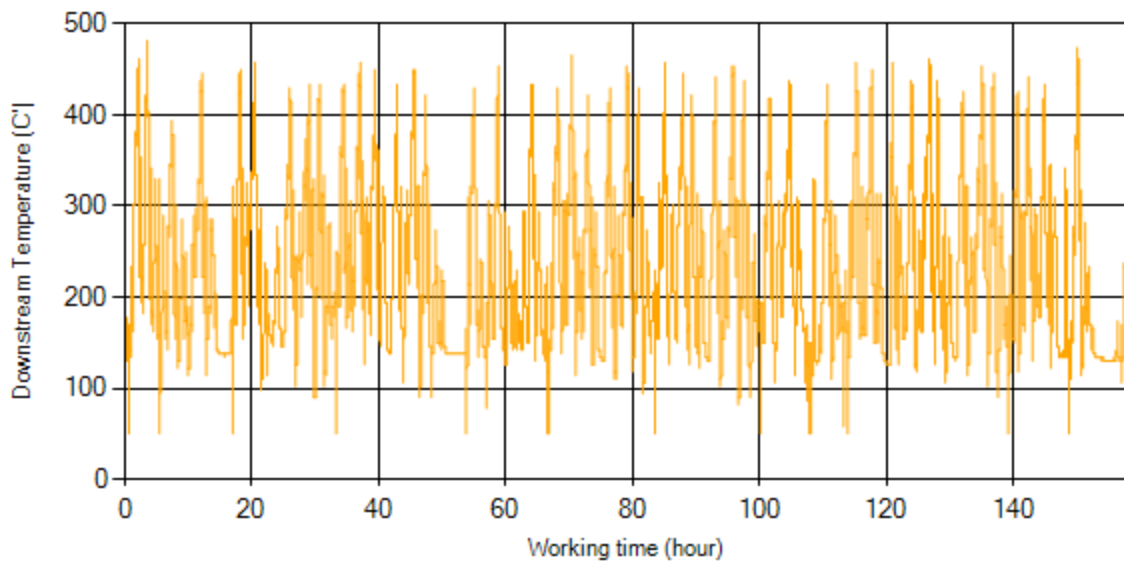


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

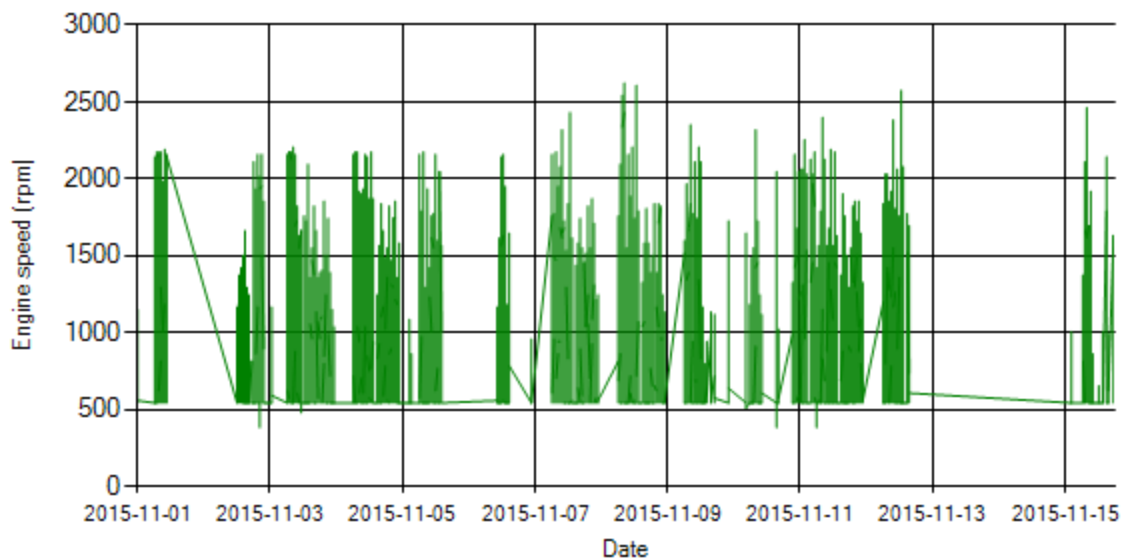


Figure 10- Engine speed distribution over the period

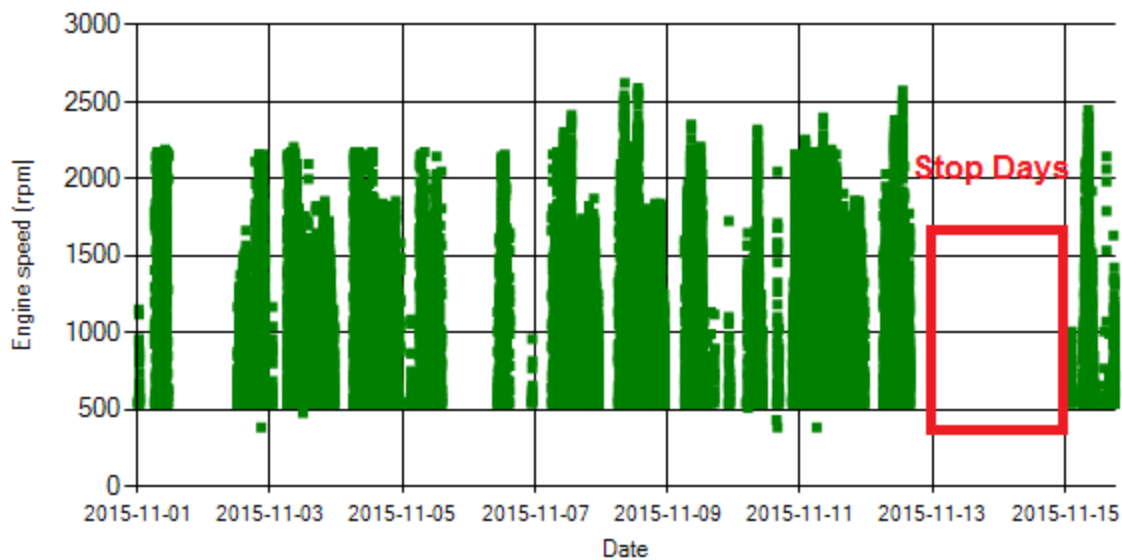


Figure 11- Engine speed diagram for calculating CPK's working days

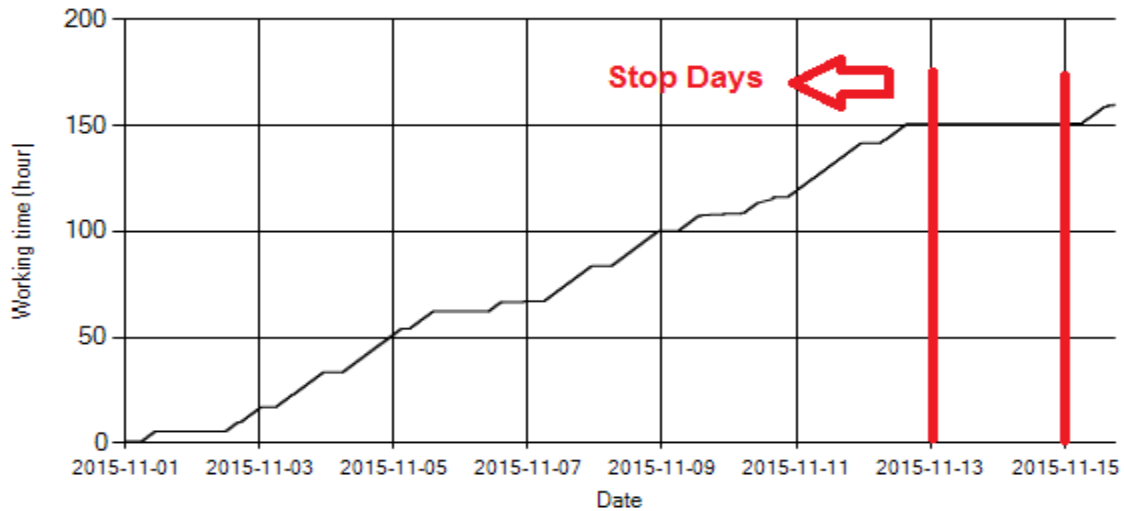


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12, bus was stationary on Nov 13<sup>th</sup> and 14<sup>th</sup>.

### Pressure-Engine Speed diagrams

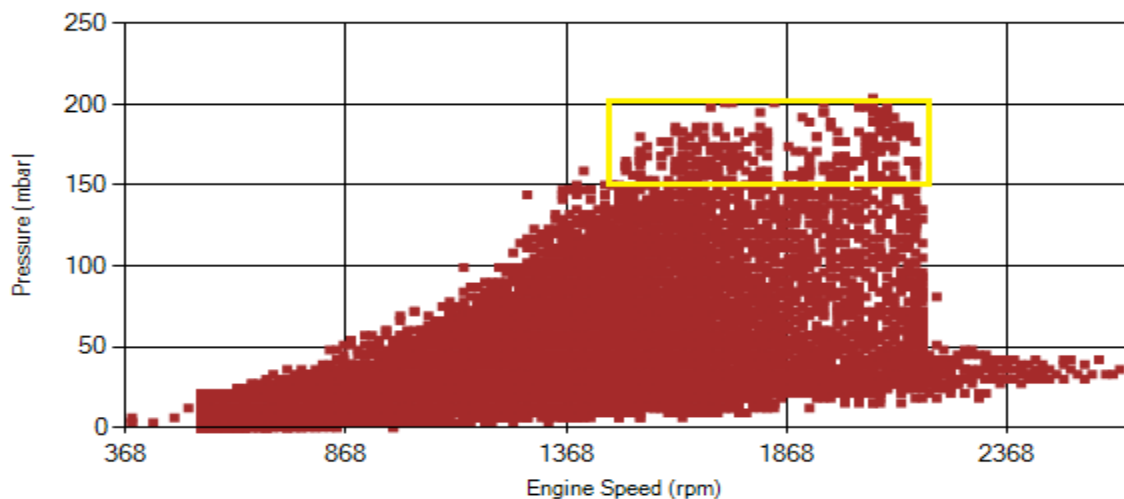


Figure 13- Pressure against engine speed

Notice: Red alarm (pressure > 200 mbar) and yellow alarm (200 > pressure > 150) ranges were indicated in figure 13.

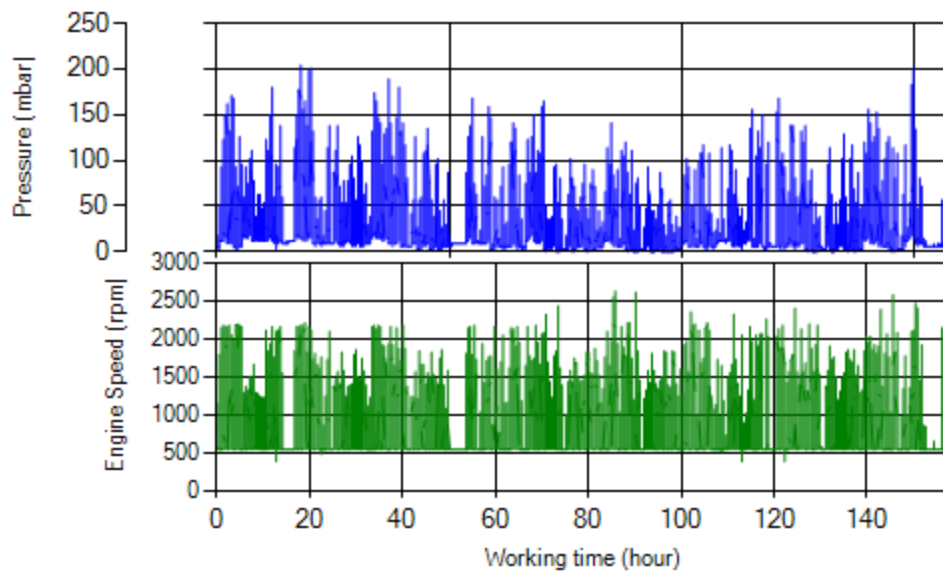


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

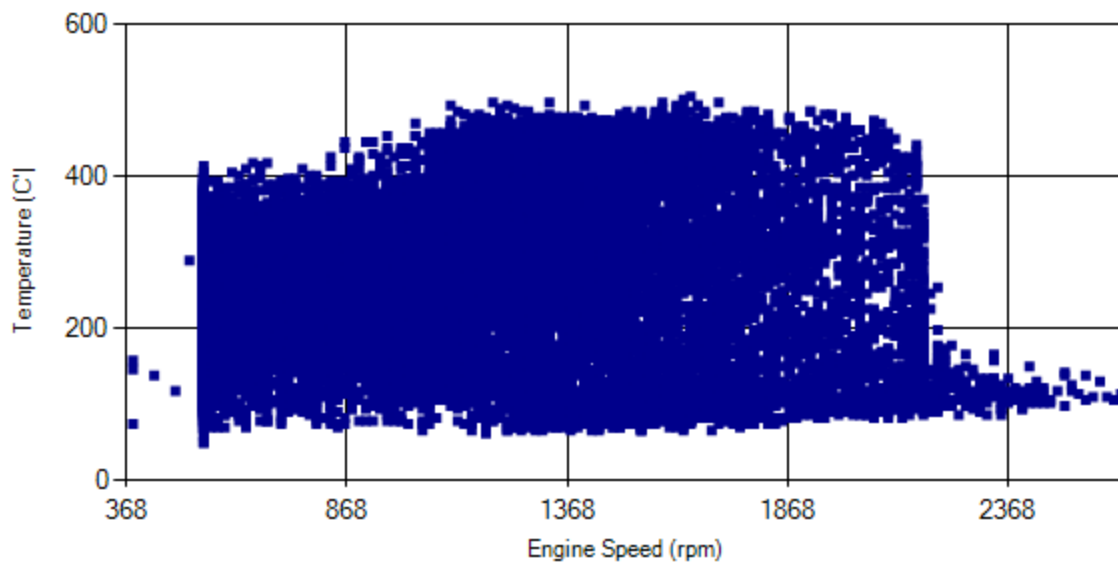


Figure 15- Temperature against engine speed



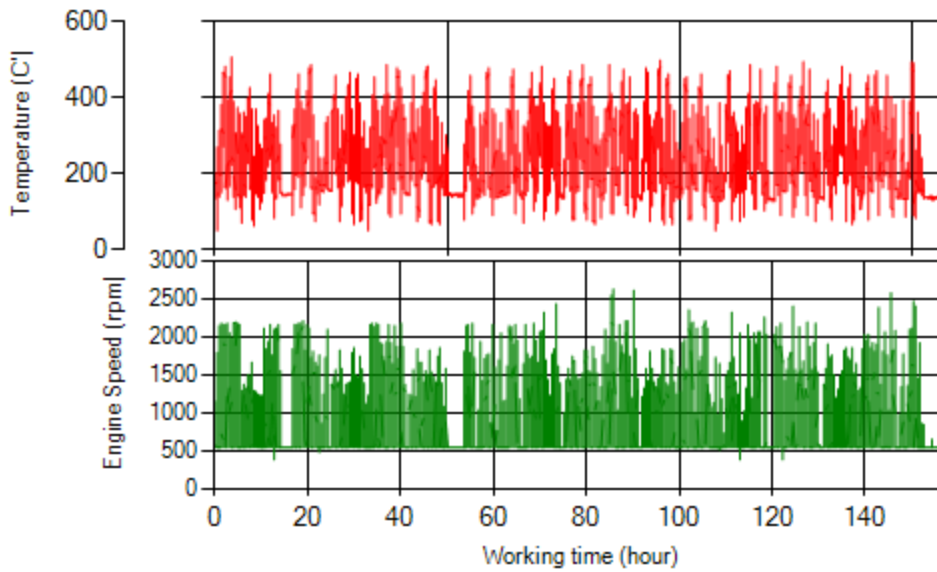


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in Figure 1, 0.02% of total working time pressure is above 200 mbar and 0.67% above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 6% of total working time temperature is above 400 °C and 12% above 350°C. This high temperature distribution is one of the important factors for filter excellent operation during the period.

Filter operation status	Excellent <input checked="" type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input type="checkbox"/>	Failed <input type="checkbox"/>

## Overall Information

*Table1- Overall Information*

Vehicle plate number	78514
CPK data logger number	LN: 001496, DN: 1914, Sim +989218355923
Bus line	Number 4 (south to north bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	HJS_01 (Passive system with FBC)
Installation date	10/Sep/2014
Report period	16/Nov/2015 – 30/Nov/2015 (fifteen days)
K value - DPF upstream	1.80 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF core was cleaned on Jun 13 <sup>th</sup> .
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	70679 km
Bus mileage over the period	2923 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	179 hours 56 minutes
Average working hours per day (including stop days)	11 hours 60 minutes
Bus average speed	16.24 km/hr
idle speed time to all working time ration	51.77 %
Total Bus fuel consumption over the period	1600 lit
Fuel consumption per hour	8.89 lit/hr
Average fuel consumption	0.55 lit/km
Total Bus additive consumption over the period	0.7 lit
Average additive consumption	239 cc/km
Additive consumption to fuel ration	438 cc/1000lit

## Temperature, Pressure and Engine Speed Overview

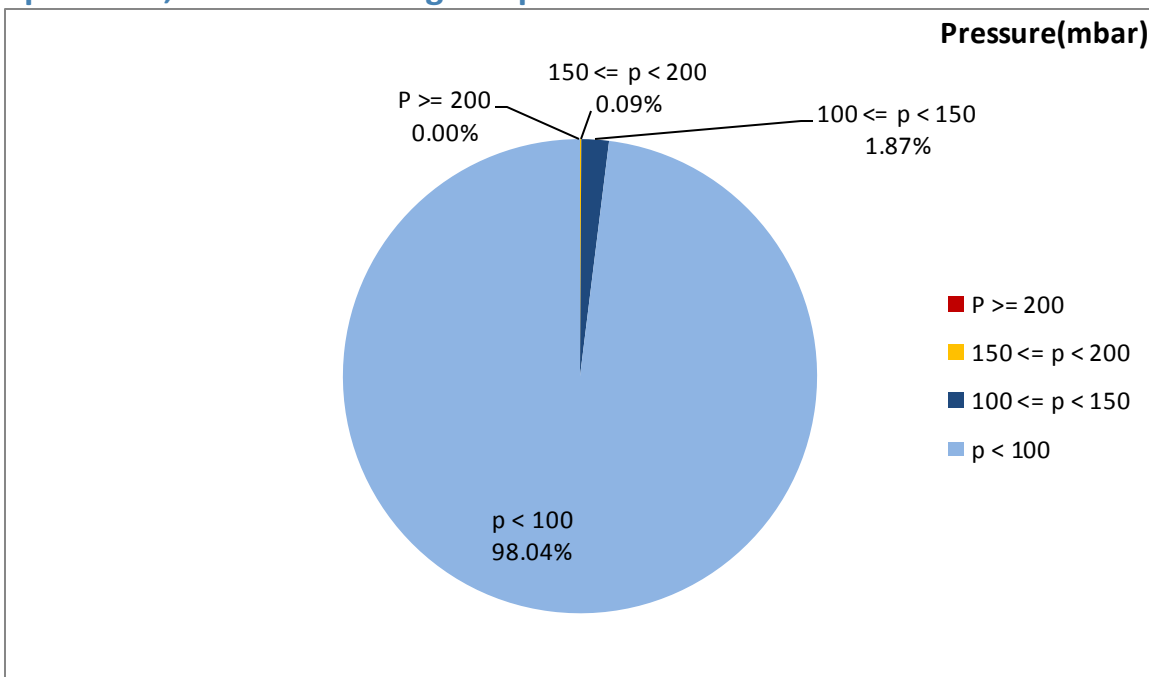


Figure 1- Pressure distribution over the working hours

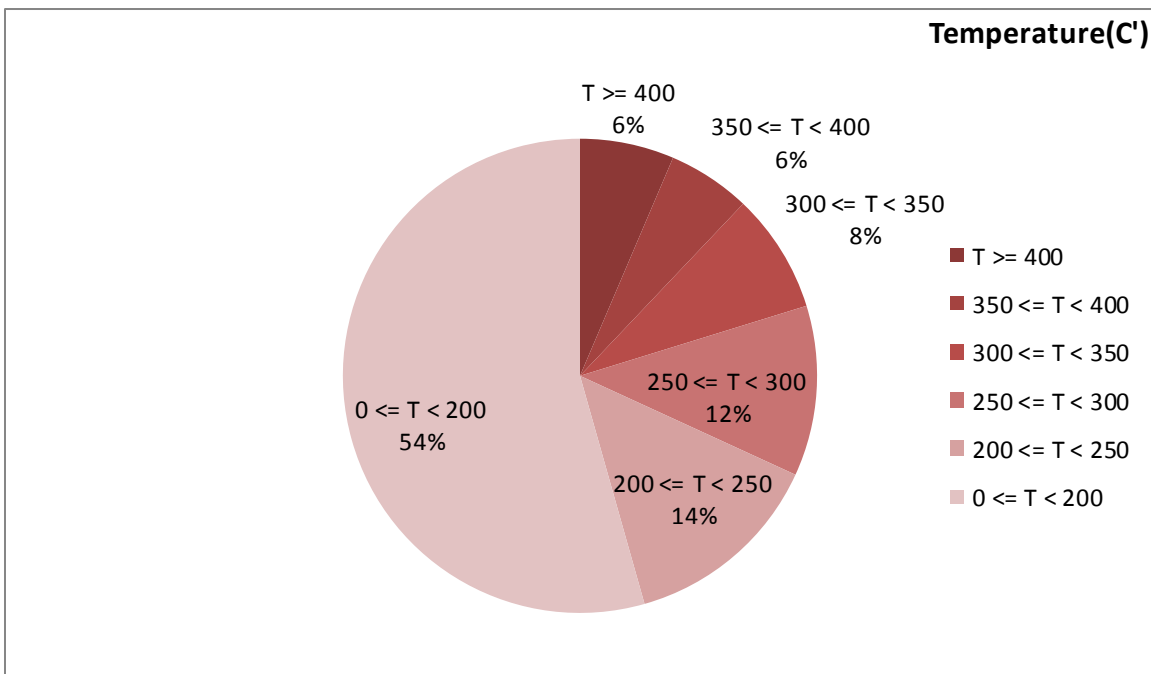


Figure 2-Temperature distribution over the working hours

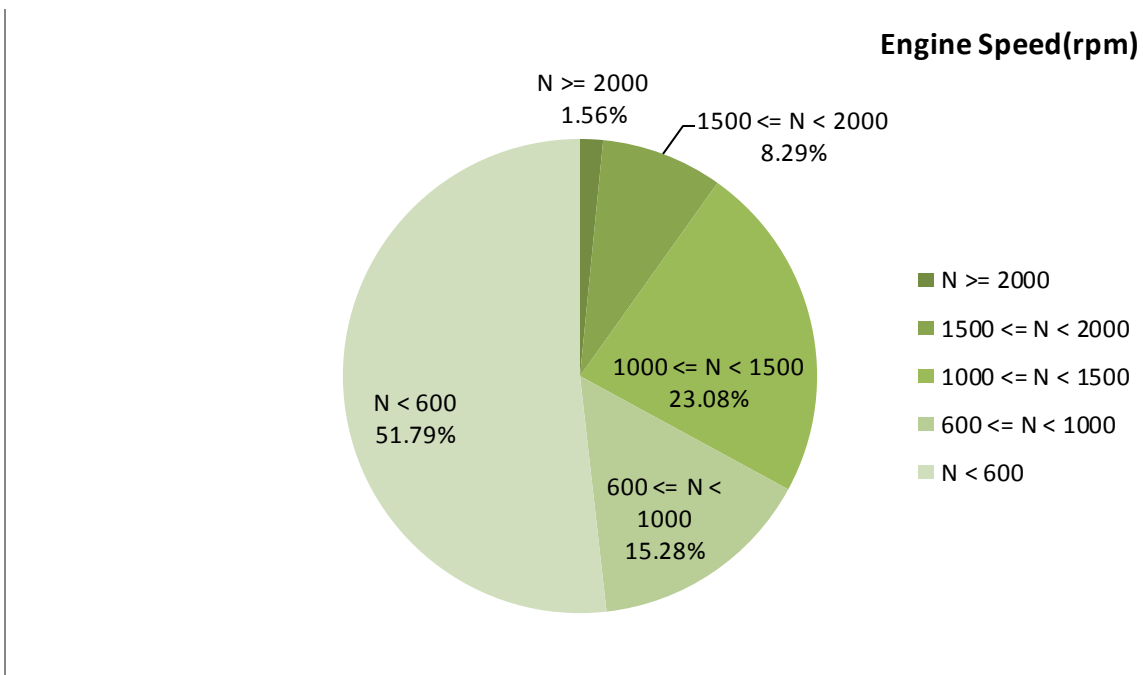


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
216.96	18.04	860

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
269.5	31.91	1197

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
518-50	171-0	2576-256

## Detailed Pressure Analysis

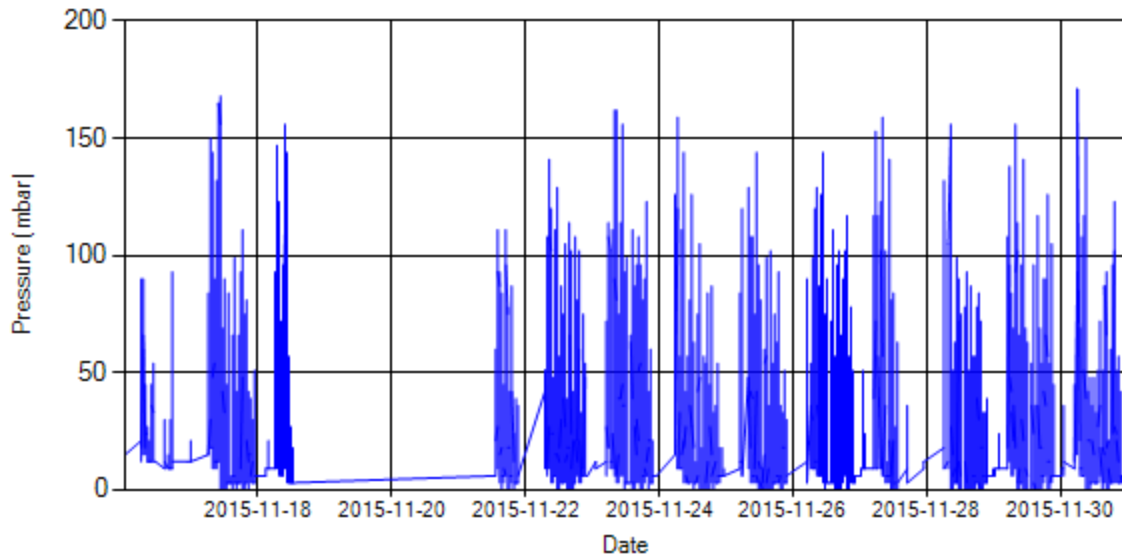


Figure 4- Pressure distribution over the period

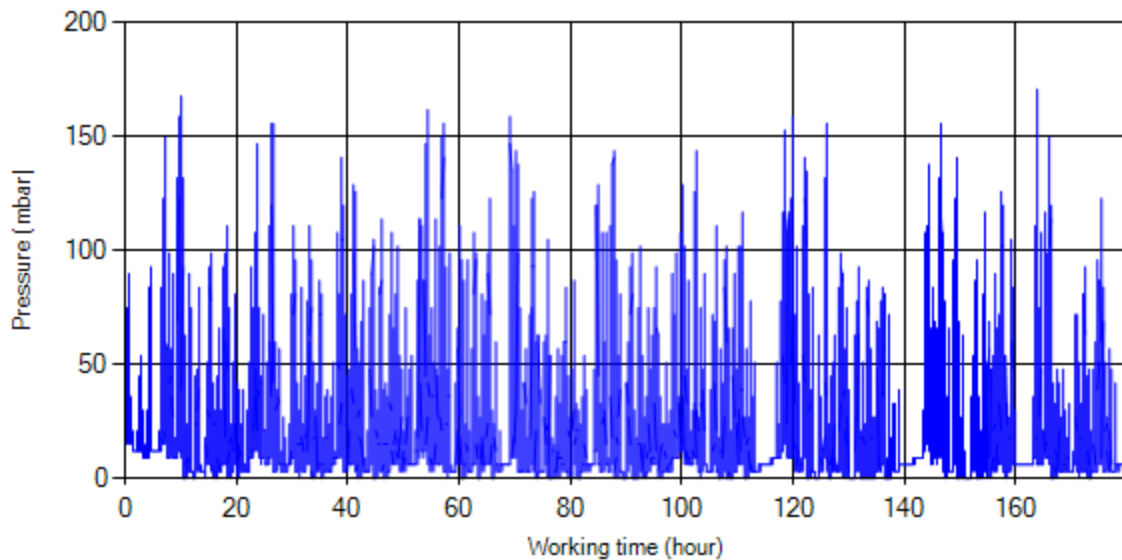


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

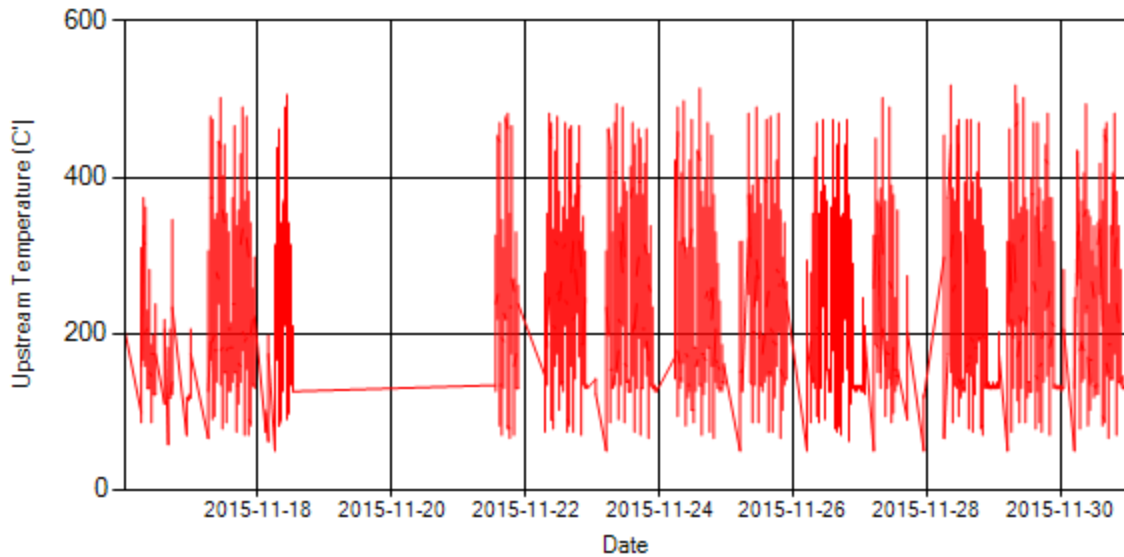


Figure 6- Temperature distribution over the period

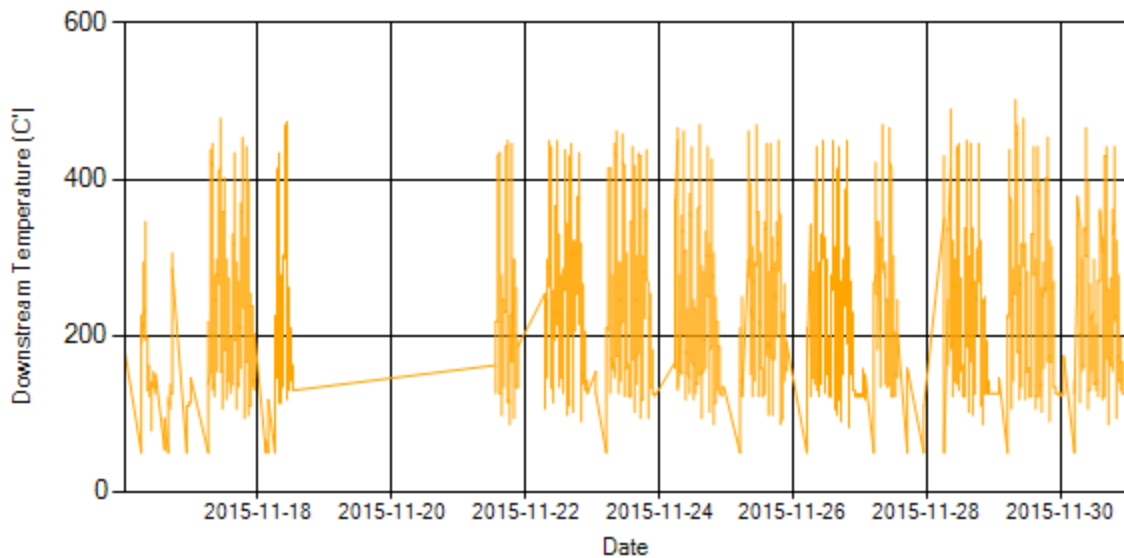
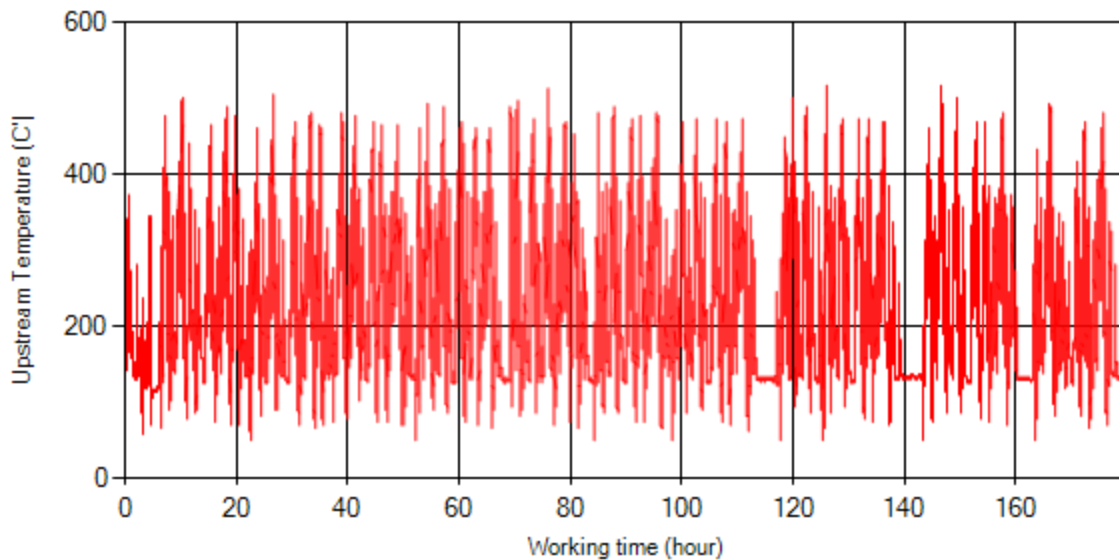
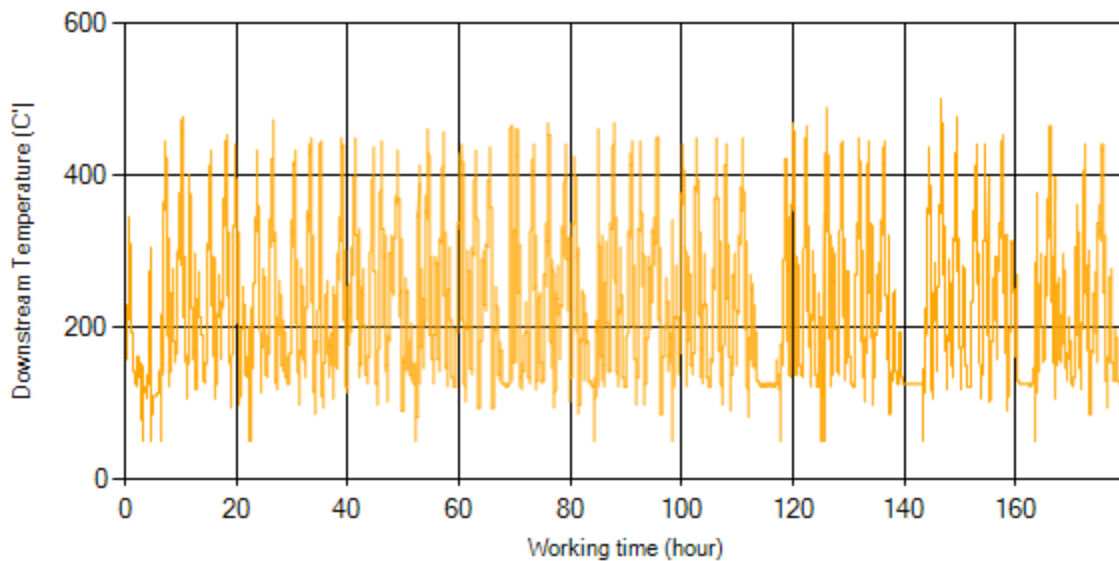


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*



## Engine Speed Diagrams

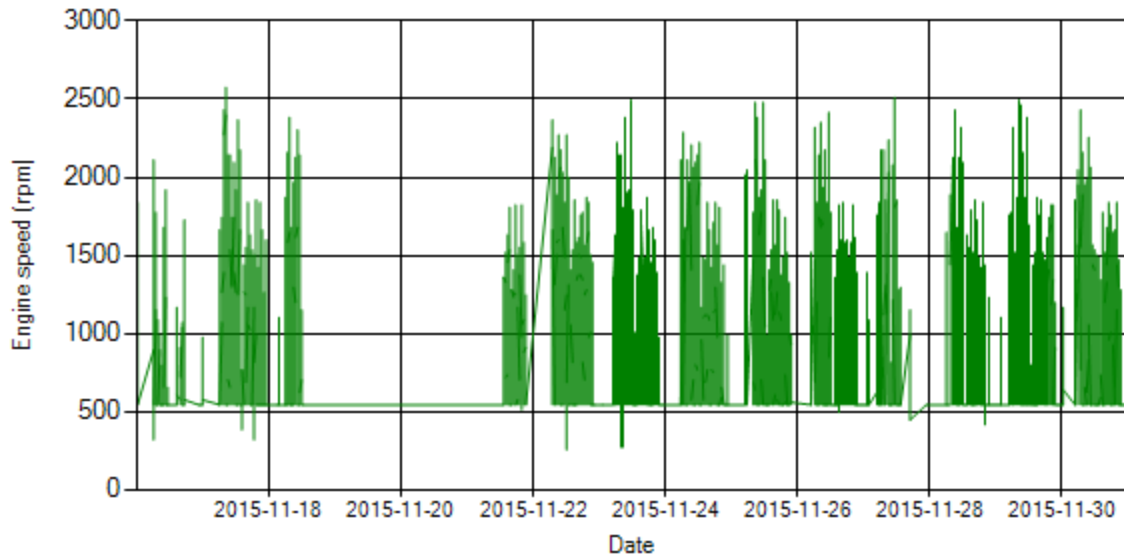


Figure 10- Engine speed distribution over the period

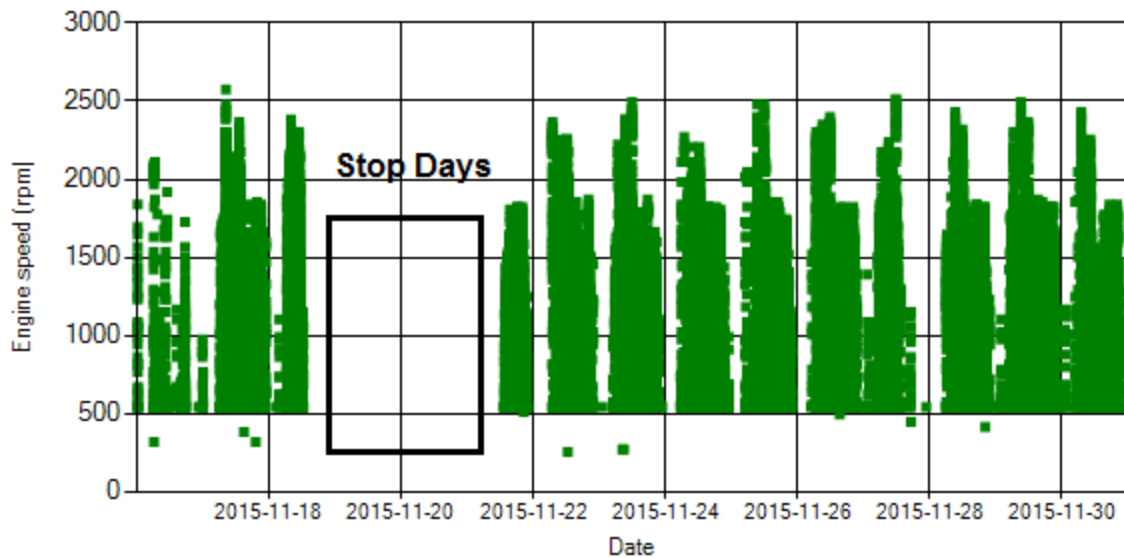


Figure 11- Engine speed diagram for calculating CPK's working days

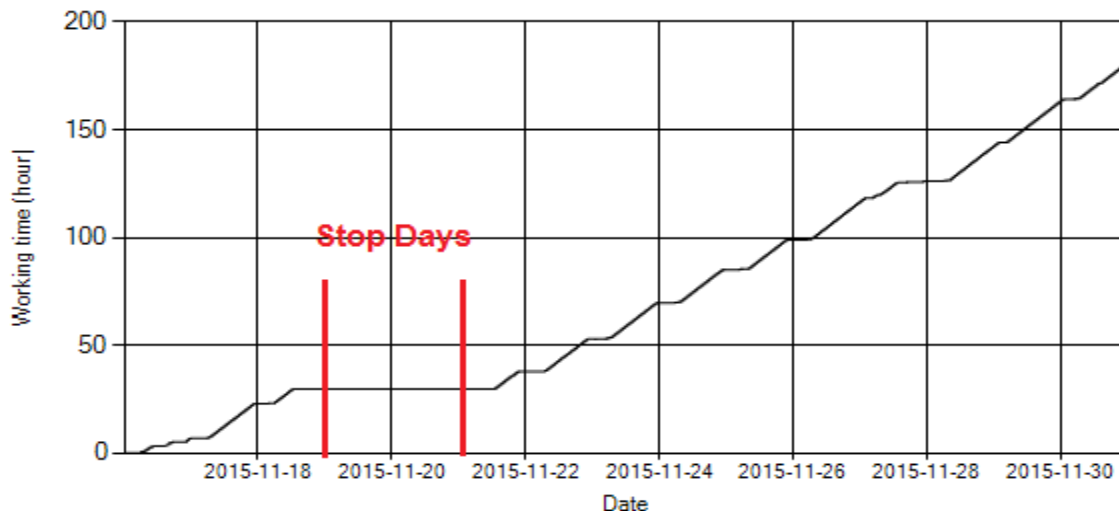


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data.

### Pressure-Engine Speed diagrams

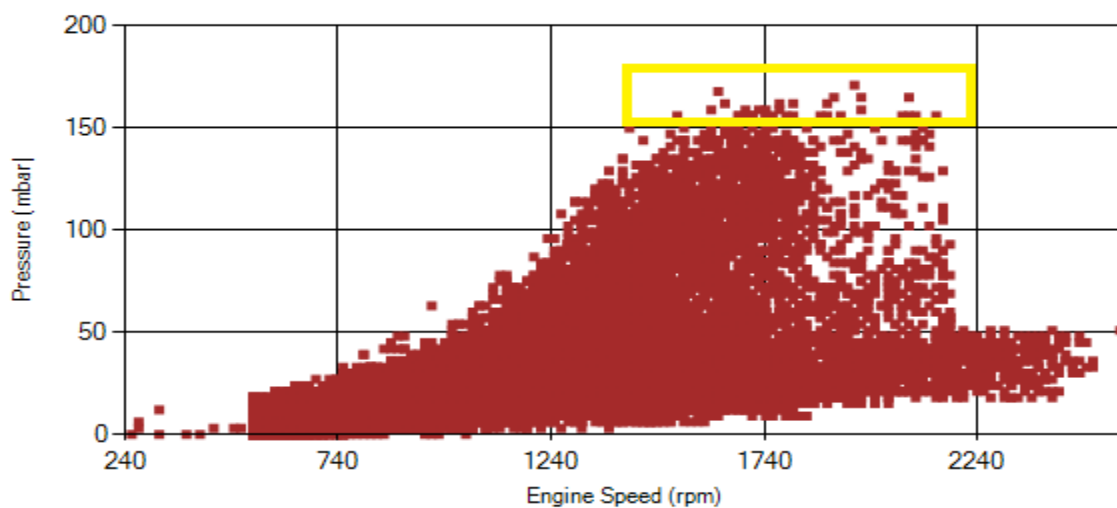


Figure 13- Pressure against engine speed

Notice: Yellow alarm ( $200 > \text{pressure} > 150$ ) range was indicated in figure 13.

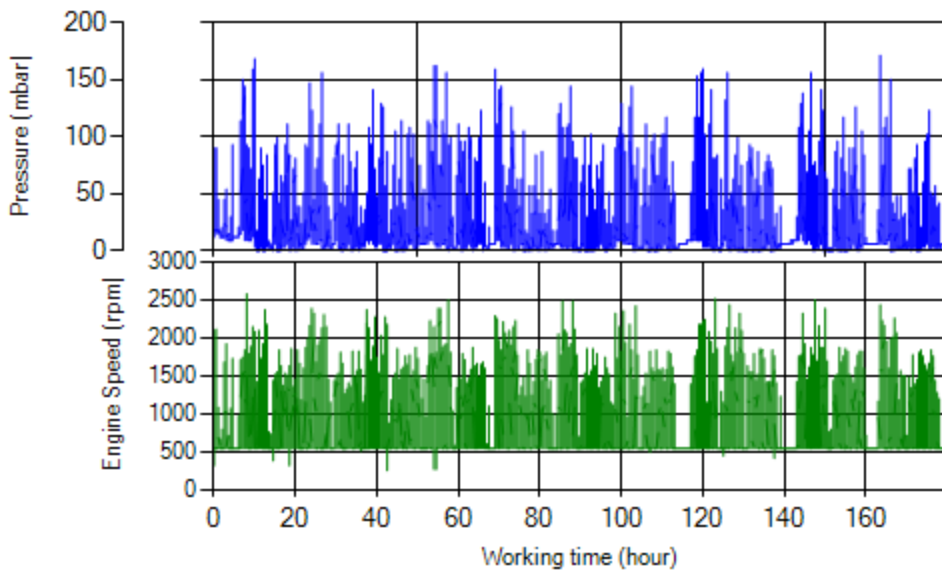


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

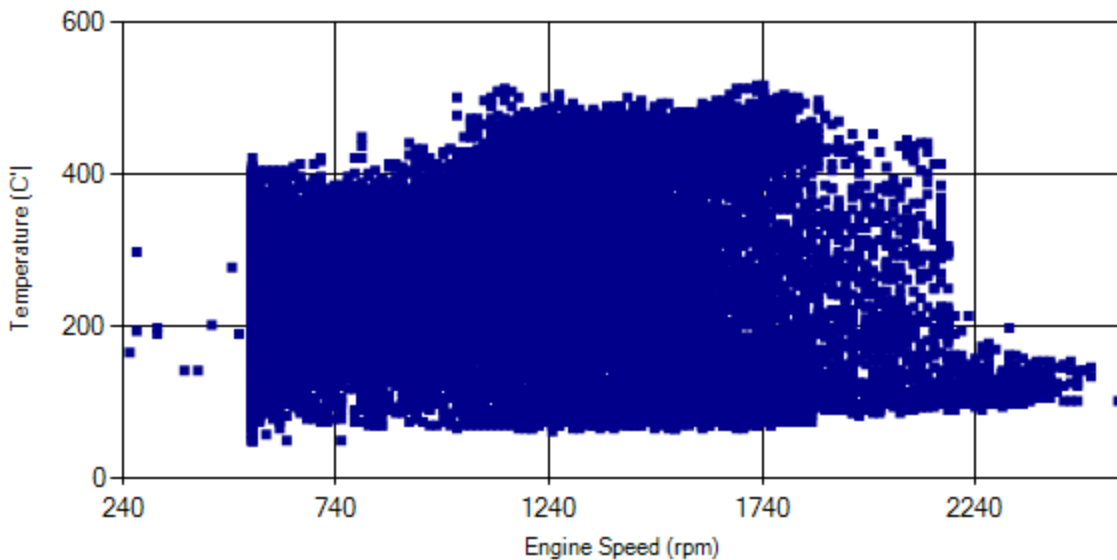


Figure 15- Temperature against engine speed

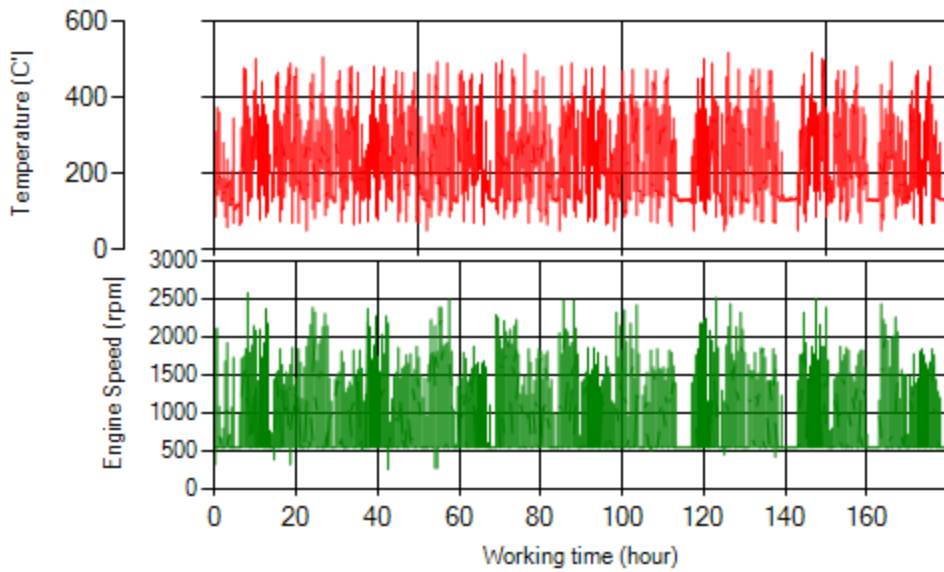


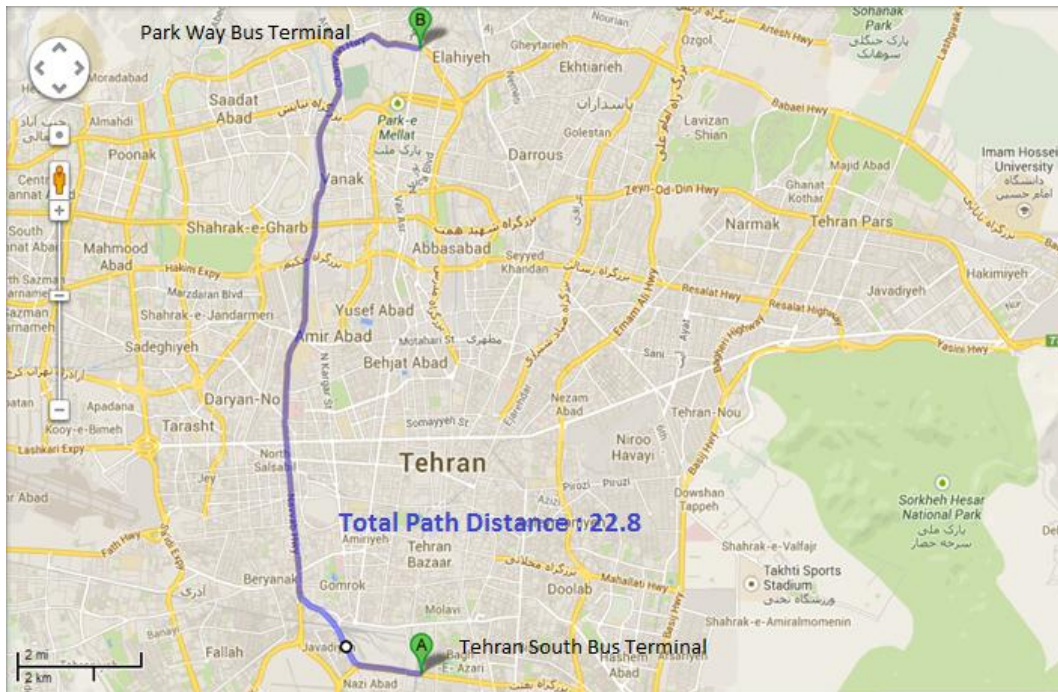
Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in Figure 1, pressure above 200 mbar wasn't observed during this period and only 0.09% of operation time pressure was above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 6% of total working time temperature is above 400 °C and 12% above 350°C.

Filter operation status	Excellent <input checked="" type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input type="checkbox"/>	Failed <input type="checkbox"/>

Vehicle plate number	78515
Bus line	Number 4 (south to north bus line)
DPF producer company	Dinex_01 (Passive system with FBC)



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## Overall Information

*Table1- Overall Information*

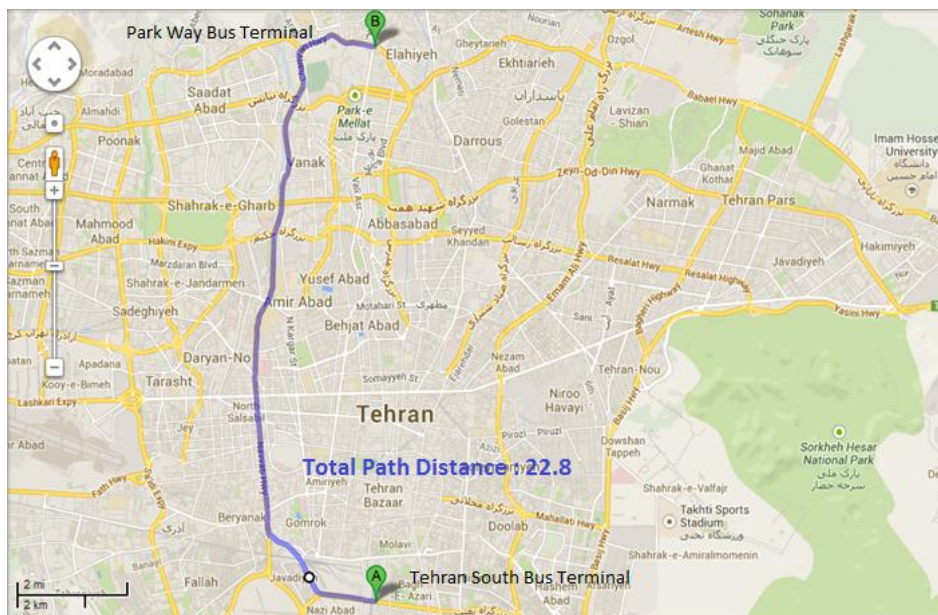
Vehicle plate number	78515
CPK data logger number	LN: 001490, DN: 1954, Sim Number +98000000000
Bus line	Number 4 (south to north bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	Dinex_01 (passive system with FBC)
Installation date	22/Oct/2014
Report period	01/Nov/2015 – 30/Nov/2015 (thirty days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	Filter core was changed on 15/Feb/2015.
Dosing status	Dosing value was reduced by 70% on March February 15 <sup>th</sup> . ( Secondary value/Initial value=0.3)

**Notice: Bus has been stopped from Sep 18<sup>th</sup> until now due to technical problems (related to Bus Company). So there was no data to providing November's report.**

Vehicle plate number	78524
Bus line	Number 4 (south to north Bus line)
DPF producer company	PURltech (Passive system with FBC)



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**Notice: System was working without DPF during this period**

## Overall Information

*Table1- Overall Information*

Vehicle plate number	78524
CPK data logger number	LN: 001443, DN: 1930, Sim +989218786219
Bus line	Number 4 (south to north Bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	PURltech (Passive system with FBC)
Installation date	28/Jan/2015
Report period	01/Nov/2015 – 15/Nov/2015 (fifteen days)
K value – DPF upstream	2.00 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	<p>DPF core was removed on Jul 22<sup>nd</sup> and was cleaned on Aug 12<sup>th</sup> for the first time.</p> <p>Considering system relatively high backpressure, filter isolation defect and air filter's deformation, DPF core was removed on Sep 16<sup>th</sup> and will be installed on system after cleaning and improving isolation system.</p>
Dosing status	Dosing value has been kept constant from installation date until now.



*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	42365 km
Bus mileage over the period	705 km
Working days over the period	8 days
Stop days	7 days
Data logger working days	8 days
Working hours over the period	80 hours 14 minutes
Average working hours per day (including stop days)	5 hours 20 minutes
Bus average speed	8.79 km/hr
idle speed time to all working time ration	- %
Total Bus fuel consumption over the period	423 lit
Fuel consumption per hour	5.27 lit/hr
Average fuel consumption	0.6 lit/km
Total Bus additive consumption over the period	-lit
Average additive consumption	- cc/km
Additive consumption to fuel ration	- cc/1000lit

**Notice:** Due to some technical problem related to data logger, rpm data were missing. So related parameters like idling speed were left blank.

**Notice:** DPF core was removed on Sep 16<sup>th</sup> and additive system was disconnected, so additive consumption during this period was zero.

**Notice:** Considering data logger problem and stop days with switch on, working hours and its related parameters were unreliable.

## Temperature, Pressure and Engine Speed Overview

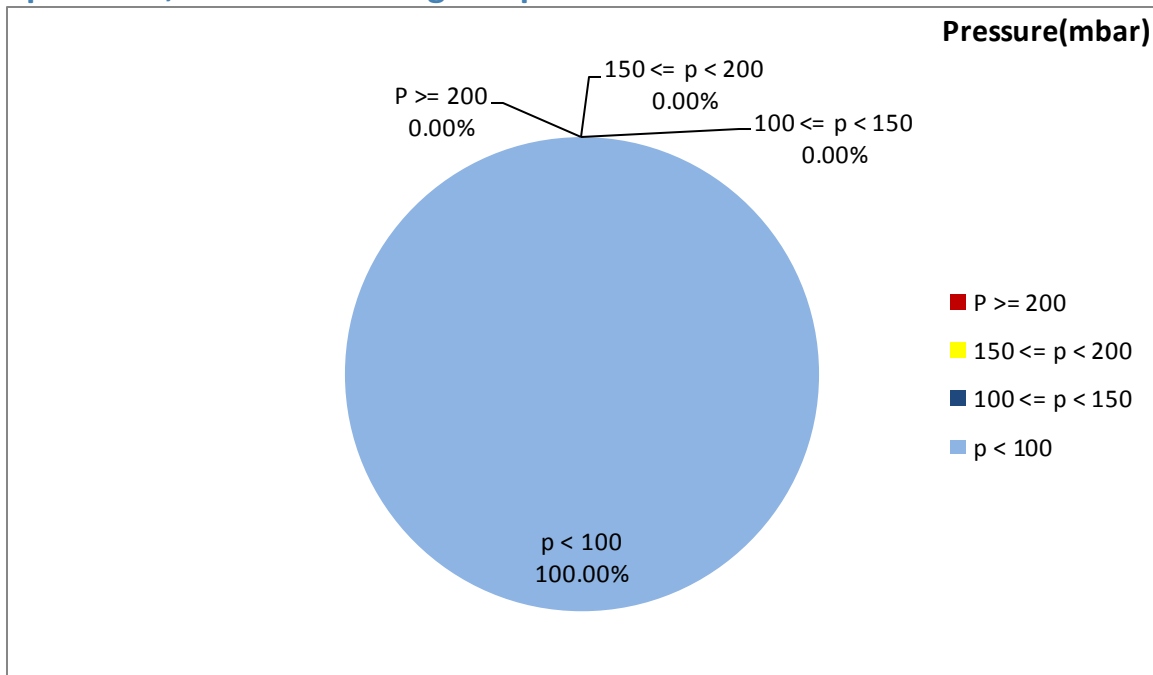


Figure 1- Pressure distribution over the working hours

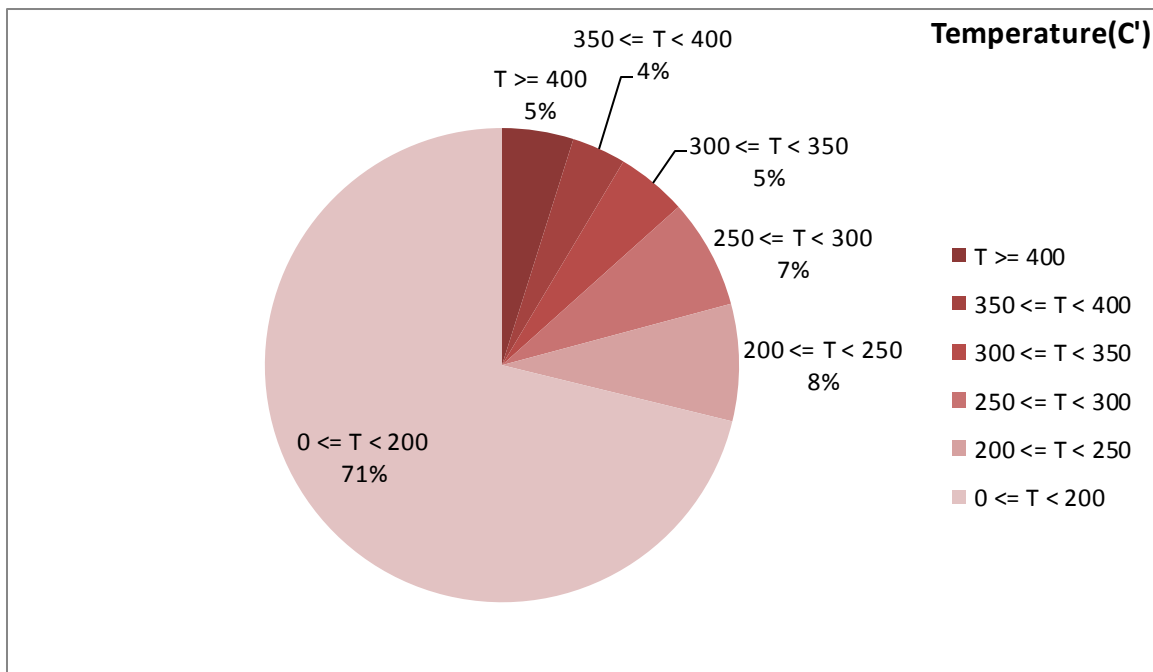
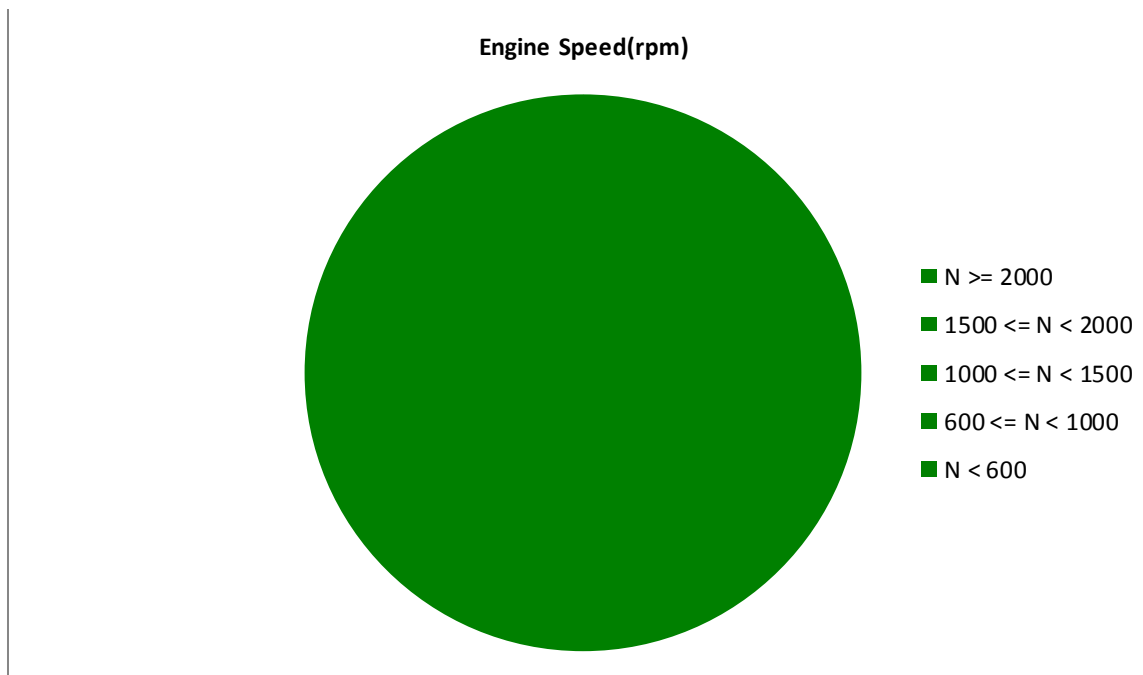


Figure 2-Temperature distribution over the working hours



*Figure 3- Engine speed distribution over the working hours*

*Table 4- Mean values*

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
175.15	4.05	-

*Table 5- Mean values without idling*

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
-	-	-

*Table 6- Max-min values*

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
546-50	96-0	-

**Notice:** Due to data logger technical problem, rpm sensor data missed. So engine speed's related parameters were left blank.

## Detailed Pressure Analysis

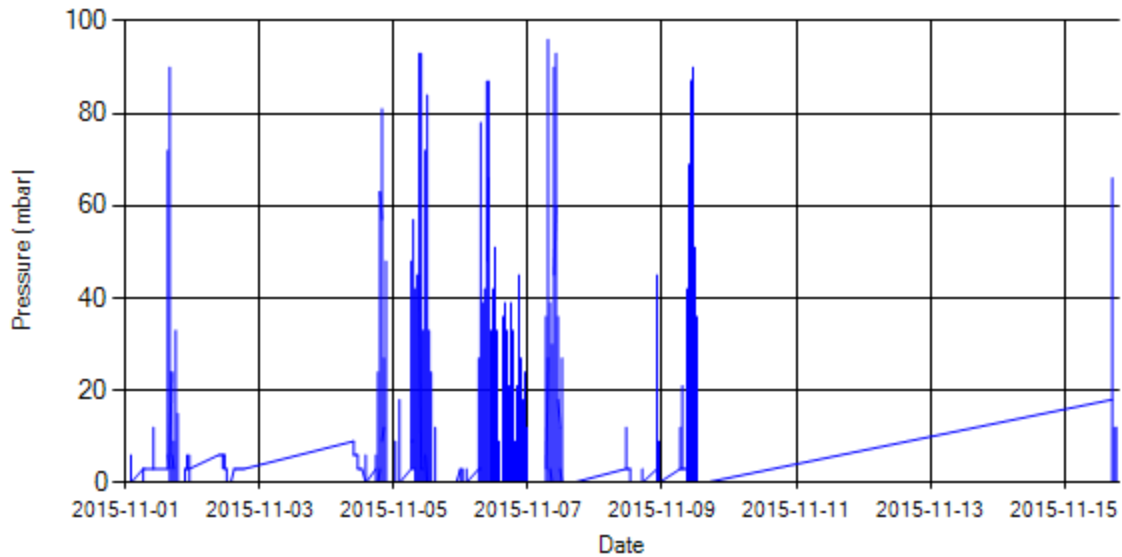


Figure 4- Pressure distribution over the period

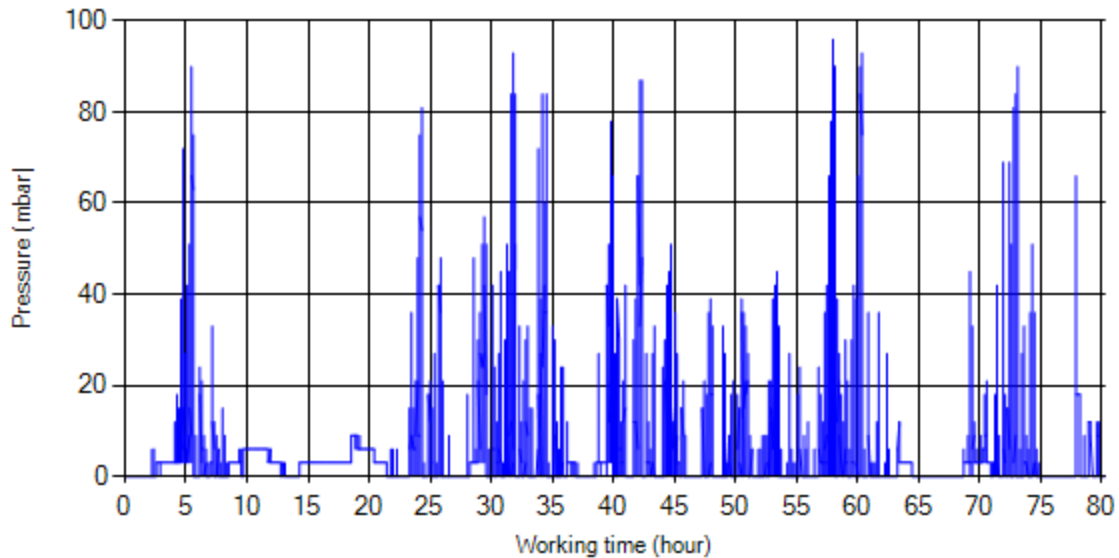


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

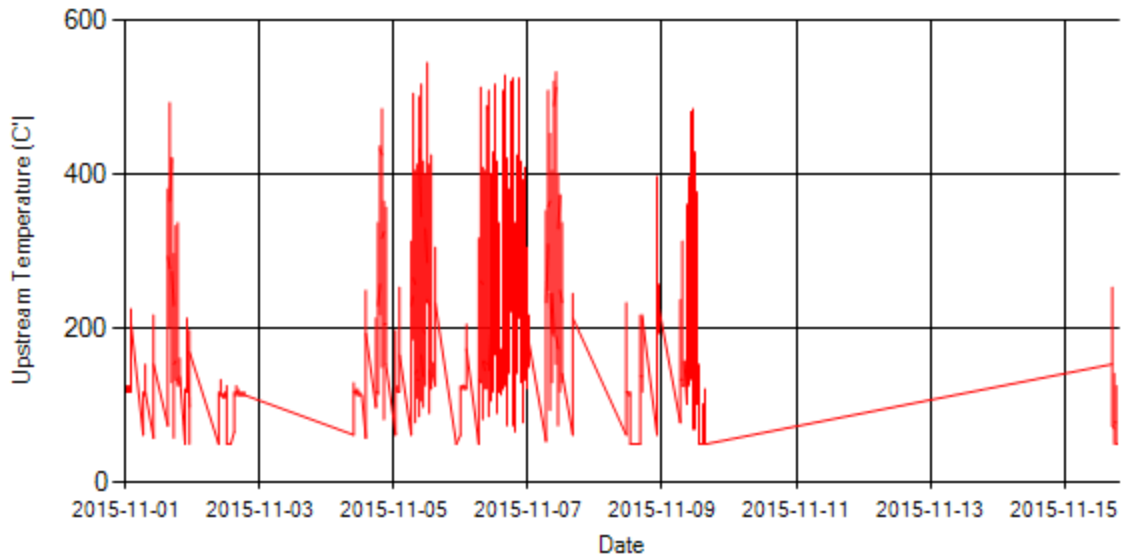


Figure 6- Temperature distribution over the period

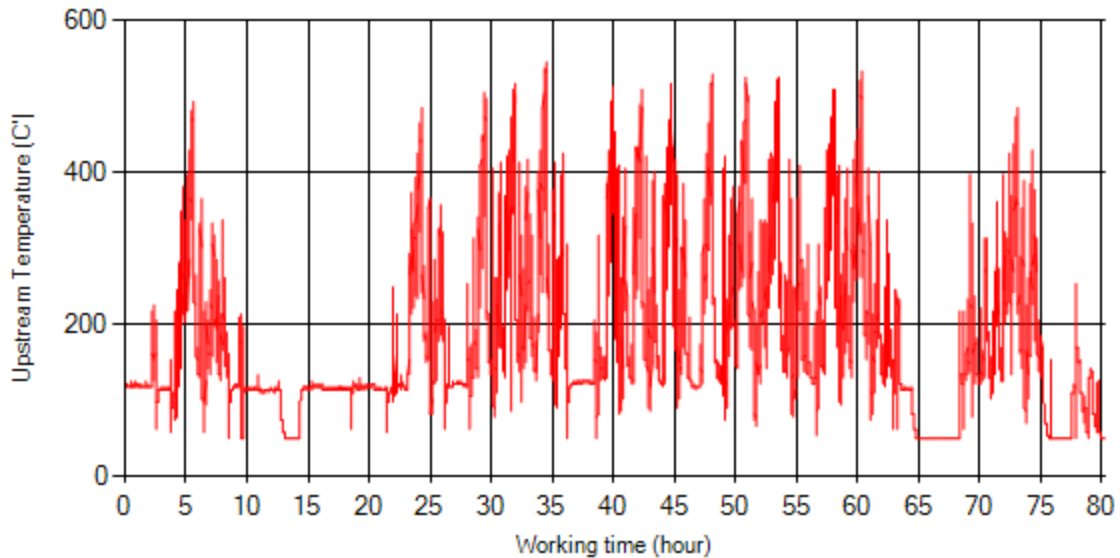


Figure 7- Temperature vs. working hours

## Engine Speed Diagrams

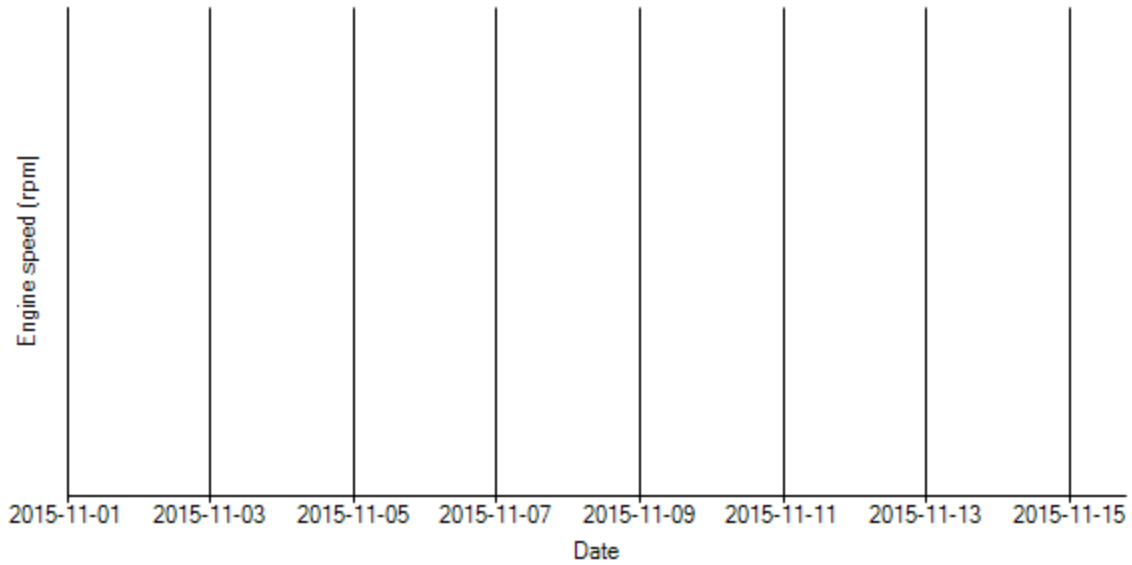


Figure 8- Engine speed distribution over the period

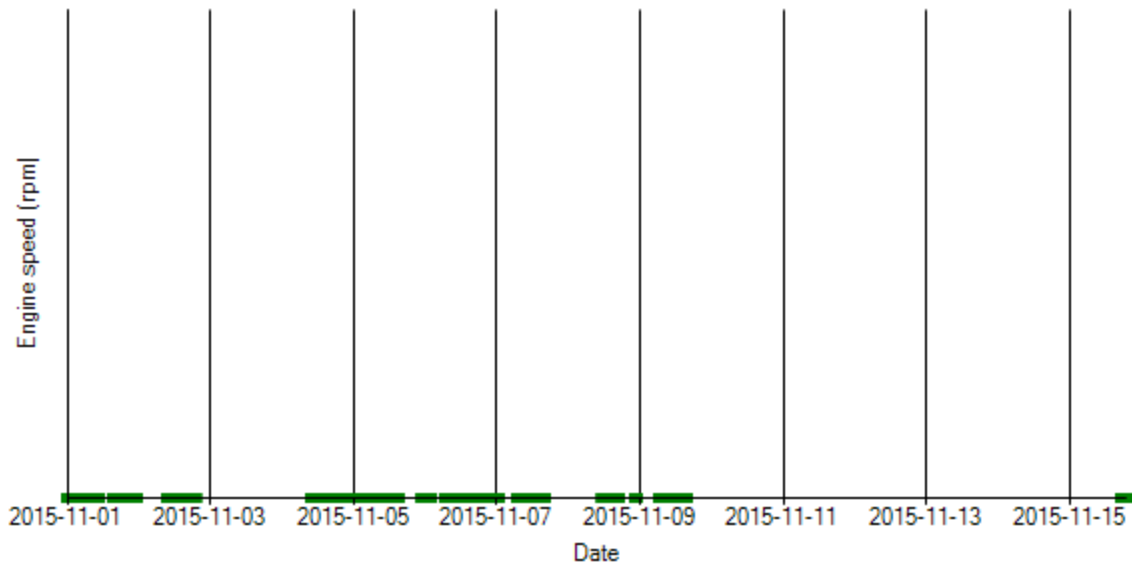


Figure 9- Engine speed diagram for calculating CPK's working days

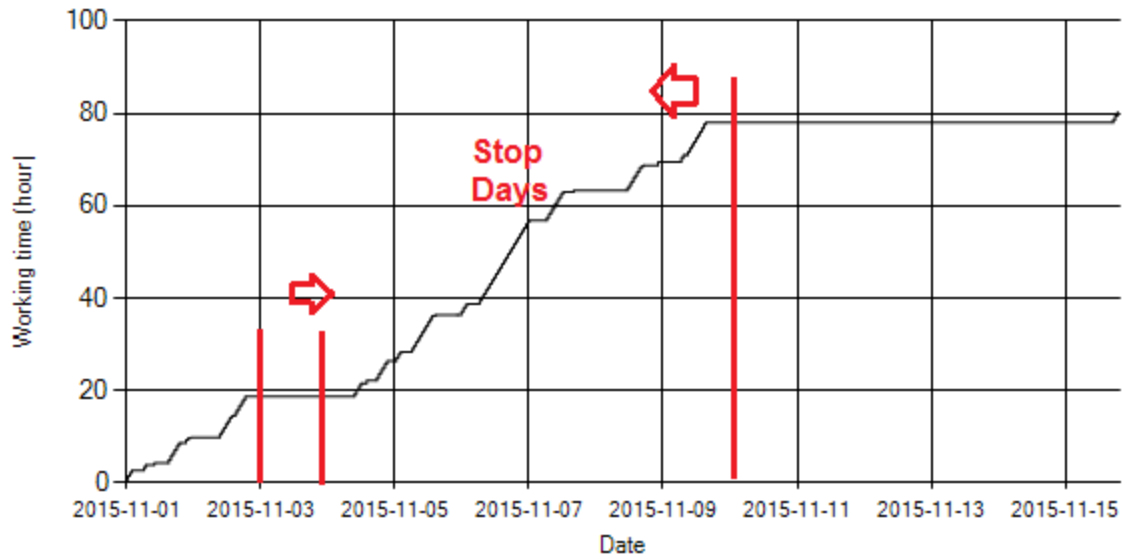


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data.

### Pressure-Engine Speed diagrams

**Notice: Due to RPM sensor problem this section was left blank.**

### Temperature-Engine Speed diagram

**Notice: Due to RPM sensor problem this section was left blank.**

### Filter Operation Analysis

**Notice: System was working without DPF during this period.**

## Overall Information

*Table1- Overall Information*

Vehicle plate number	78524
CPK data logger number	LN: 001443, DN: 1930, Sim +989218786219
Bus line	Number 4 (south to north Bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	PURIttech (Passive system with FBC)
Installation date	28/Jan/2015
Report period	16/Nov/2015 – 30/Nov/2015 (fifteen days)
K value – DPF upstream	2.00 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	<p>DPF core was removed on Jul 22<sup>nd</sup> and was cleaned on Aug 12<sup>th</sup> for the first time.</p> <p>Considering system relatively high backpressure, filter isolation defect and air filter's deformation, DPF core was removed on Sep 16<sup>th</sup> and installed on Nov 17<sup>th</sup>.</p> <p>The third cleaning was unavoidable after only 6 days working and was done on 29<sup>th</sup> Nov. System only worked for two days and DPF was replaced by muffler on Nov 30<sup>th</sup>.</p>
Dosing status	Dosing value has been kept constant from installation date until now.



*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	43765 km
Bus mileage over the period	1400 km
Working days over the period	11 days
Stop days	4 days
Data logger working days	11 days
Working hours over the period	124 hours 31 minutes
Average working hours per day (including stop days)	8 hours 18 minutes
Bus average speed	11.24 km/hr
idle speed time to all working time ration	58.05 %
Total Bus fuel consumption over the period	896 lit
Fuel consumption per hour	7.2 lit/hr
Average fuel consumption	0.64 lit/km
Total Bus additive consumption over the period	0.5 lit
Average additive consumption	357 cc/km
Additive consumption to fuel ration	558 cc/1000lit

## Temperature, Pressure and Engine Speed Overview

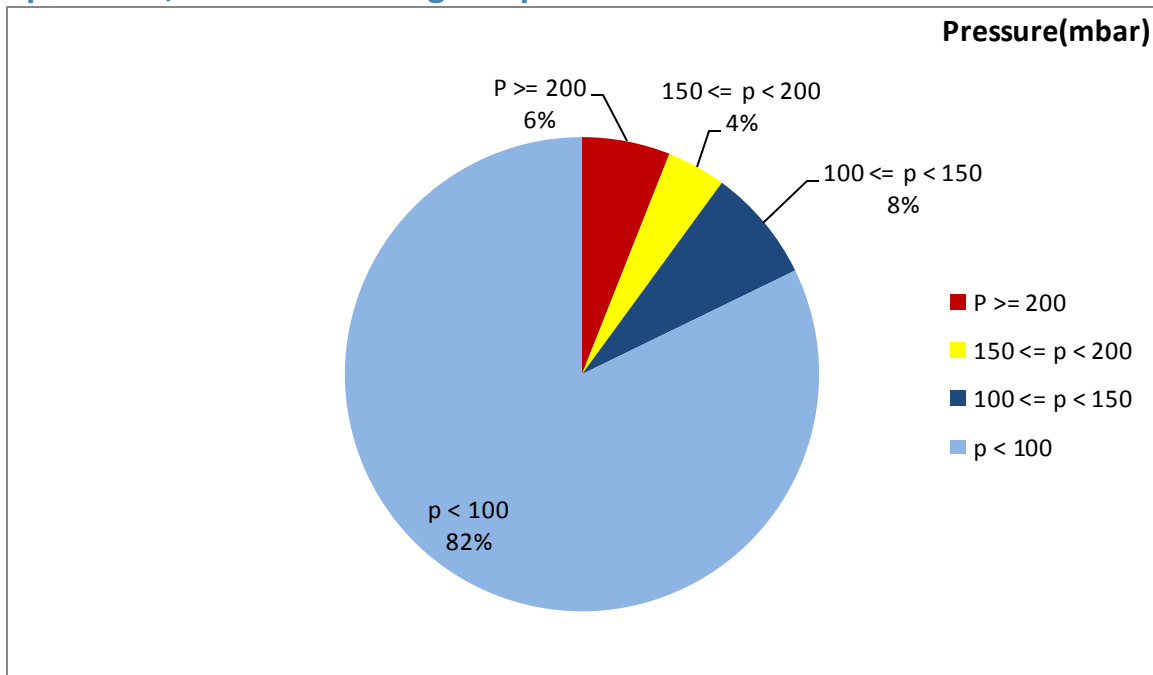


Figure 1- Pressure distribution over the working hours

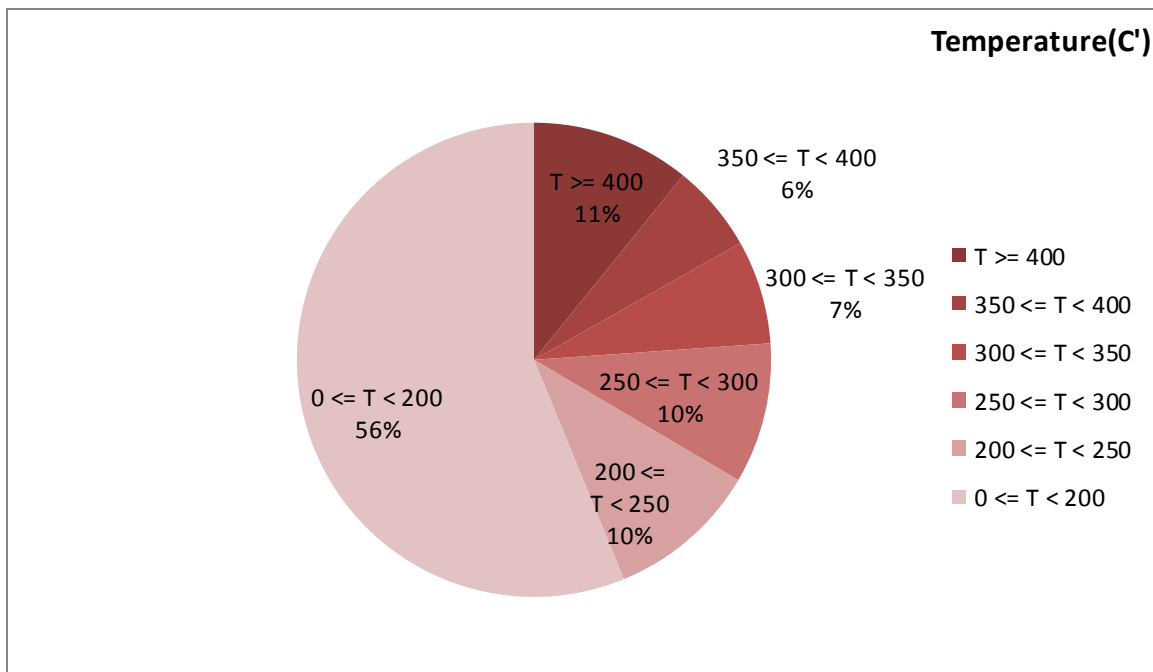


Figure 2-Temperature distribution over the working hours

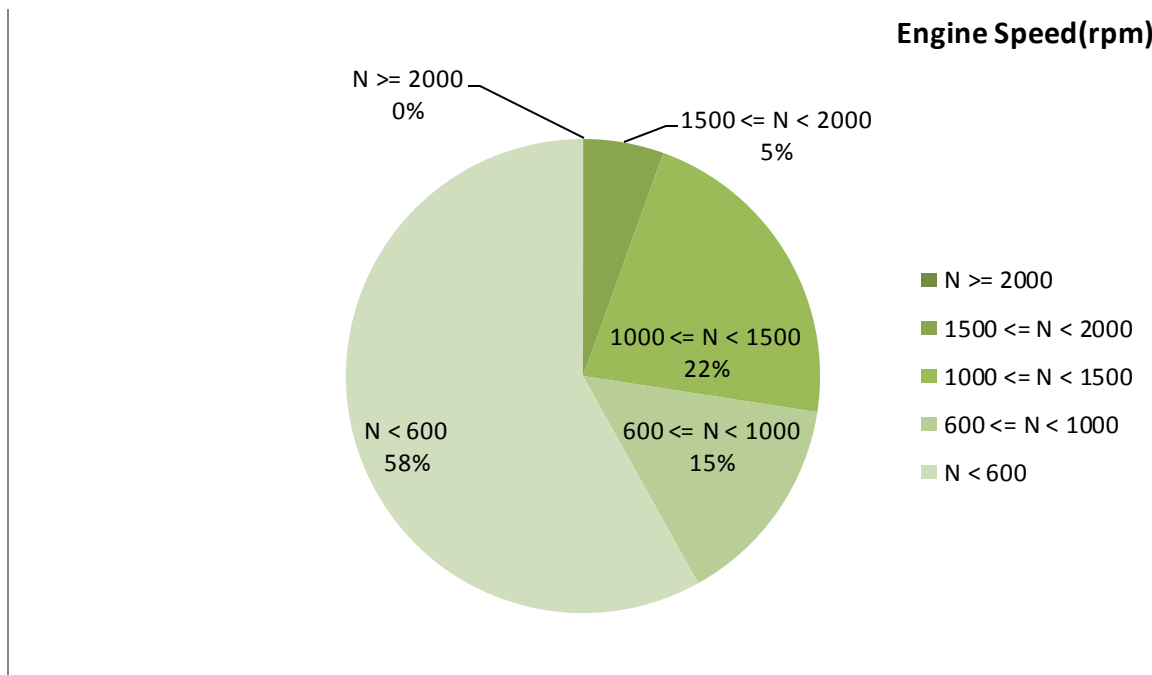


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
226.53	63.62	788

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
313.81	113.32	1124

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
694-50	615-0	2128-256

## Detailed Pressure Analysis

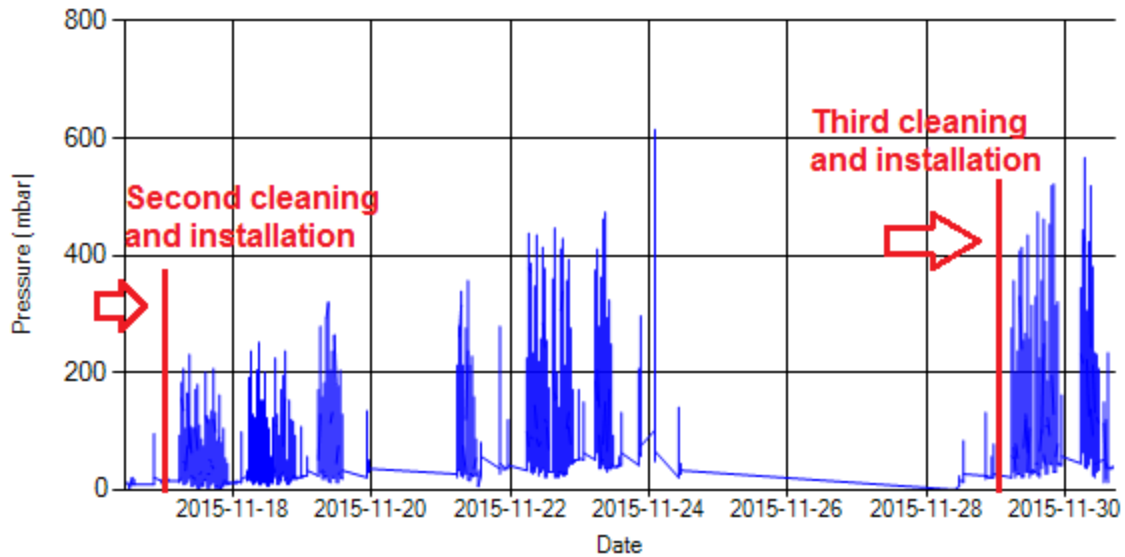


Figure 4- Pressure distribution over the period

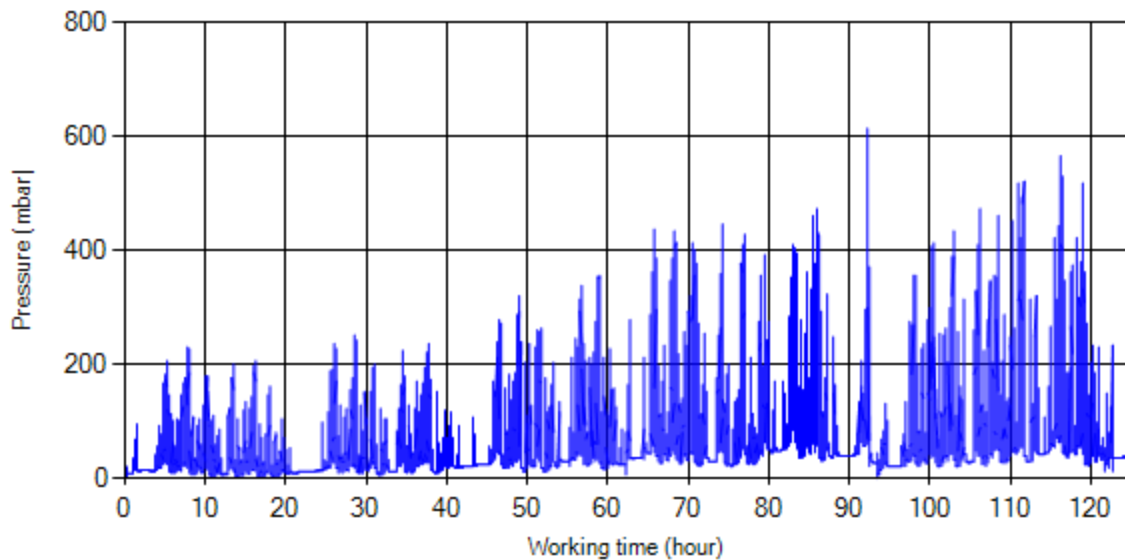


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

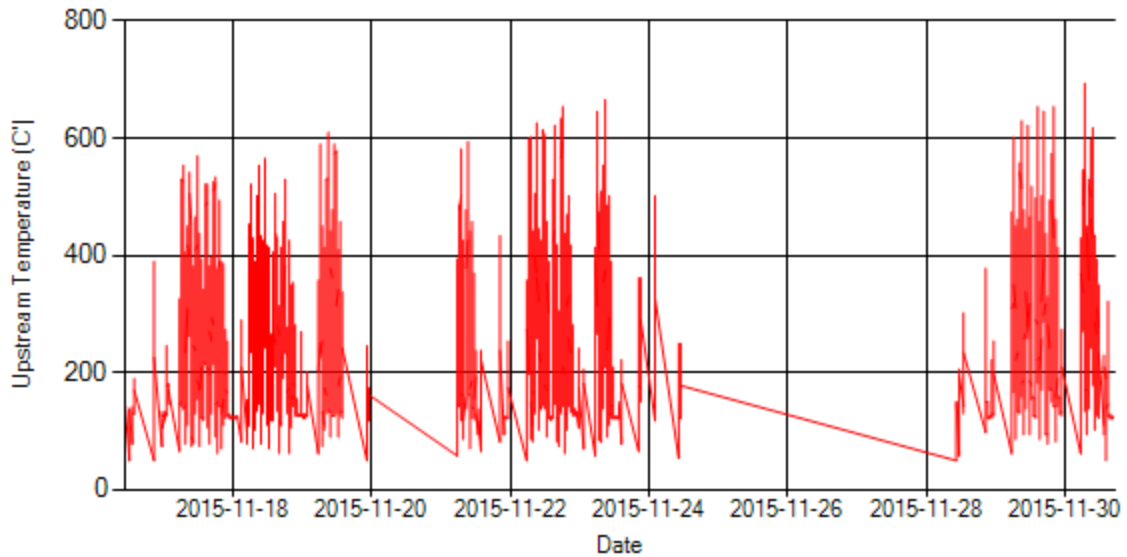


Figure 6- Temperature distribution over the period

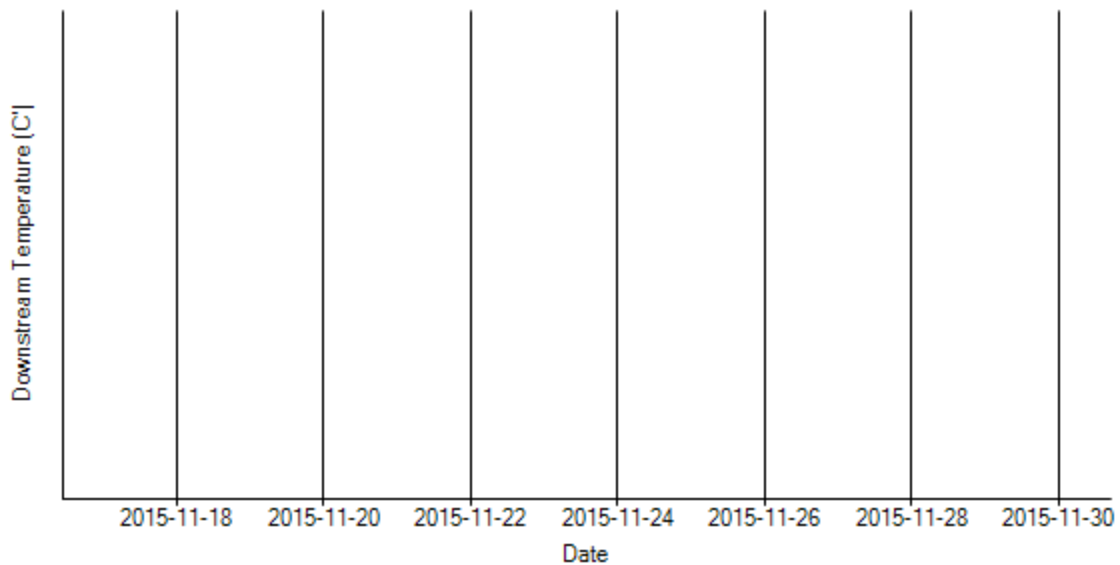
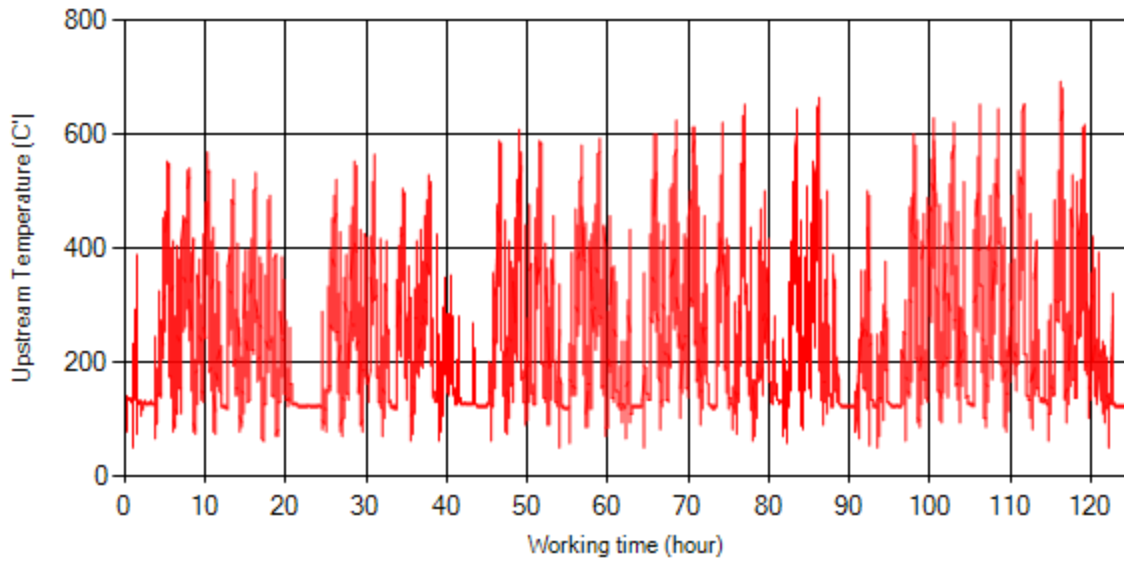
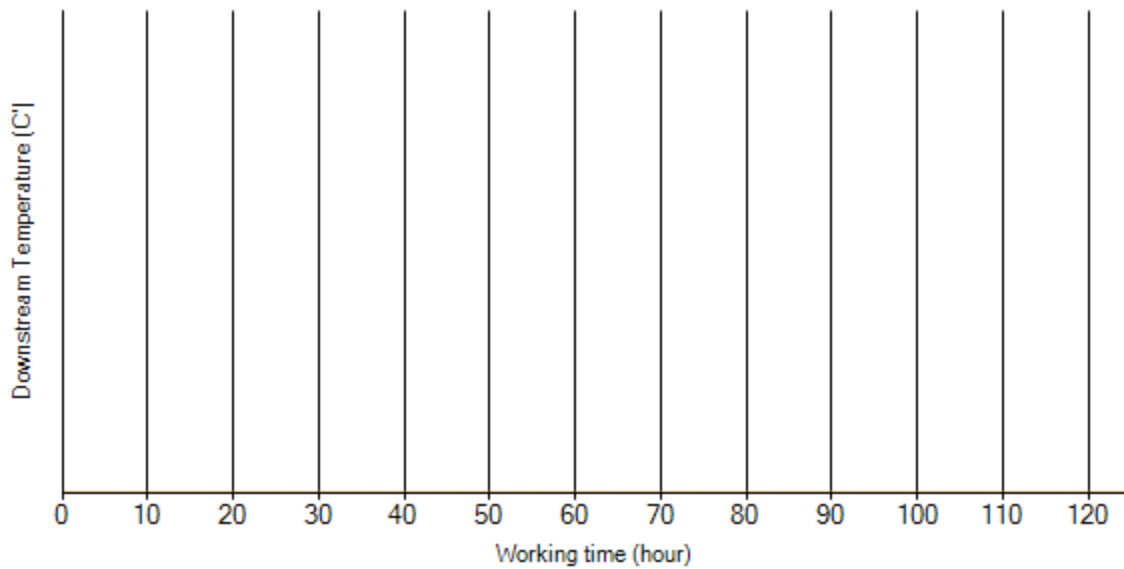


Figure 7- Temperature distribution over the period

Notice: Temp 2 sensor had problem during this period.



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

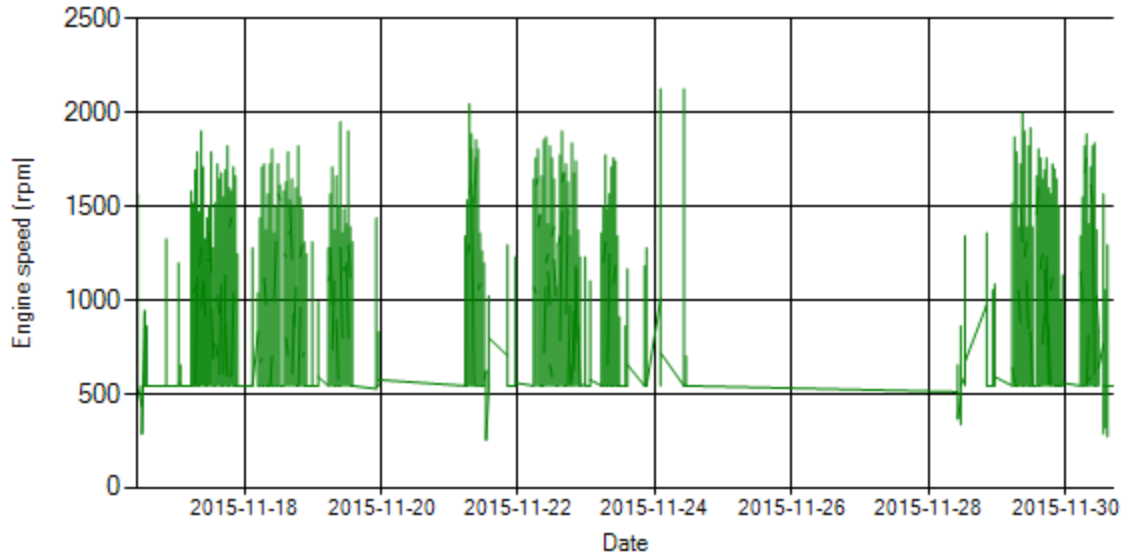


Figure 10- Engine speed distribution over the period

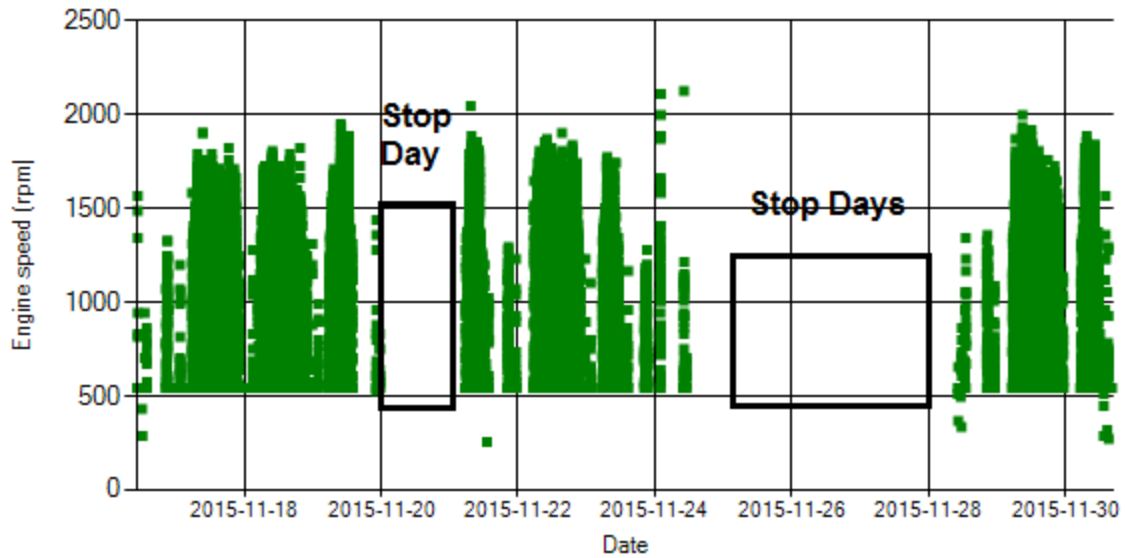


Figure 11- Engine speed diagram for calculating CPK's working days

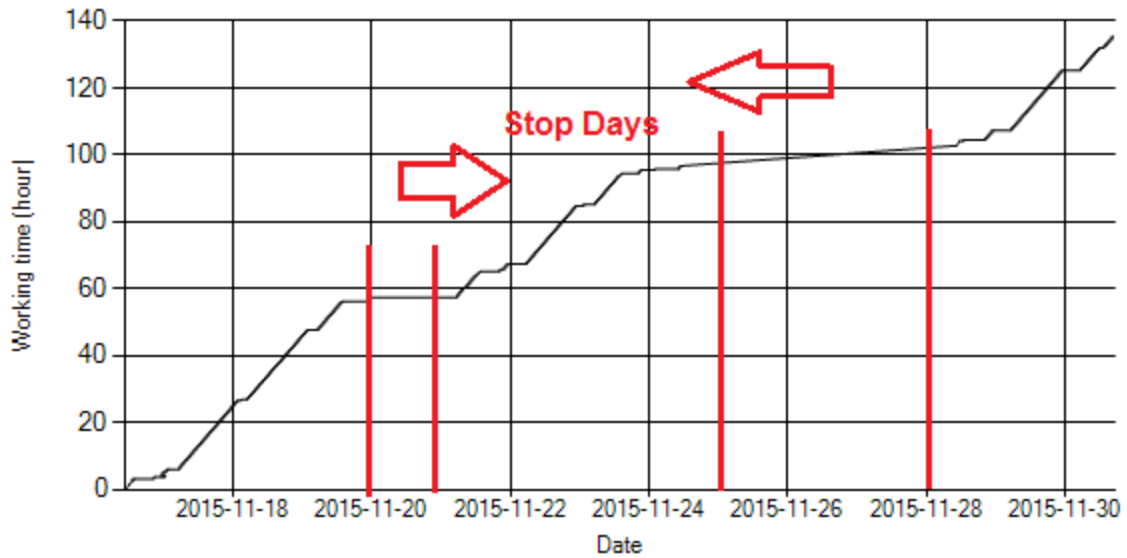


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data.

### Pressure-Engine Speed diagrams

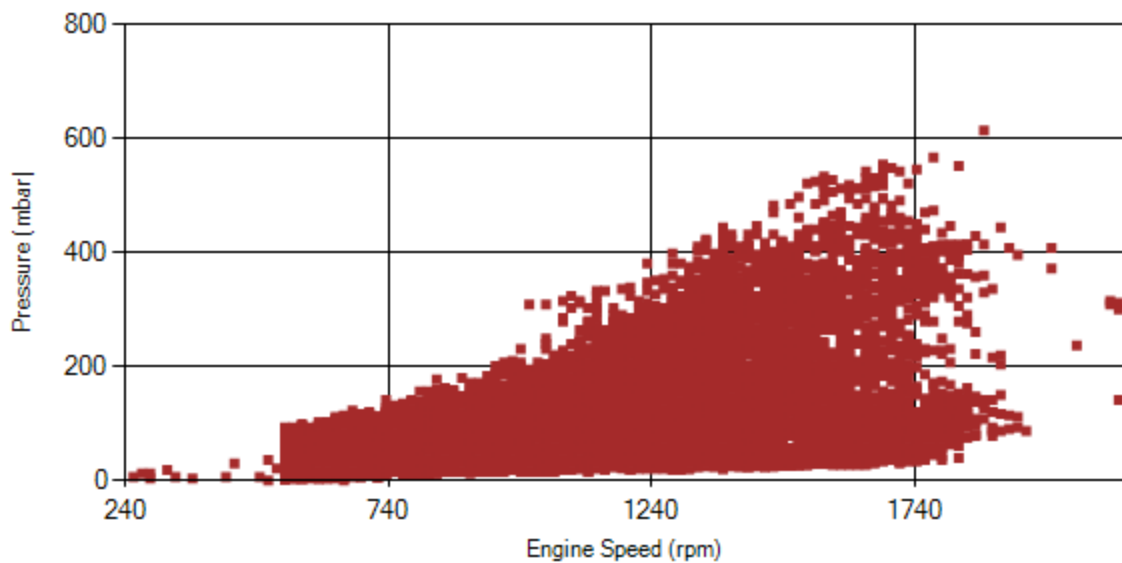


Figure 13- Pressure against engine speed



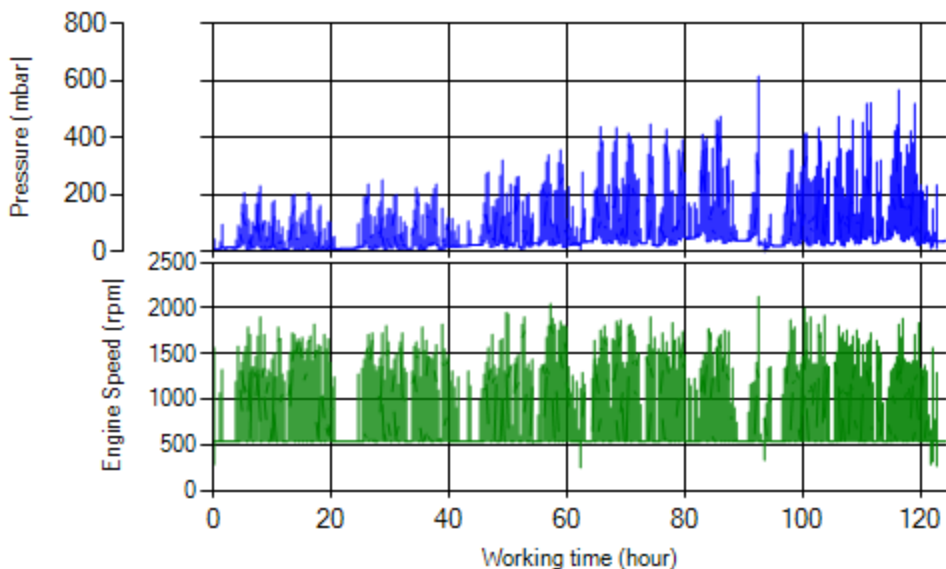


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

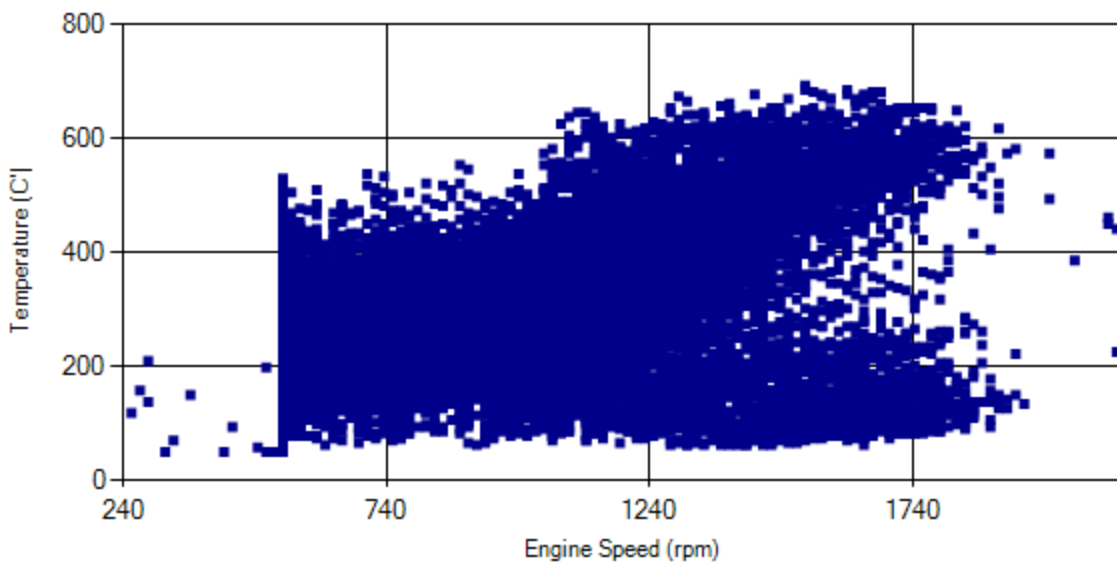


Figure 15- Temperature against engine speed

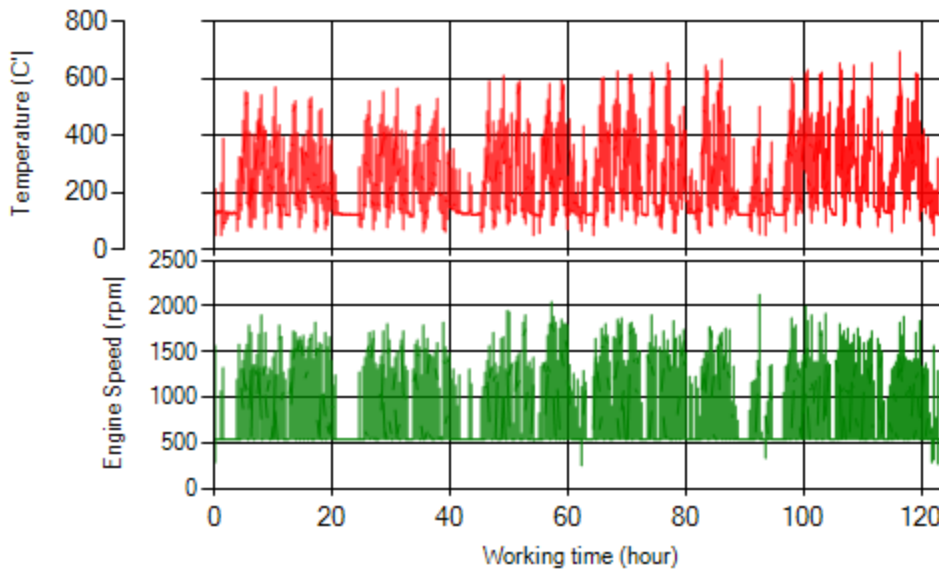


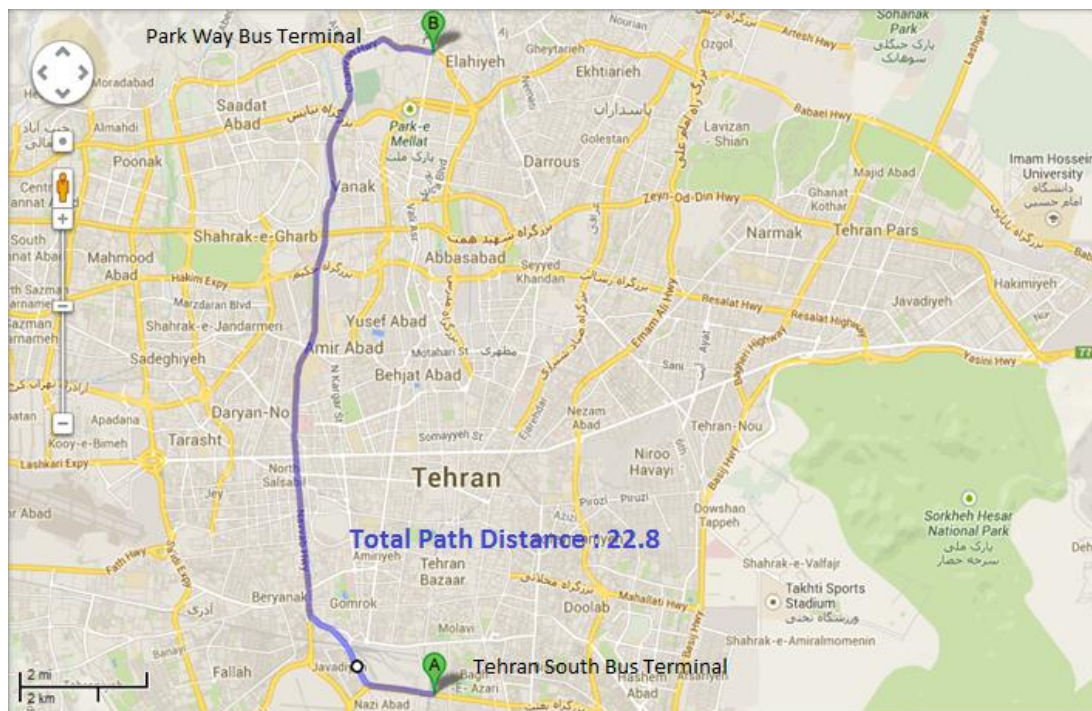
Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, 6% of working time pressure was above 200 mbar and only 10% above 150mbar.
- Figure 2 displays flow temperature distribution for DPF’s upstream. It can be obviously observed that 11% of total working time, temperature is above 400 °C and 17% above 350°C.
- Two cleaning for 8 days working was unacceptable for this DPF operation.

Filter operation status	Excellent <input type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input checked="" type="checkbox"/>	Failed <input type="checkbox"/>

Vehicle plate number	85423
Bus line	Number 4 (south to north bus line)
DPF producer company	HJS_02 (active system with FBC – electrical heater)



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## Overall Information

*Table1- Overall Information*

Vehicle plate number	85423
CPK data logger number	LN: 001505, DN: 2001, Sim Number +989218469621
Bus line	Number 4 (south to north bus line)
Bus Terminals	South Bus Terminal - Park Way Bus Tehran Terminal
Total path distance	22.8 km
DPF producer company	HJS_02 (active system with FBC – electrical heater)
Installation date	19/Feb/2015
Report period	01/Nov/2015- 15/Nov/2015 (fifteen days)
K value - DPF upstream	1.75 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF has been working from installation date until now without any cleaning.
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	45131 km
Bus mileage over the period	3000 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	208 hours 55 minutes
Average working hours per day (including stop days)	13 hours 55 minutes
Bus average speed	14.36 km/hr
idle speed time to all working time ration	51.48 %
Total Bus fuel consumption over the period	1700 lit
Fuel consumption per hour	8.14 lit/hr
Average fuel consumption	0.57 lit/km
Total Bus additive consumption over the period	0.8 lit
Average additive consumption	267 cc/km
Additive consumption to fuel ration	471 cc/1000lit

### Temperature, Pressure and Engine Speed Overview

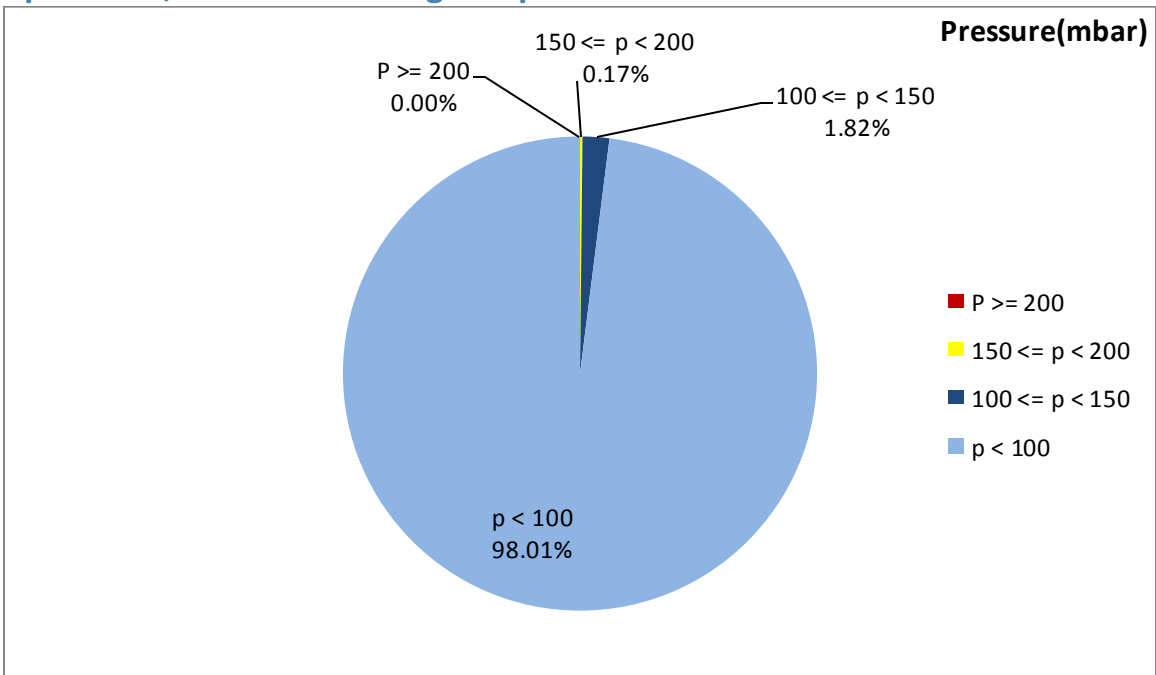


Figure 1- Pressure distribution over the working hours

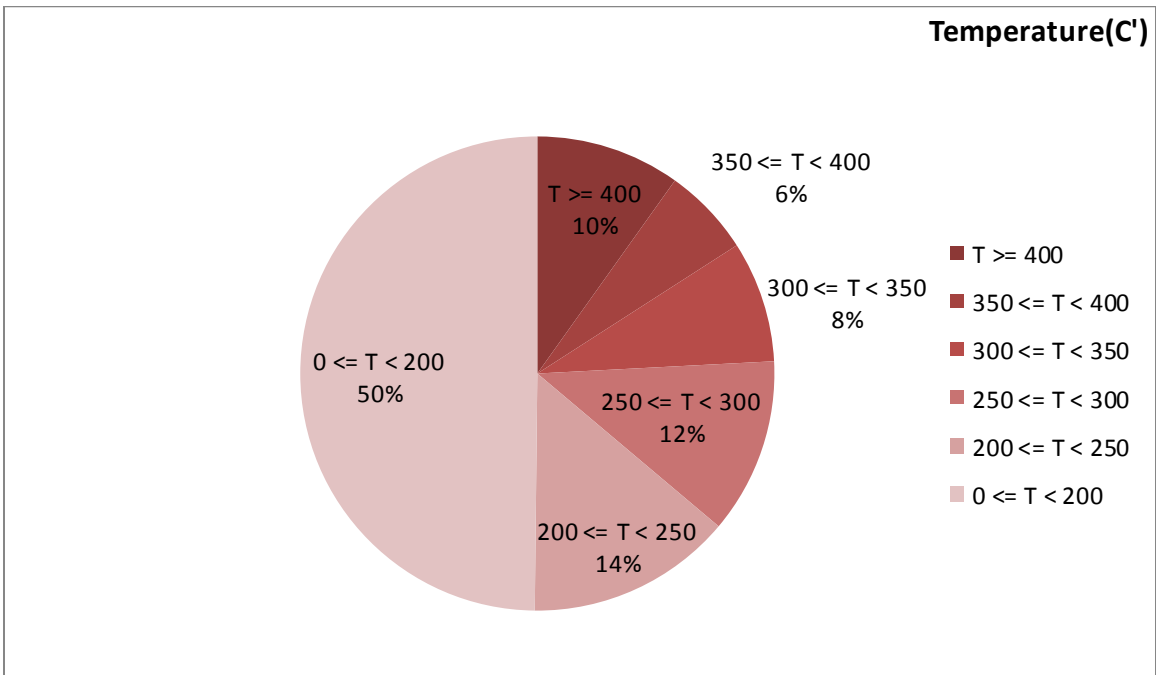


Figure 2-Temperature distribution over the working hours

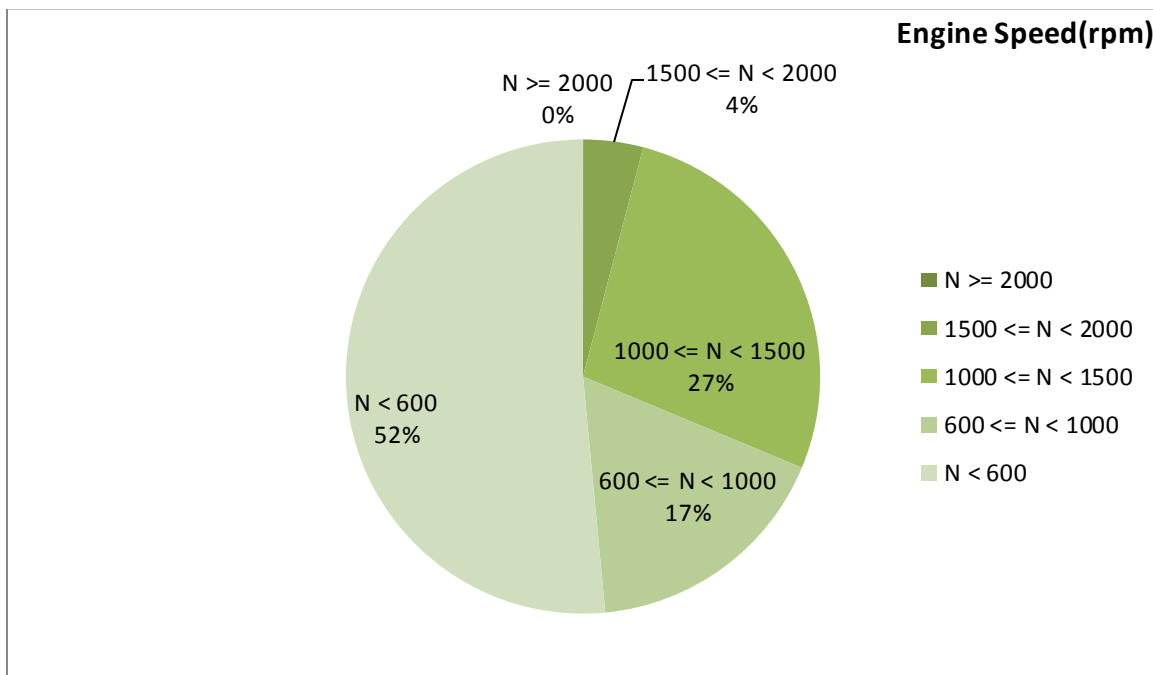


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
231.12	18.15	816

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
297.48	31.65	1102

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
622-50	201-0	2080-256

## Detailed Pressure Analysis

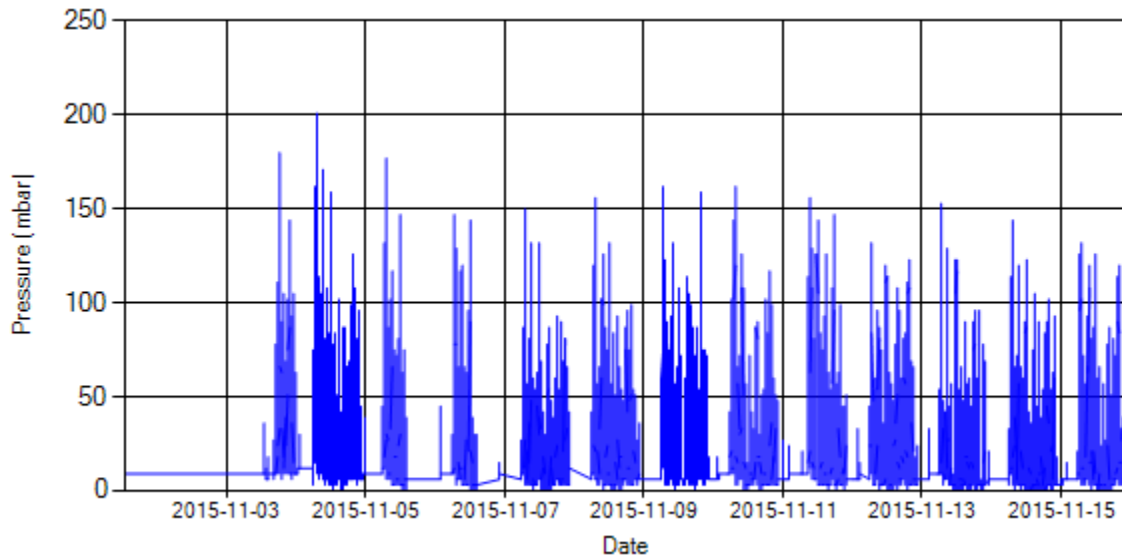


Figure 4- Pressure distribution over the period

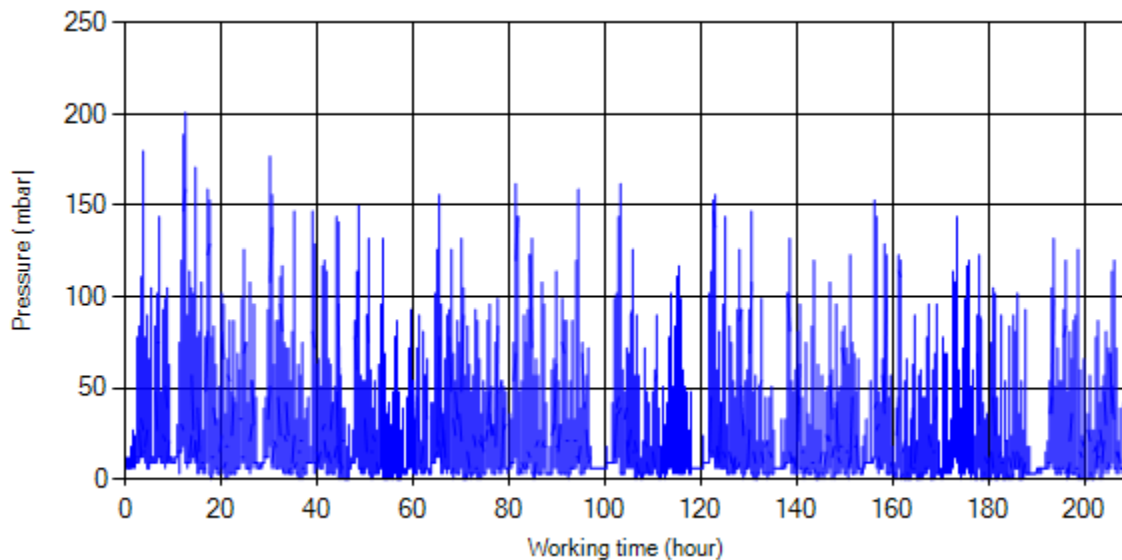


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.



## Detailed Temperature Analysis

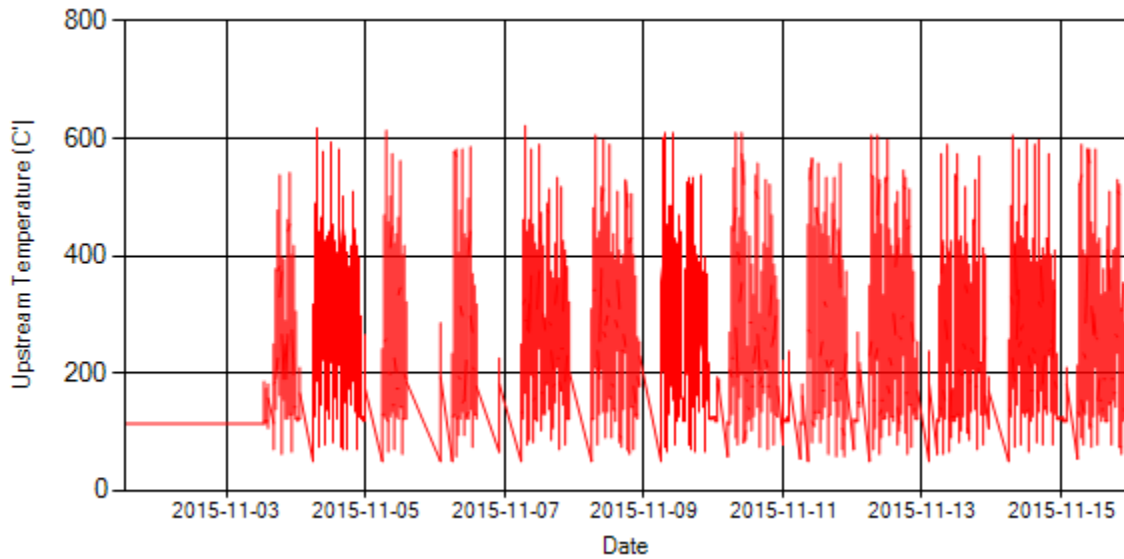


Figure 6- Temperature distribution over the period

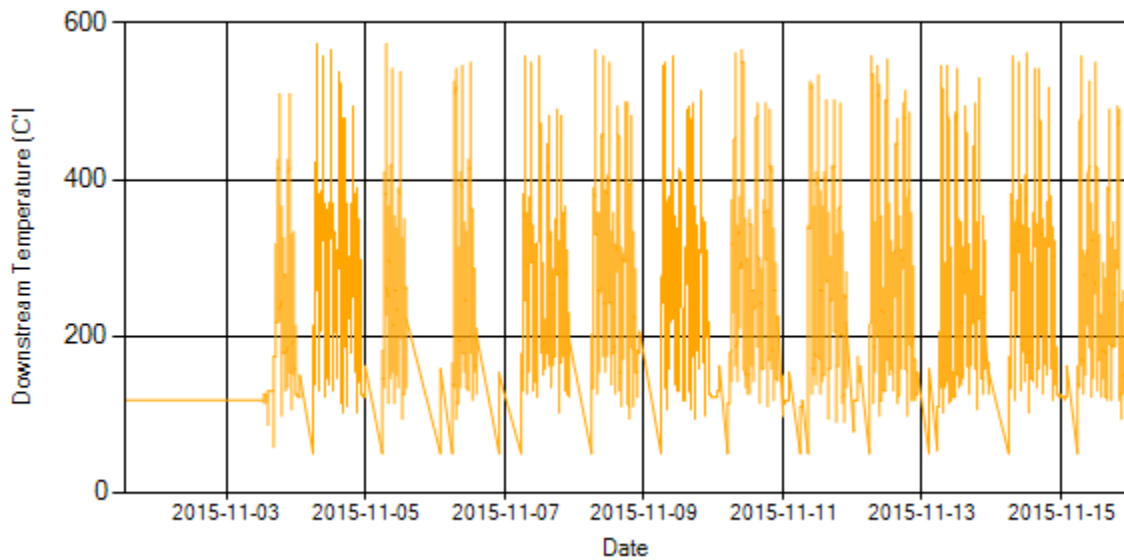
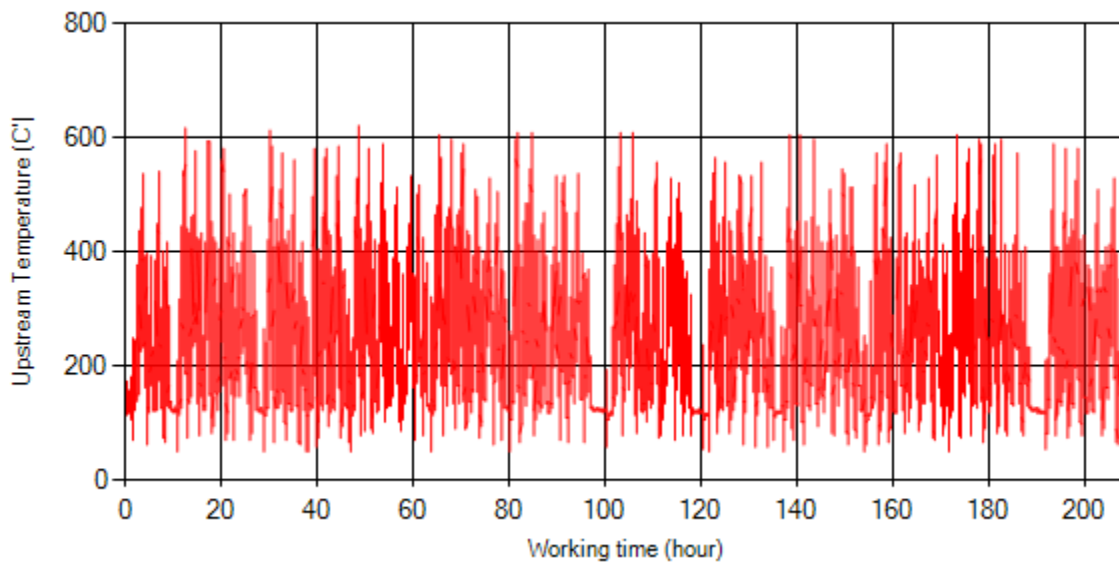
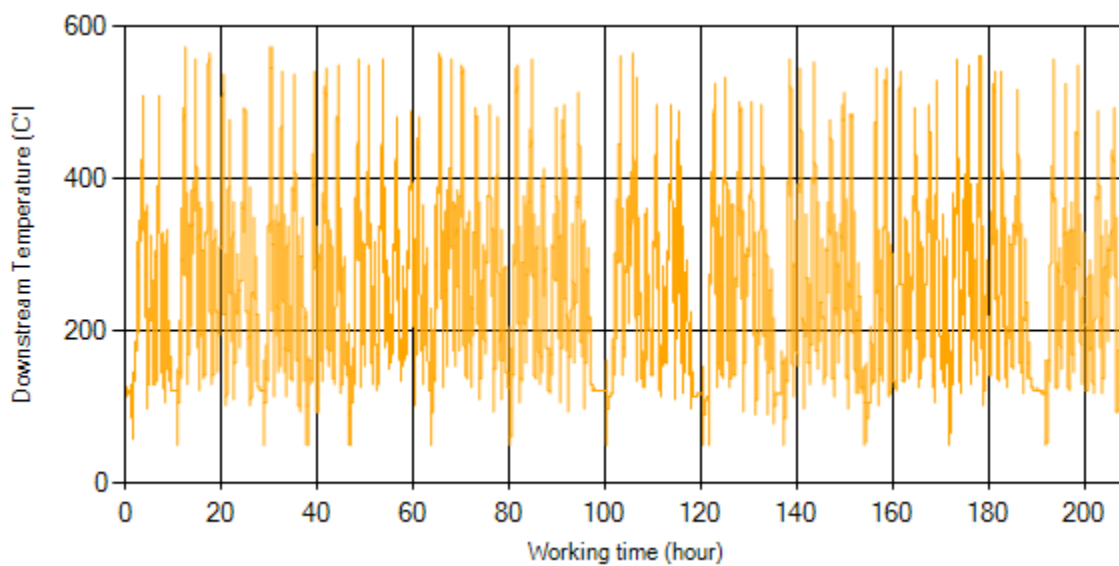


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

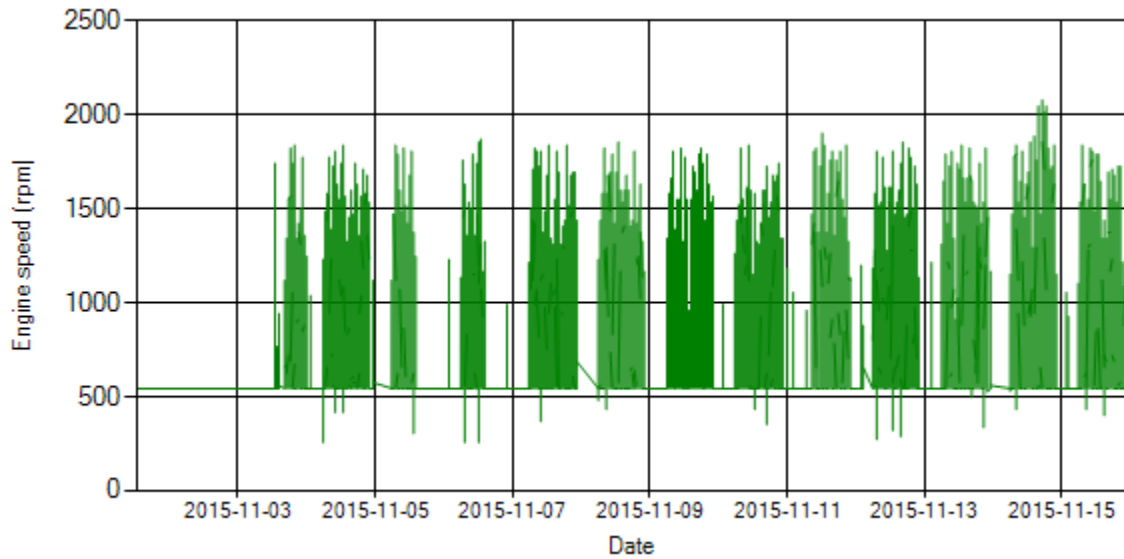


Figure 10- Engine speed distribution over the period

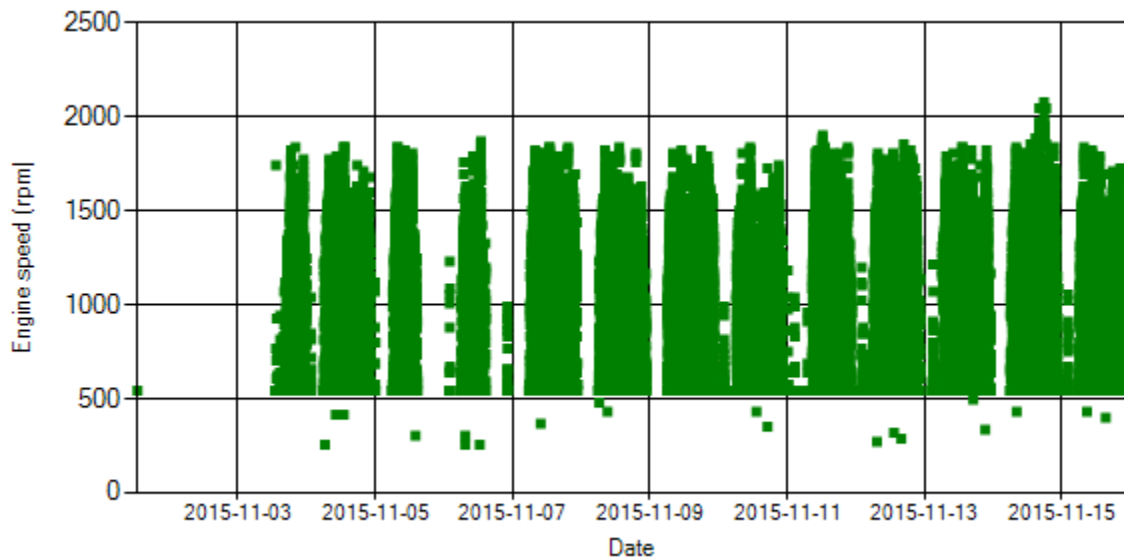


Figure 11- Engine speed diagram for calculating CPK's working days

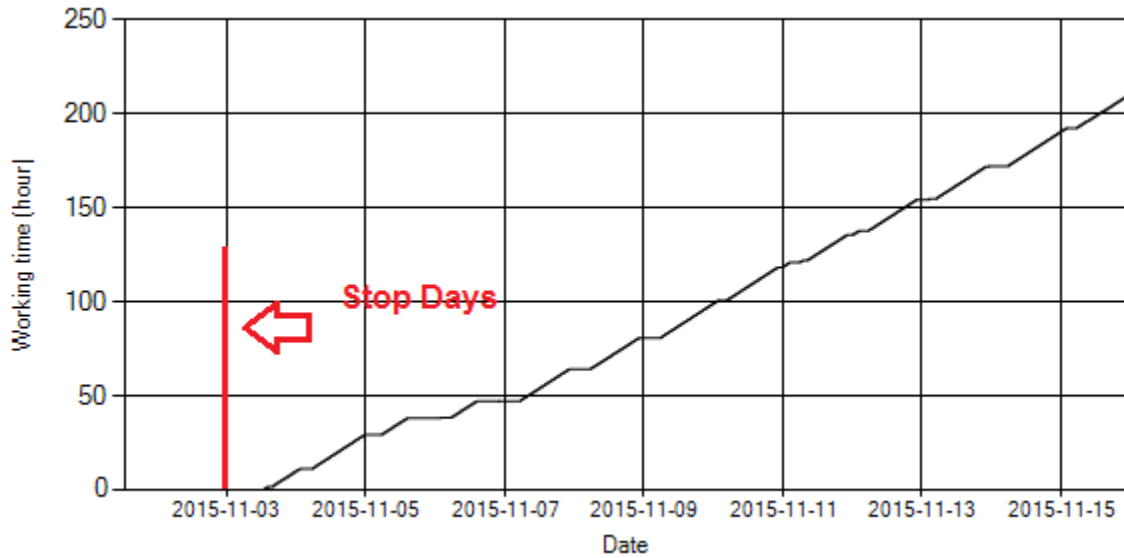


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data.

### Pressure-Engine Speed diagrams

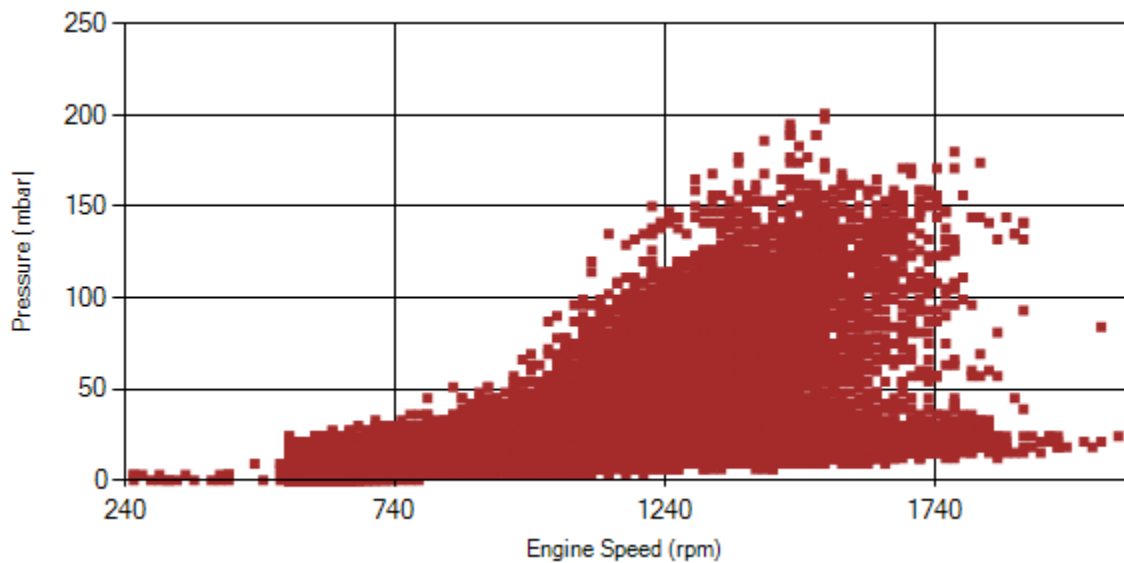


Figure 13- Pressure against engine speed

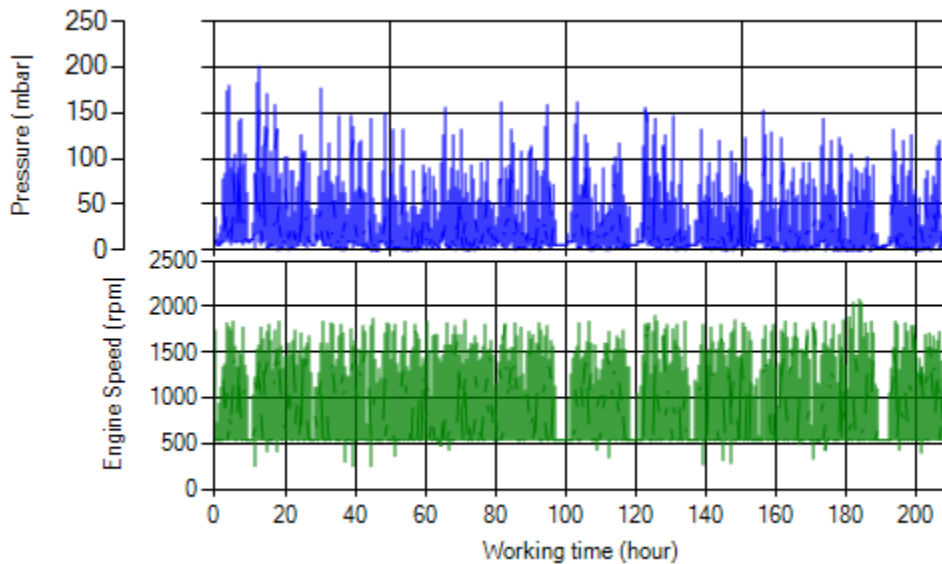


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

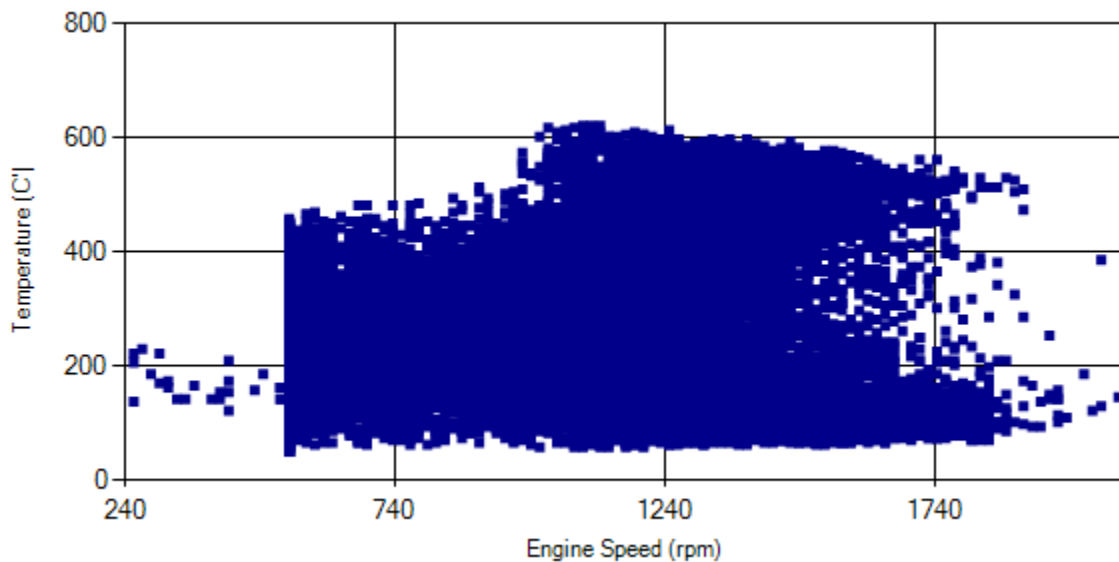


Figure 15- Temperature against engine speed

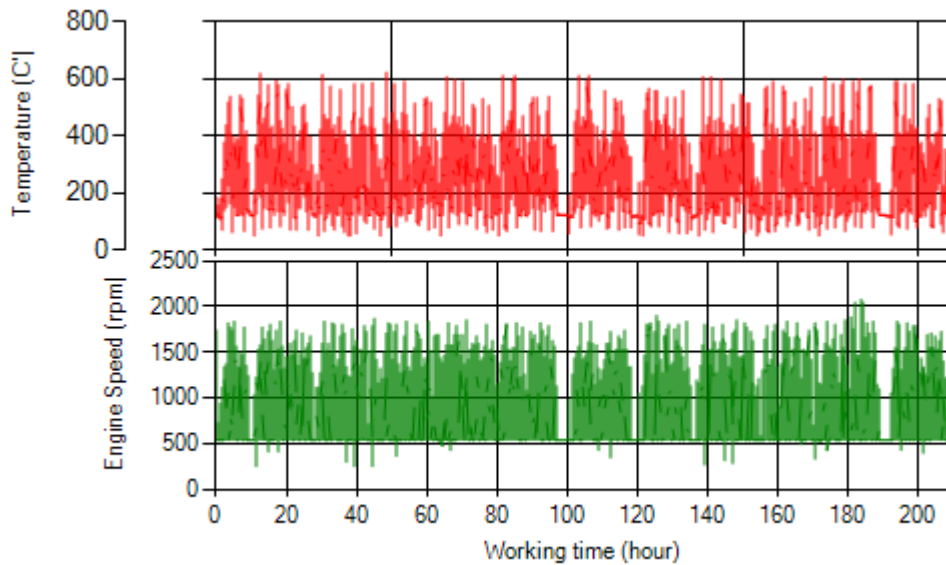


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, only 0.17% of time pressure was above 150 mbar and pressure above 200 can't be seen.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed that 10% of total working-time temperature is above 400 °C and 16% above 350°C.

Filter operation status	Excellent <input checked="" type="checkbox"/> Good <input type="checkbox"/> Maintenance required <input type="checkbox"/> Failed <input type="checkbox"/>
-------------------------	--

## Overall Information

*Table1- Overall Information*

Vehicle plate number	85423
CPK data logger number	LN: 001505, DN: 2001, Sim Number +989218469621
Bus line	Number 4 (south to north bus line)
Bus Terminals	South Bus Terminal - Park Way Bus Tehran Terminal
Total path distance	22.8 km
DPF producer company	HJS_02 (active system with FBC – electrical heater)
Installation date	19/Feb/2015
Report period	16/Nov/2015- 30/Nov/2015 (fifteen days)
K value - DPF upstream	1.75 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF has been working from installation date until now without any cleaning.
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	47931 km
Bus mileage over the period	2800 km
Working days over the period	15 days
Stop days	0 day
Data logger working days	15 days
Working hours over the period	217 hours 1 minutes
Average working hours per day (including stop days)	14hours 28 minutes
Bus average speed	12.9 km/hr
idle speed time to all working time ration	55.59 %
Total Bus fuel consumption over the period	1556 lit
Fuel consumption per hour	7.17 lit/hr
Average fuel consumption	0.56 lit/km
Total Bus additive consumption over the period	0.75 lit
Average additive consumption	268 cc/km
Additive consumption to fuel ration	482 cc/1000lit



## Temperature, Pressure and Engine Speed Overview

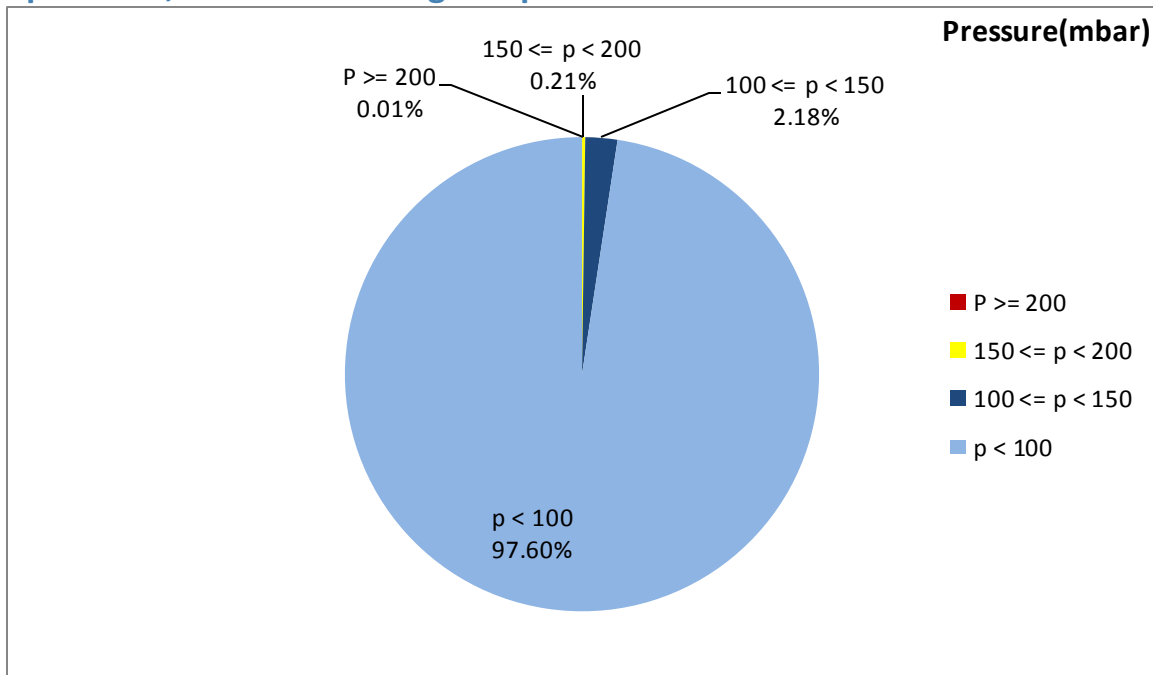


Figure 1- Pressure distribution over the working hours

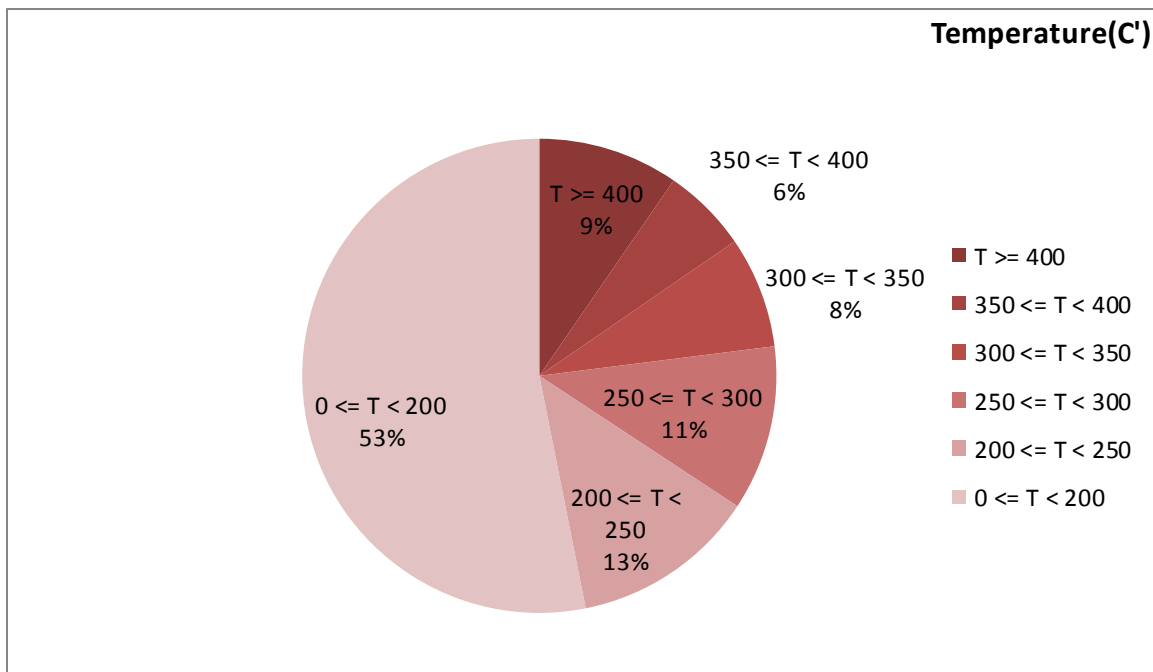


Figure 2-Temperature distribution over the working hours

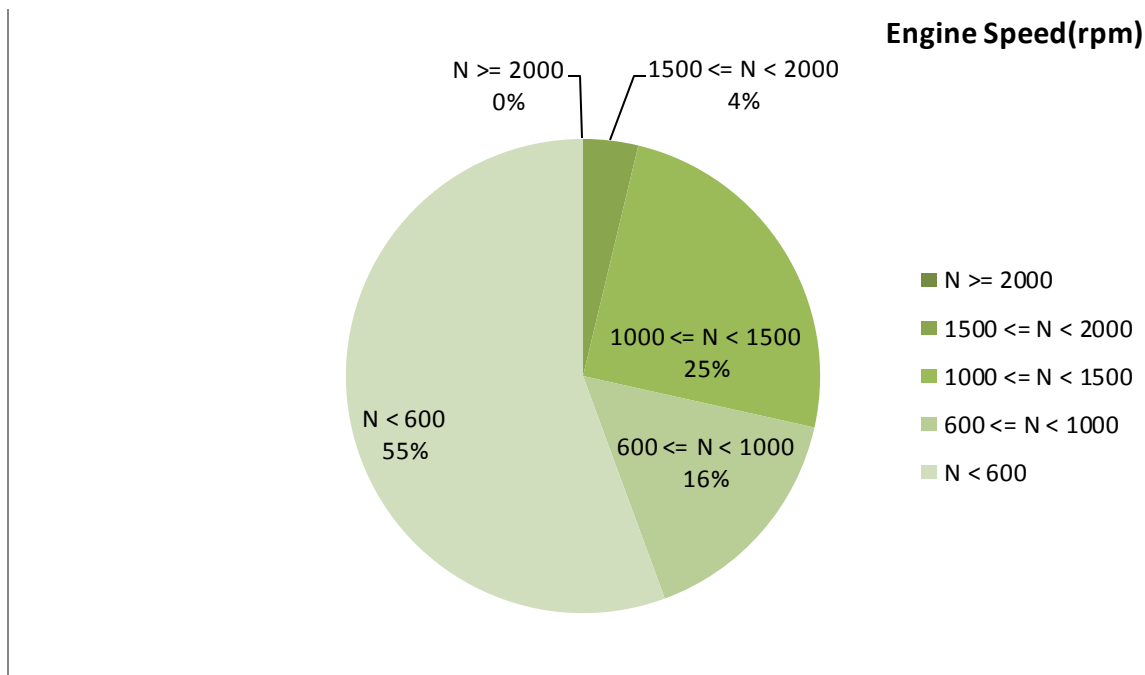


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
224.96	18.66	792

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
302.83	34.29	1099

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
646-50	219-0	1904-256

## Detailed Pressure Analysis

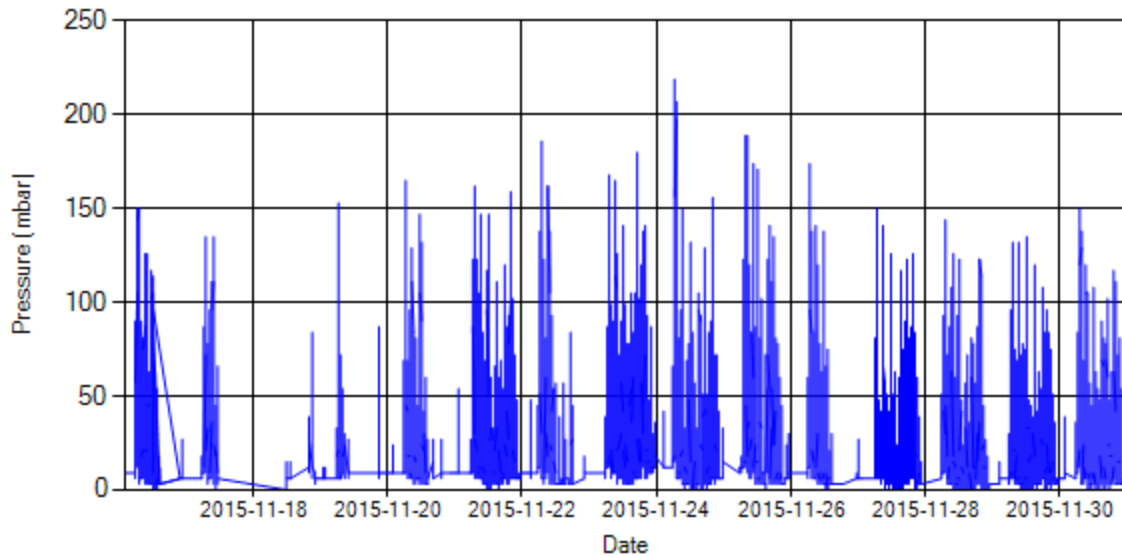


Figure 4- Pressure distribution over the period

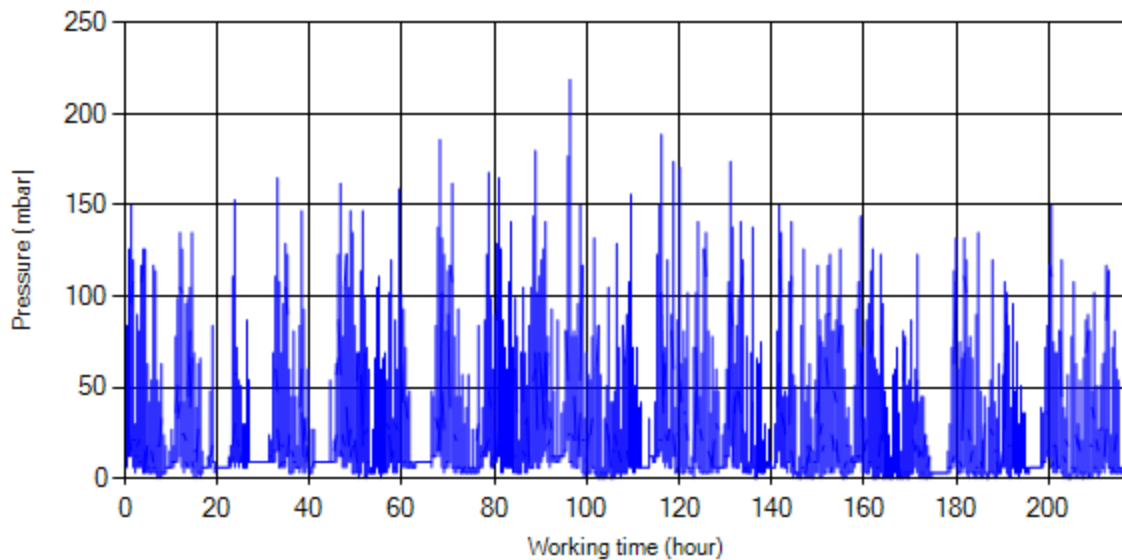


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

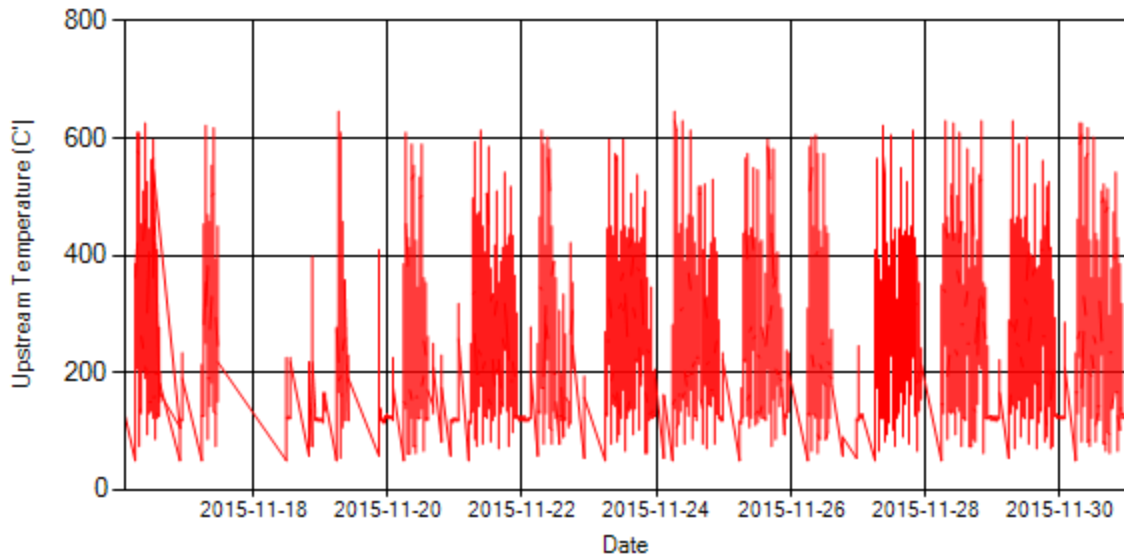


Figure 6- Temperature distribution over the period

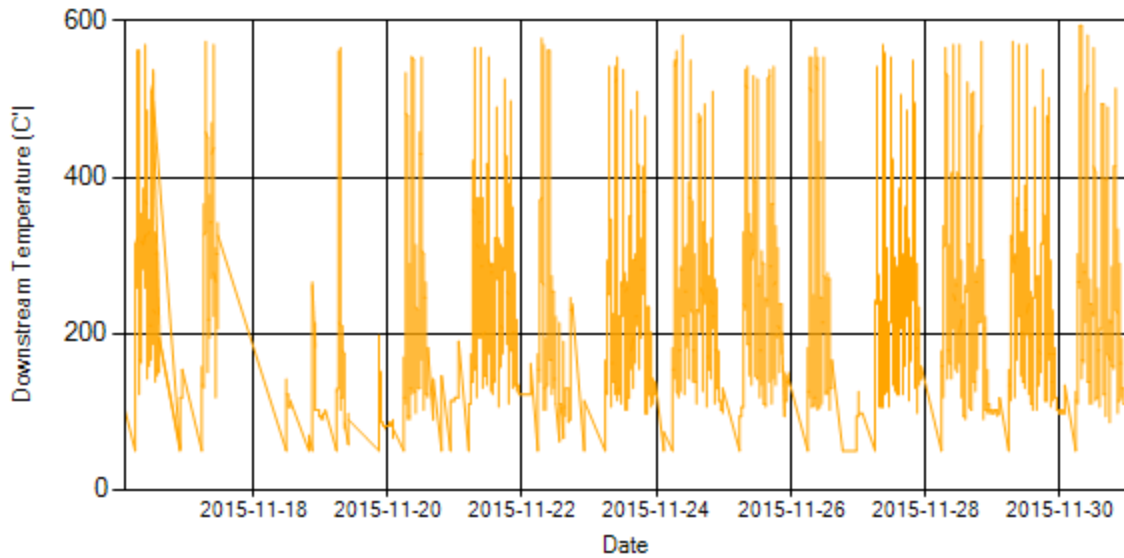
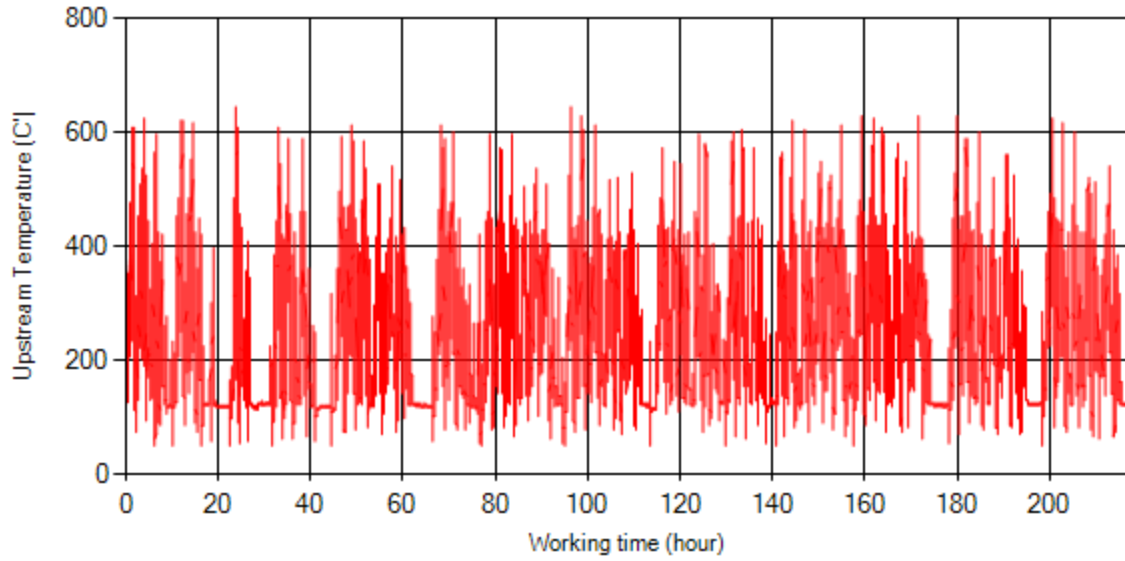
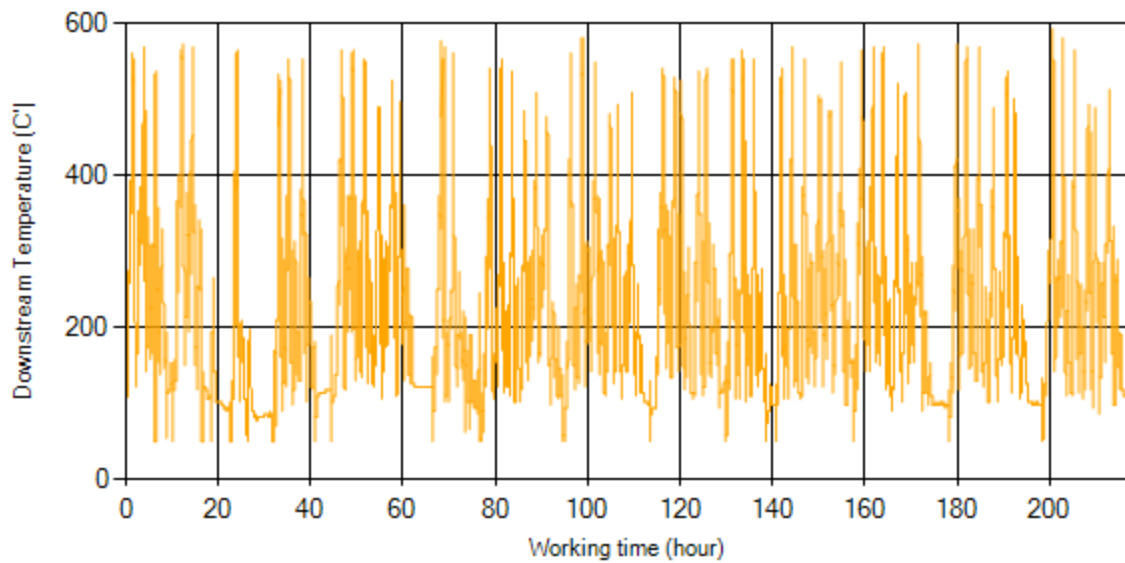


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

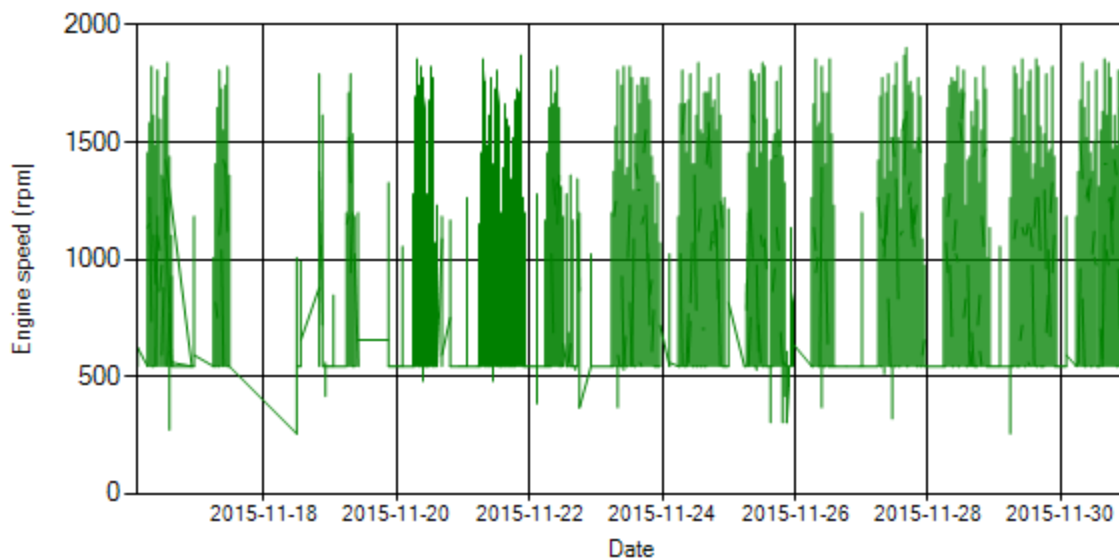


Figure 10- Engine speed distribution over the period

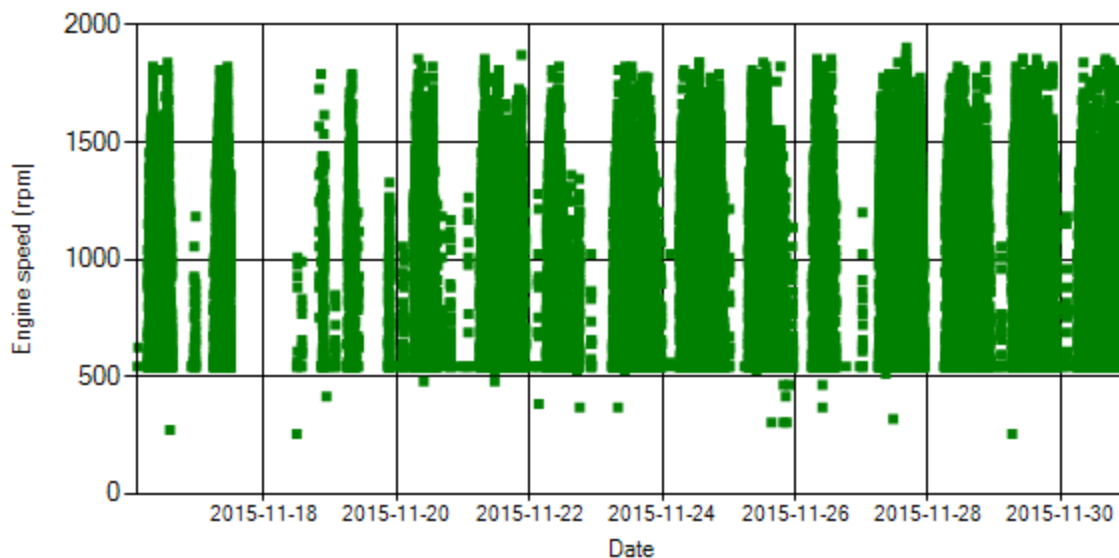


Figure 11- Engine speed diagram for calculating CPK's working days

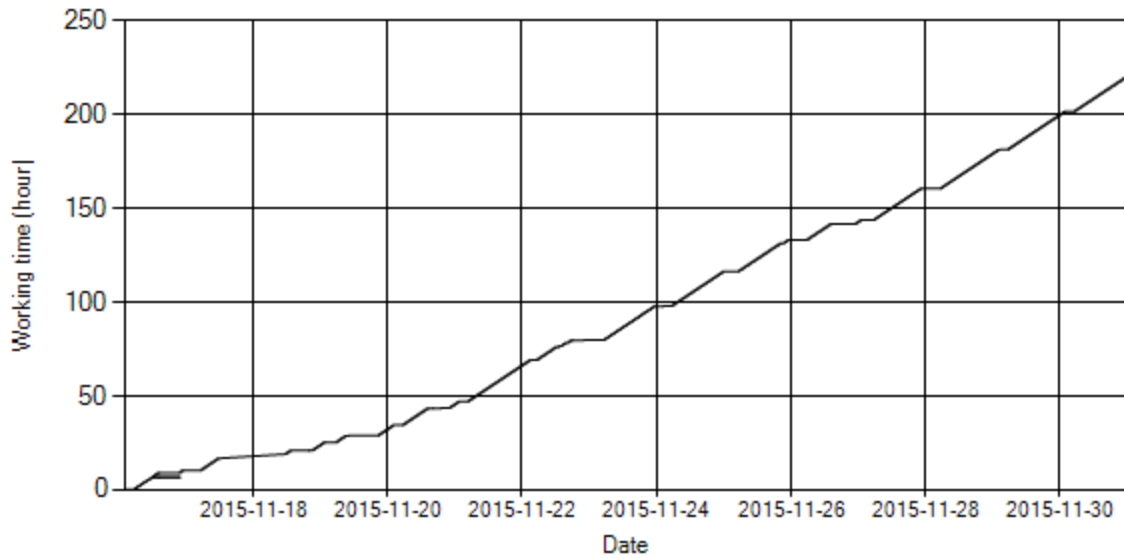


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12, bus was working all days during the period.

### Pressure-Engine Speed diagrams

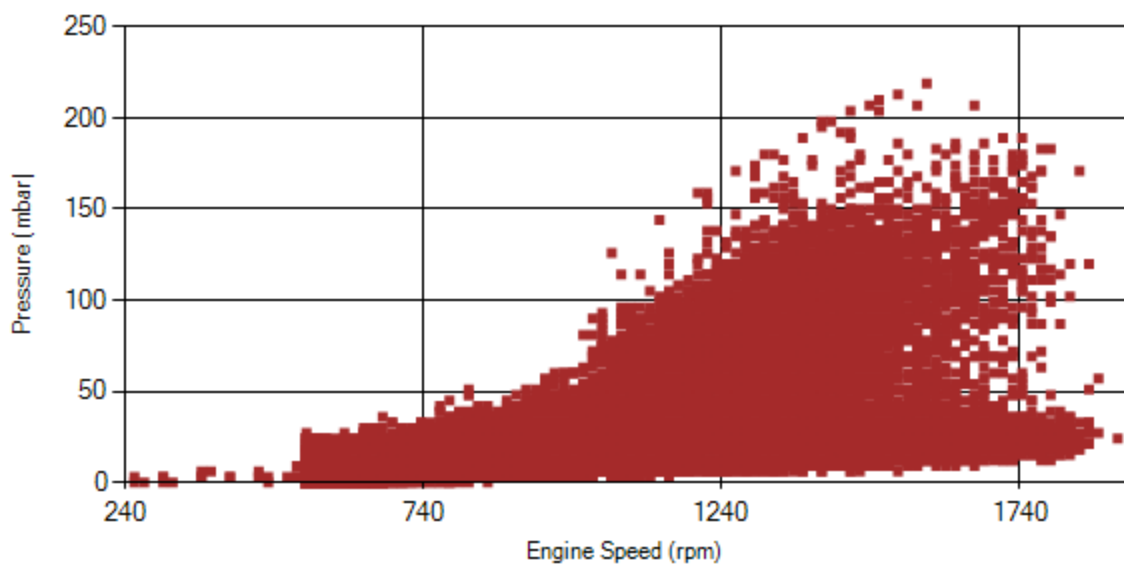


Figure 13- Pressure against engine speed

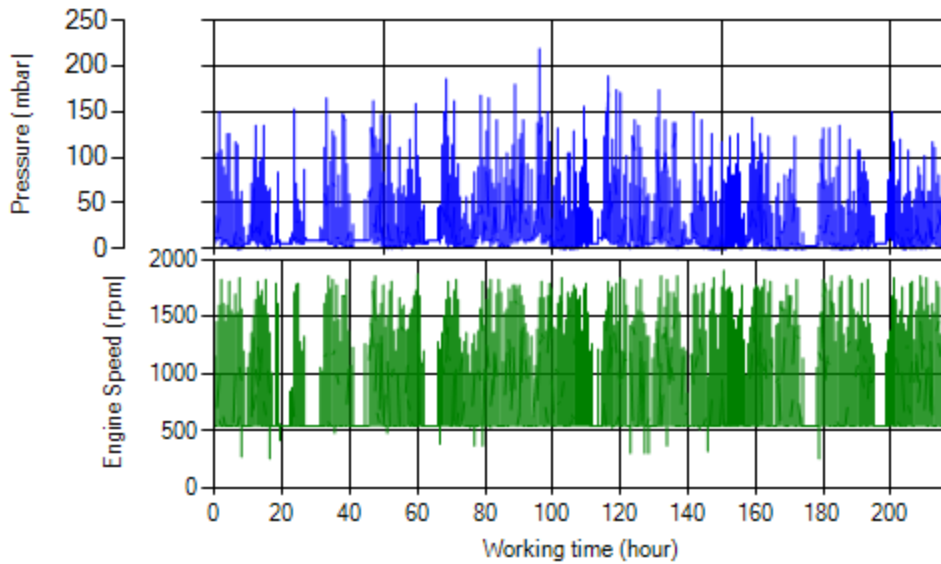


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

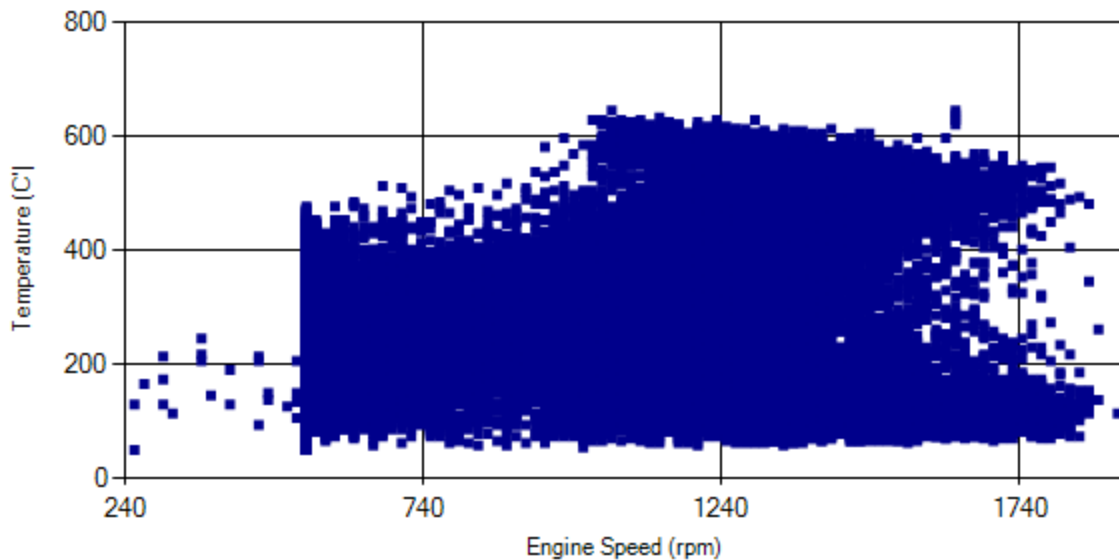


Figure 15- Temperature against engine speed



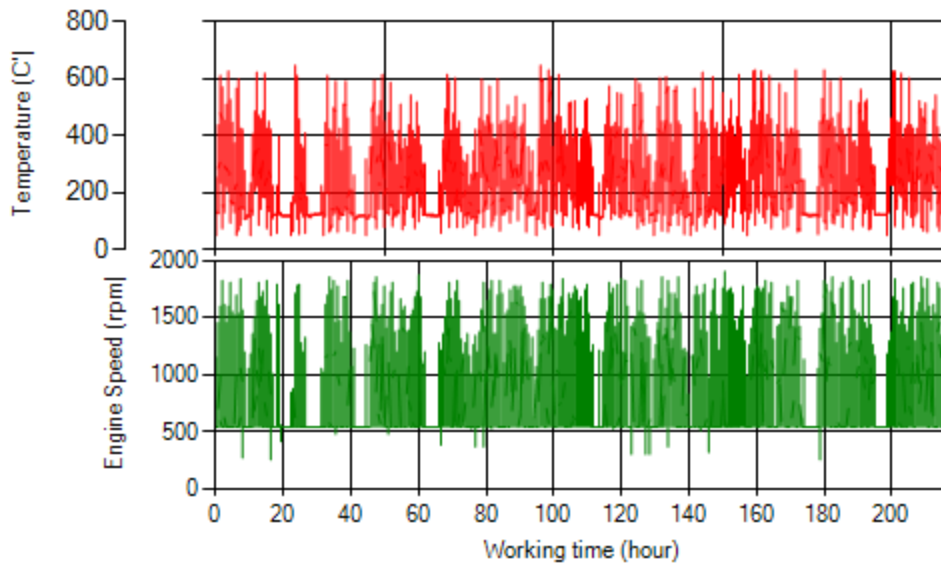


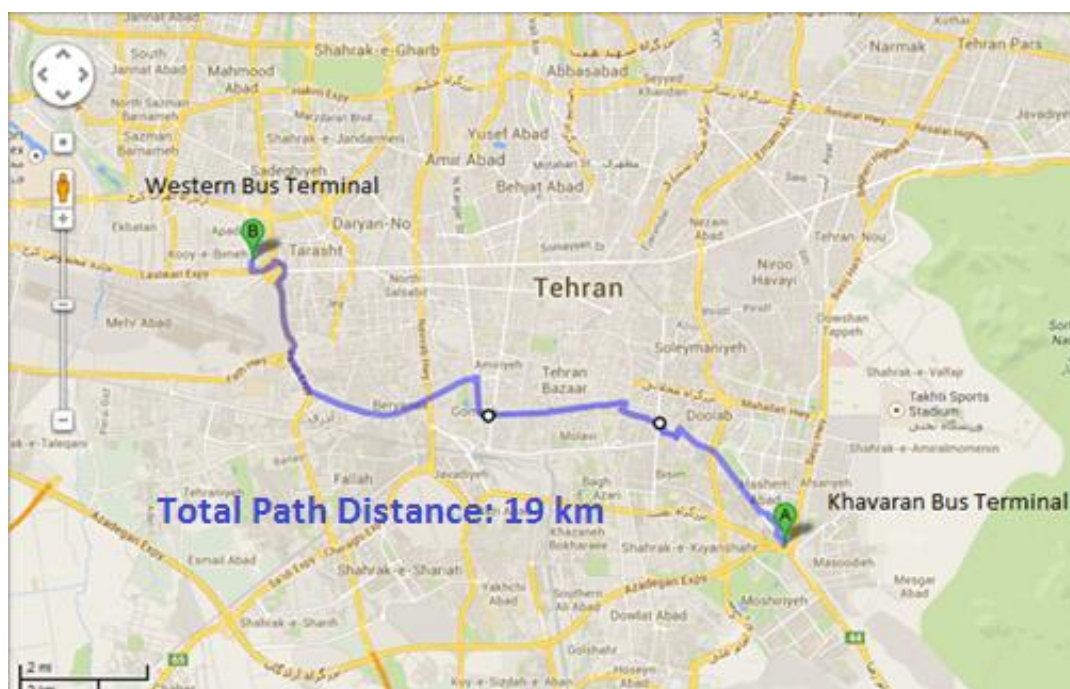
Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, only 0.01% of time pressure was above 200 mbar and 0.22% above 150 mbar.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed that 9% of total working-time temperature is above 400 °C and 15% above 350°C.

Filter operation status	Excellent <input checked="" type="checkbox"/> Good <input type="checkbox"/> Maintenance required <input type="checkbox"/> Failed <input type="checkbox"/>
-------------------------	--

Vehicle plate number	33572 (28958)
Bus line	Number 2 (west to east bus line)
DPF producer company	HJS_03 (active system with FBC – electrical heater)



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## Overall Information

*Table1- Overall Information*

Vehicle plate number	33572 (28958)
CPK data logger number	LN: 001521, DN: 1995, Sim Number +989218469643
Bus line	Number 2 (west to east bus line)
Bus Terminals	Khavaran Bus Terminal - Western Bus Terminal
Total path distance	19 km
DPF producer company	HJS_03 (active system with FBC – electrical heater)
Installation date	19/Feb/2015
Report period	01/Nov/2015 – 15/Nov/2015 (fifteen days)
K value - DPF upstream	1.75 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF was cleaned on Oct 5 <sup>th</sup> for the first time.
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	37432 km
Bus mileage over the period	2607 km
Working days over the period	15 days
Stop days	0 day
Data logger working days	15 days
Working hours over the period	244 hours 58 minutes
Average working hours per day (including stop days)	16 hours 19 minutes
Bus average speed	10.64 km/hr
idle speed time to all working time ration	-
Total Bus fuel consumption over the period	1694 lit
Fuel consumption per hour	6.9 lit/hr
Average fuel consumption	0.65 lit/km
Total Bus additive consumption over the period	0.75 lit
Average additive consumption	288 cc/km
Additive consumption to fuel ration	444 cc/1000lit (batch dosing with tank level)

Notice: RPM sensor got problem on Nov 11<sup>th</sup> . So some engine speed related parameters missed or show unreasonable values (e.g. working hours and related parameters)

### Temperature, Pressure and Engine Speed Overview

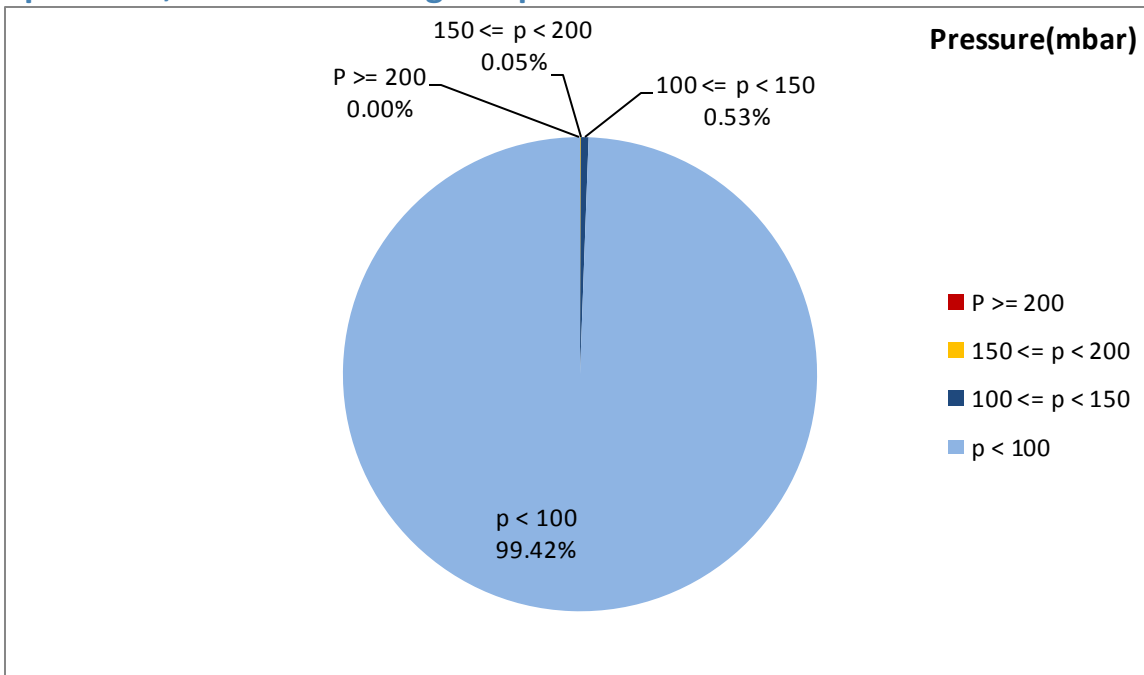


Figure 1- Pressure distribution over the working hours

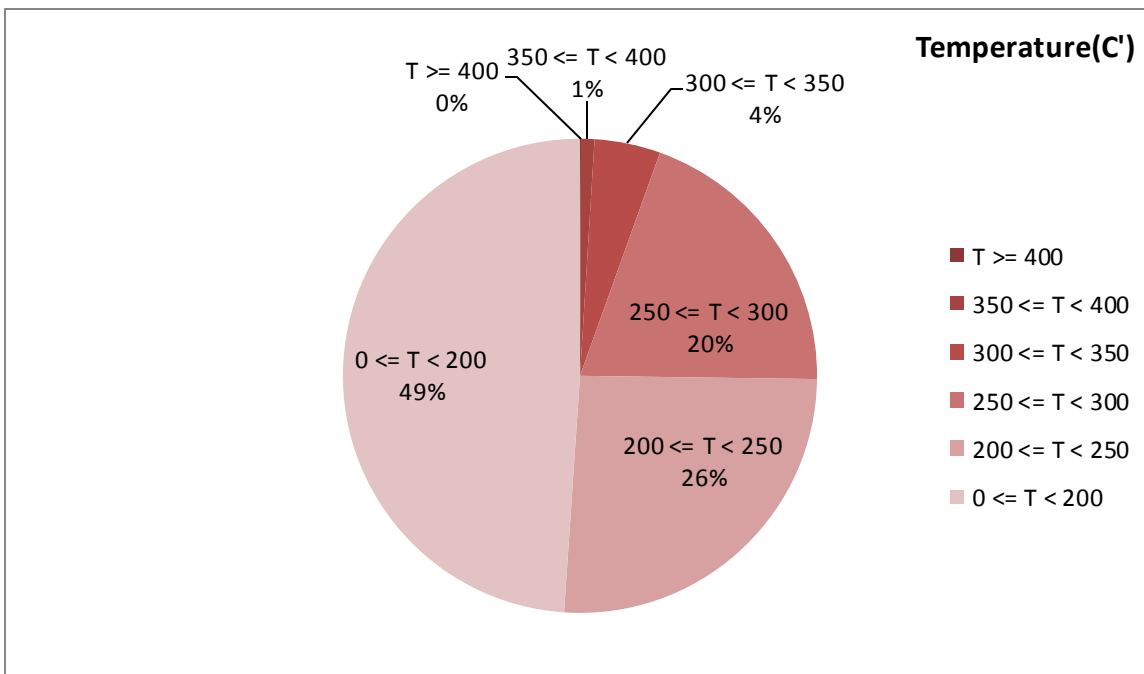


Figure 2-Temperature distribution over the working hours

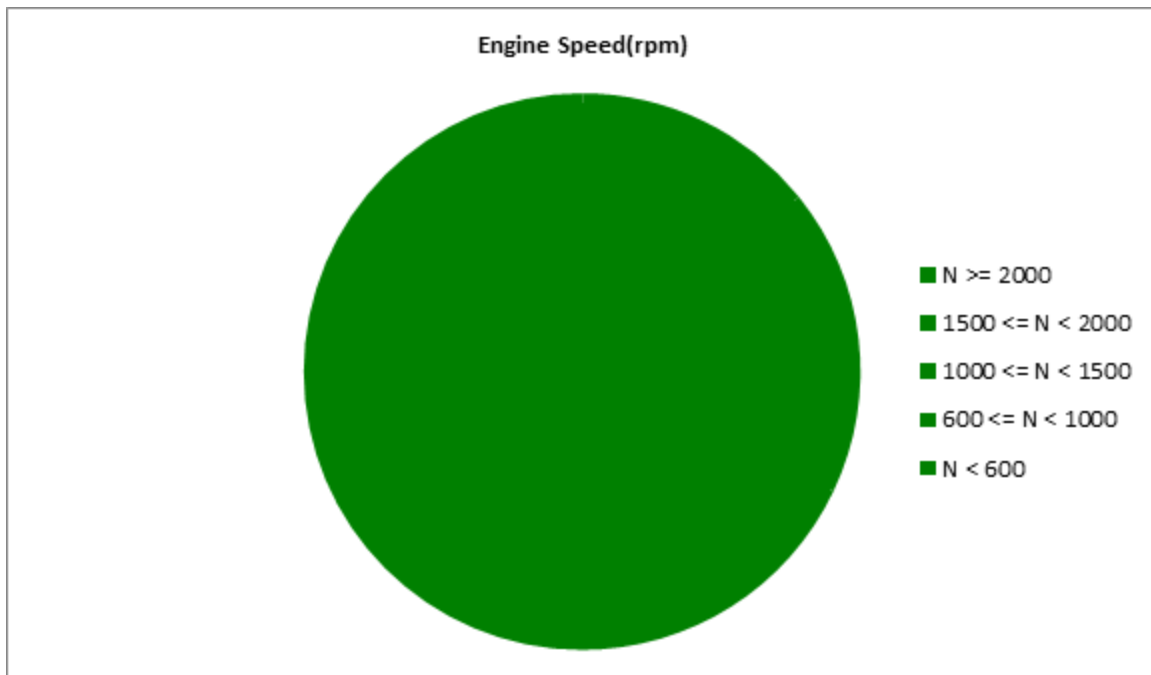


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
198.09	18.29	-

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
-	-	-

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
450-50	216-0	2096-0

Notice: RPM sensor got problem on Nov 11<sup>th</sup> . So some engine speed related parameters missed or show unreasonable values.

## Detailed Pressure Analysis

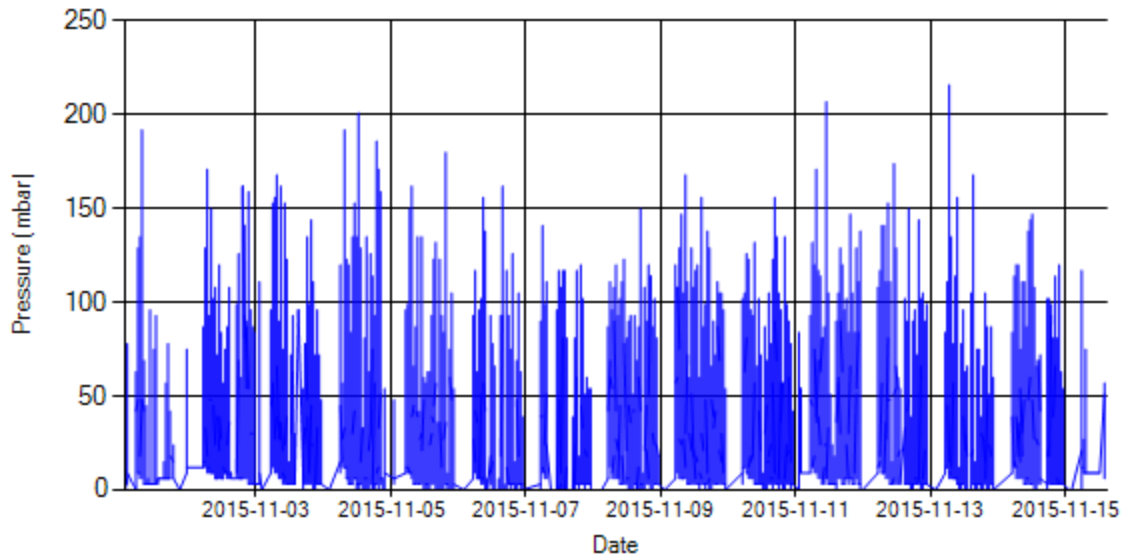


Figure 4- Pressure distribution over the period

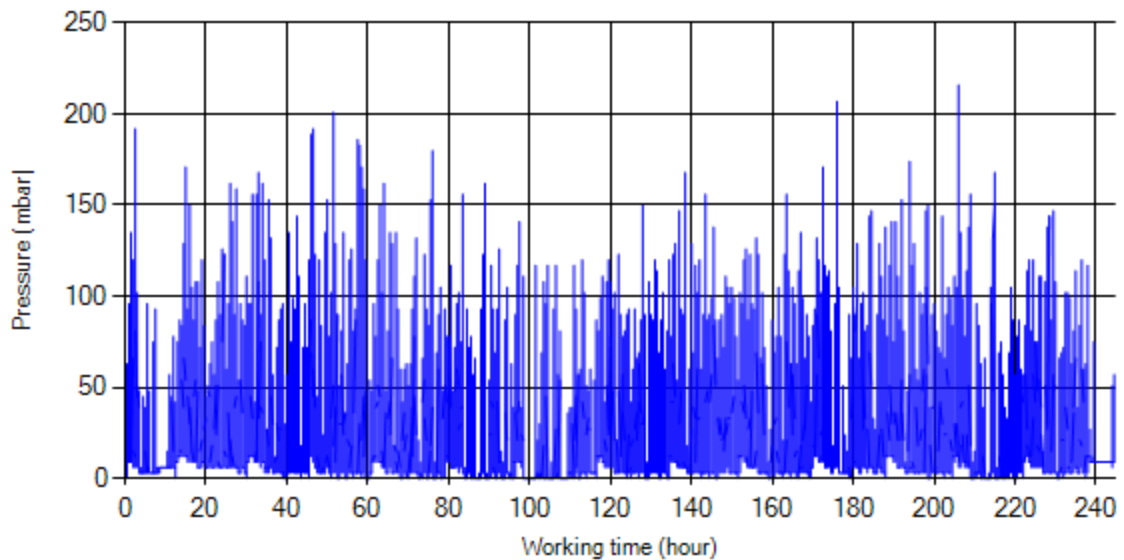


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

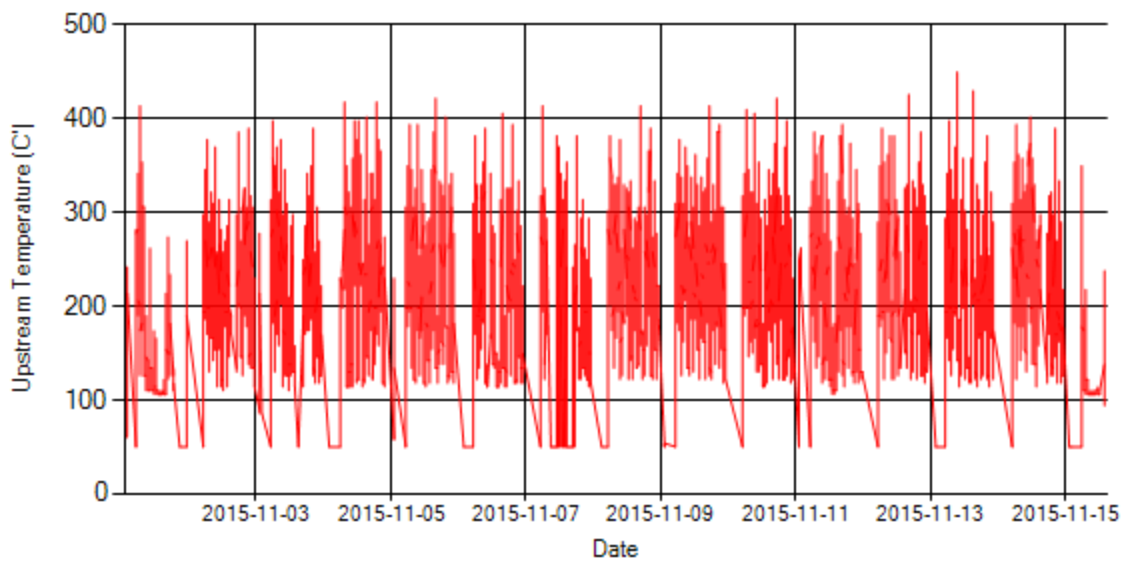


Figure 6- Temperature distribution over the period

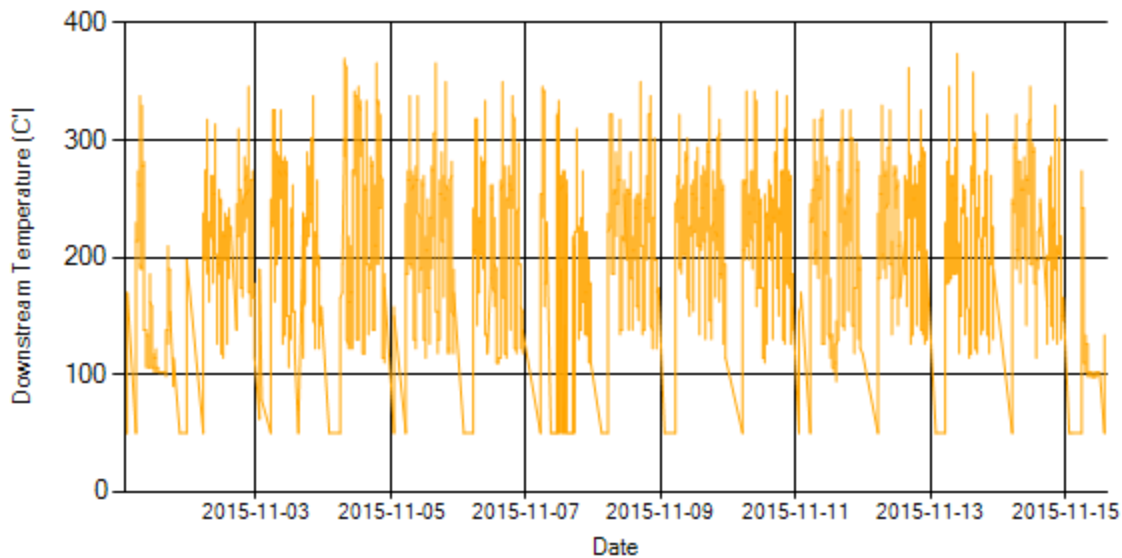
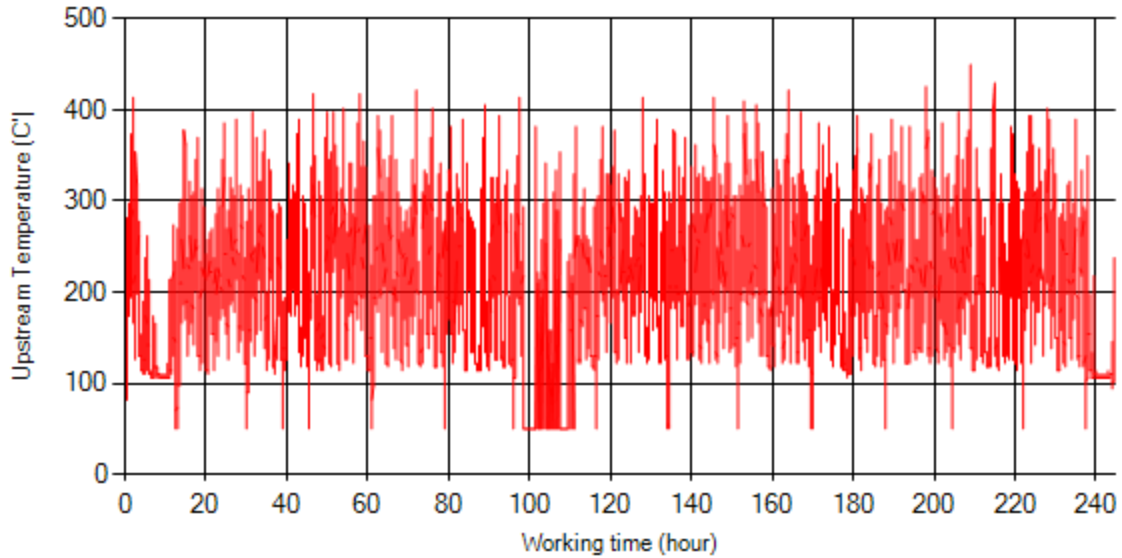
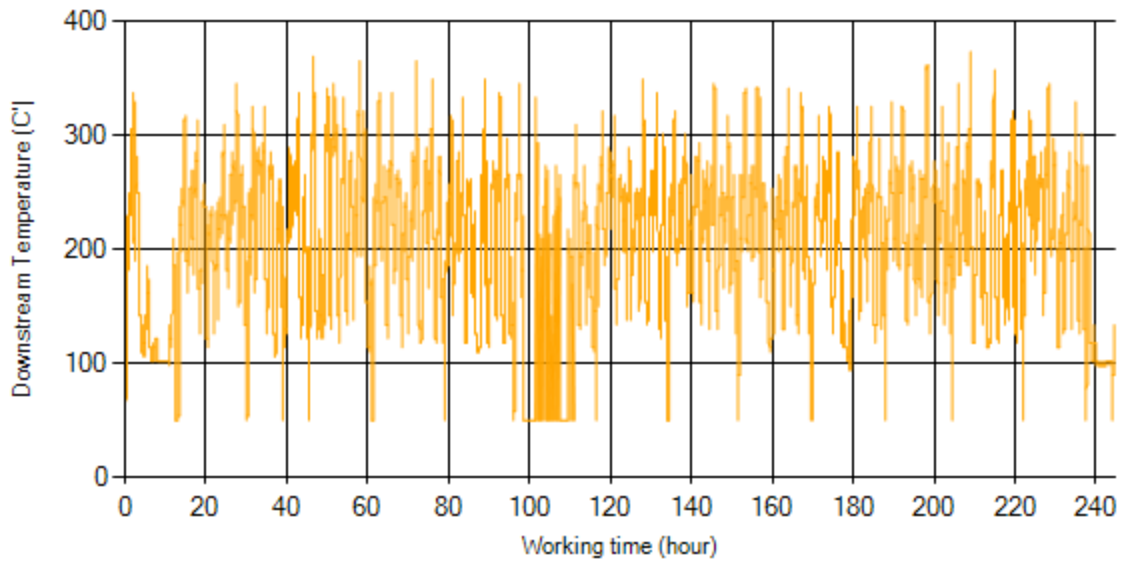


Figure 7- Temperature distribution over the period





*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

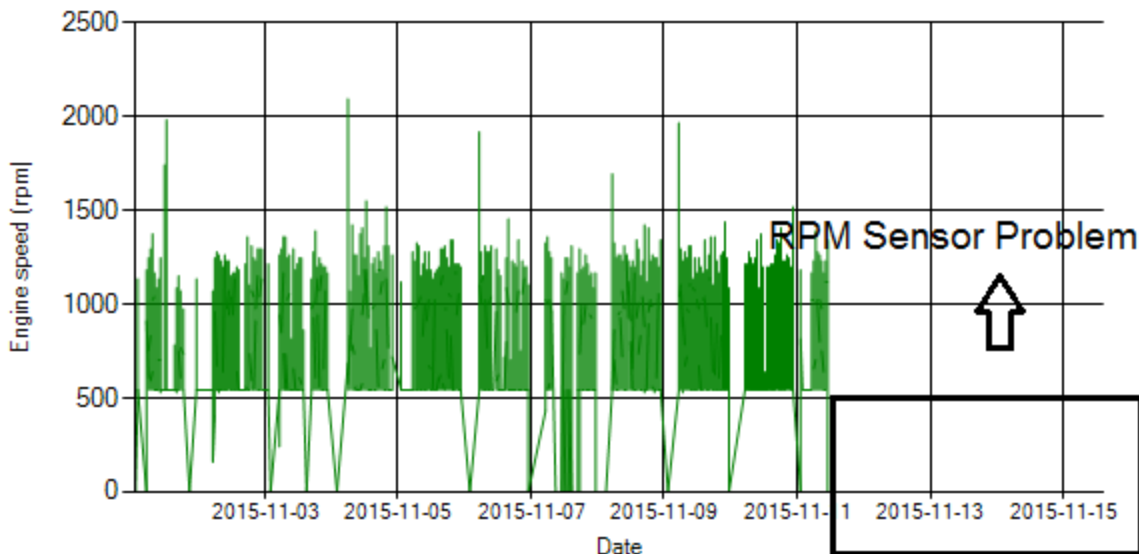


Figure 10- Engine speed distribution over the period

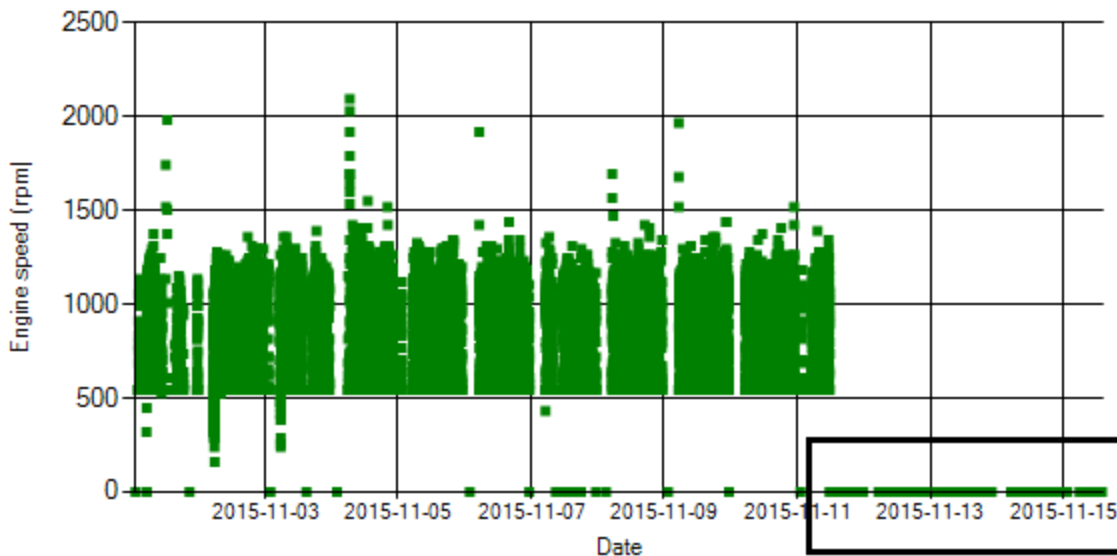


Figure 11- Engine speed diagram for calculating CPK's working days

Notice: RPM sensor got problem on Nov 11<sup>th</sup> . So some engine speed related parameters missed or show unreasonable values.

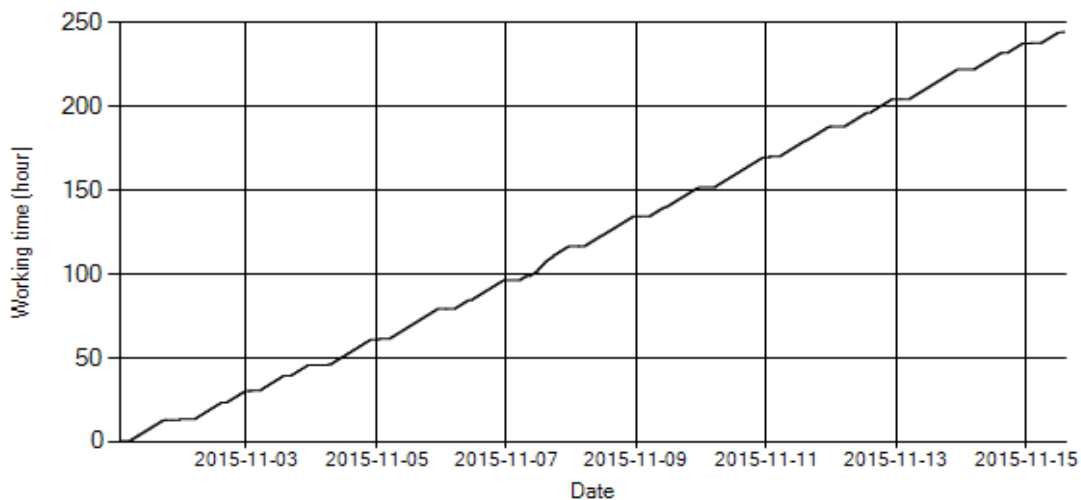


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12, system was working all days during the period.

### Pressure-Engine Speed diagrams

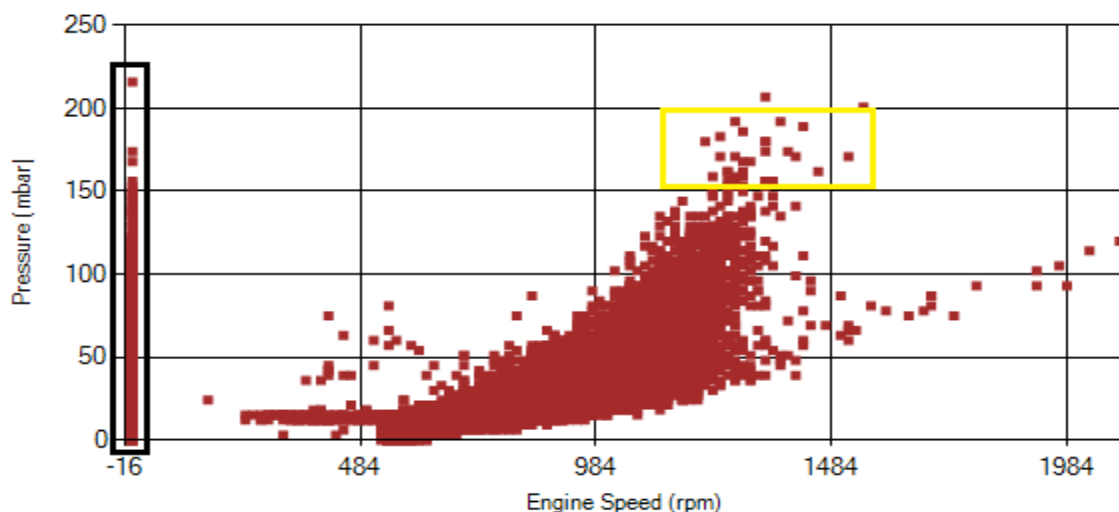


Figure 13- Pressure against engine speed

Notice: Yellow alarm ( $200 > \text{pressure} > 150$ ) range was indicated in figure 13. Straight line (black region) was because of RPM sensor problem.

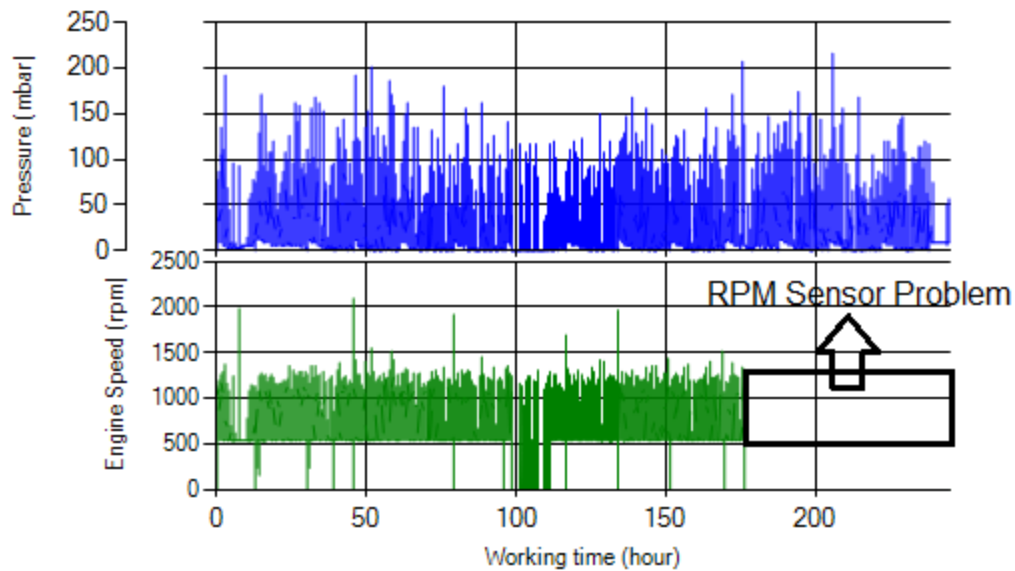


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

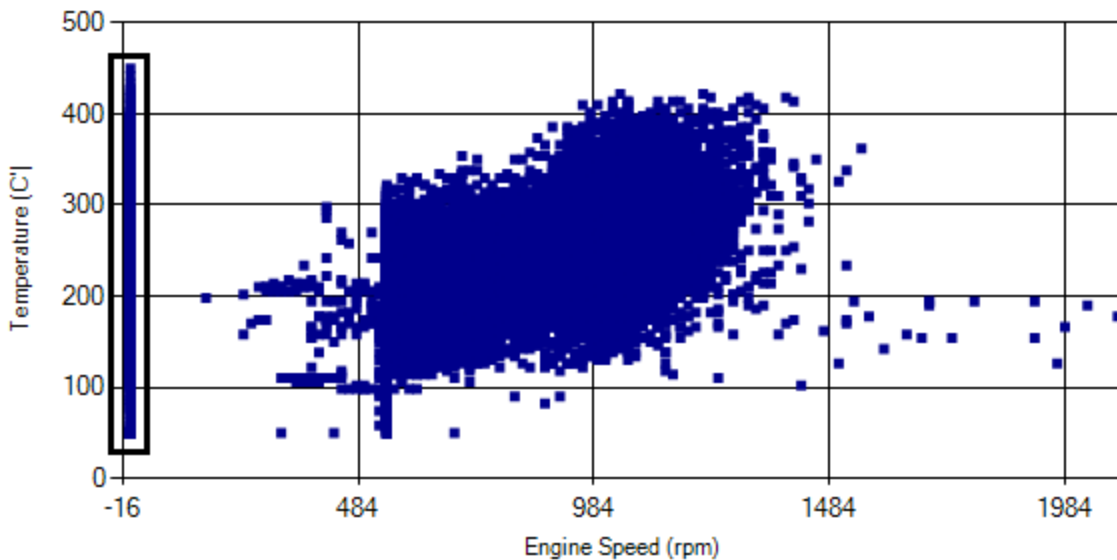


Figure 15- Temperature against engine speed

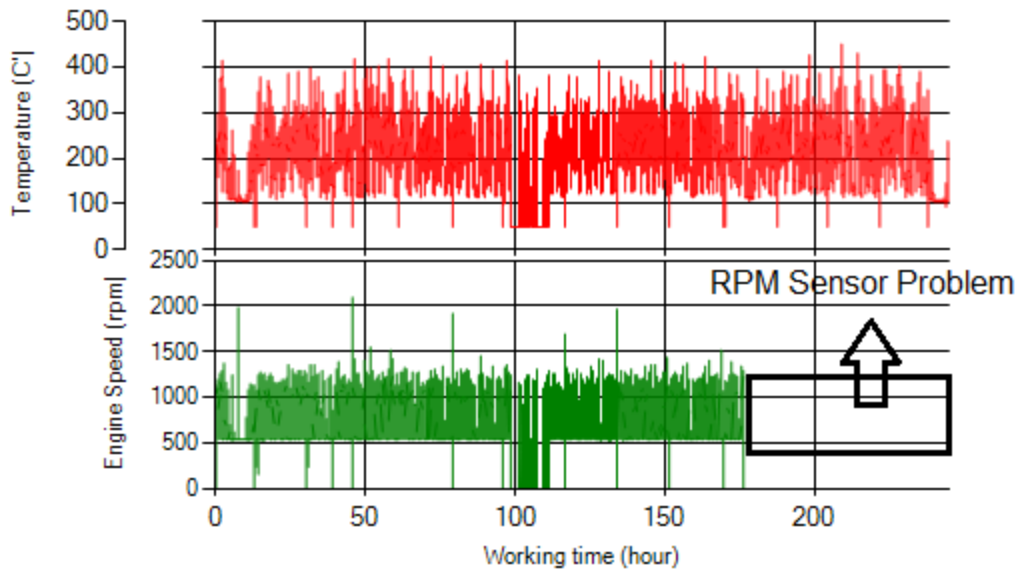


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, only 0.05% of total working time pressure was above 150 mbar during this period. This low pressure distribution was due to filter cleaning on Oct 5<sup>th</sup>.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed that 1% of total working time temperature is above 350°C.

Filter operation status	Excellent <input checked="" type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input type="checkbox"/>	Failed <input type="checkbox"/>

## Overall Information

*Table1- Overall Information*

Vehicle plate number	33572 (28958)
CPK data logger number	LN: 001521, DN: 1995, Sim Number +989218469643
Bus line	Number 2 (west to east bus line)
Bus Terminals	Khavaran Bus Terminal - Western Bus Terminal
Total path distance	19 km
DPF producer company	HJS_03 (active system with FBC – electrical heater)
Installation date	19/Feb/2015
Report period	16/Nov/2015 – 30/Nov/2015 (fifteen days)
K value - DPF upstream	1.75 [1/m]
K value – DPF downstream	0.02 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF was cleaned on Oct 5 <sup>th</sup> for the first time.
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	38979 km
Bus mileage over the period	1547 km
Working days over the period	11 days
Stop days	4 days
Data logger working days	11 days
Working hours over the period	137 hours 48 minutes
Average working hours per day (including stop days)	9 hours 11 minutes
Bus average speed	11.2 km/hr
idle speed time to all working time ration	-
Total Bus fuel consumption over the period	990 lit
Fuel consumption per hour	7.2 lit/hr
Average fuel consumption	0.64 lit/km
Total Bus additive consumption over the period	0.42 lit
Average additive consumption	271 cc/km
Additive consumption to fuel ration	424 cc/1000lit

Notice: RPM sensor got problem on Nov 11<sup>th</sup> and was fixed on Nov 23<sup>rd</sup>. So some engine speed related parameters missed or show unreasonable values (e.g. working hours and related parameters)

## Temperature, Pressure and Engine Speed Overview

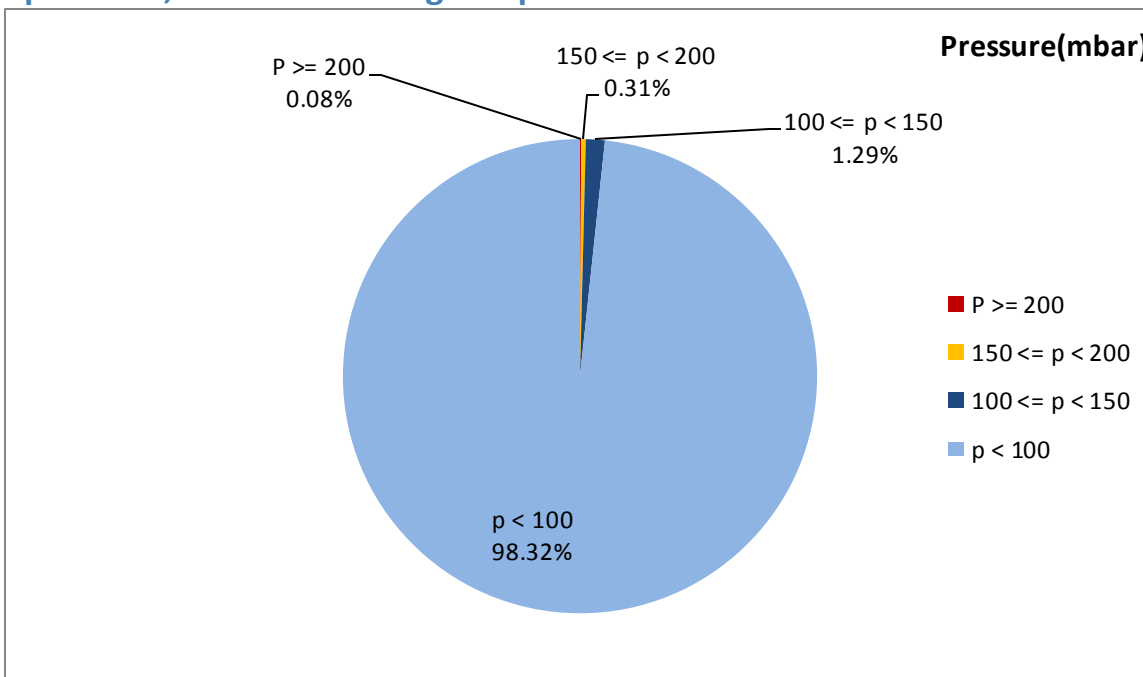


Figure 1- Pressure distribution over the working hours

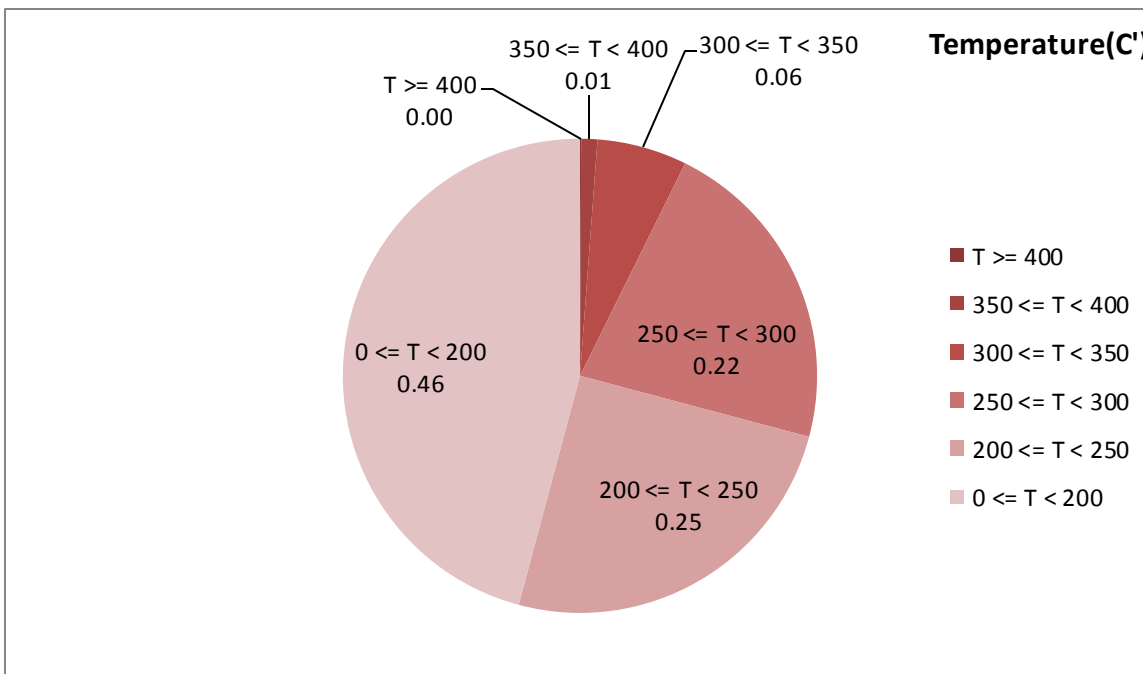


Figure 2-Temperature distribution over the working hours



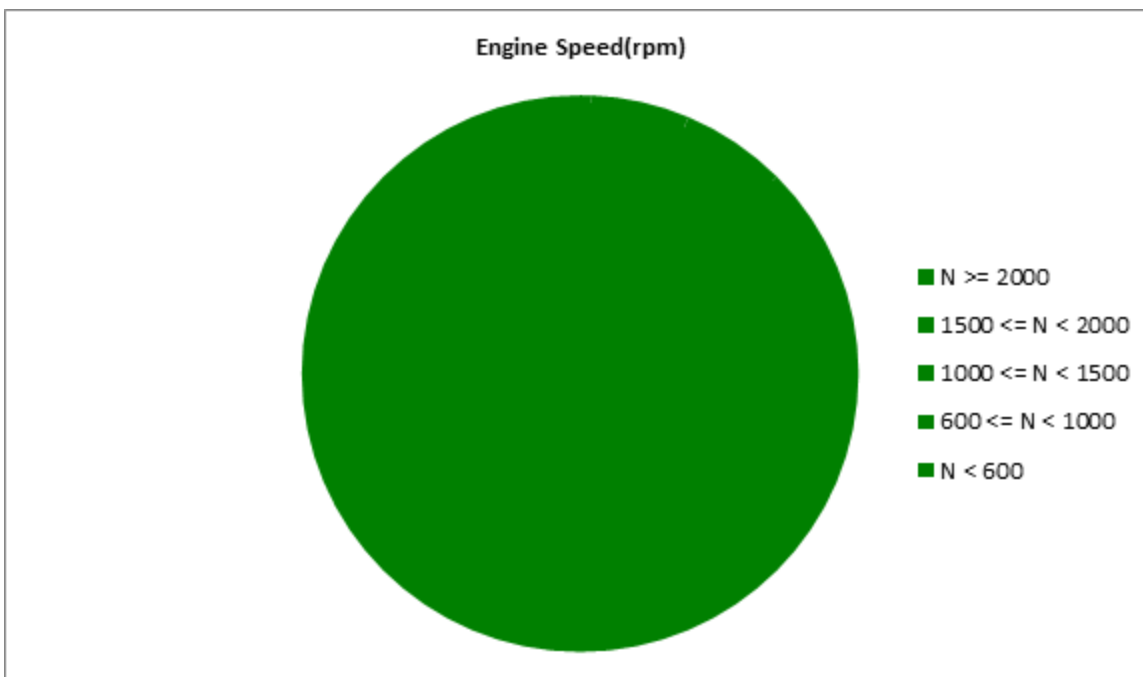


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
206.72	20.41	-

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
-	-	-

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
458-50	282-0	-

Notice: RPM sensor had problem during this period . So some engine speed related parameters missed or show unreasonable values.

## Detailed Pressure Analysis

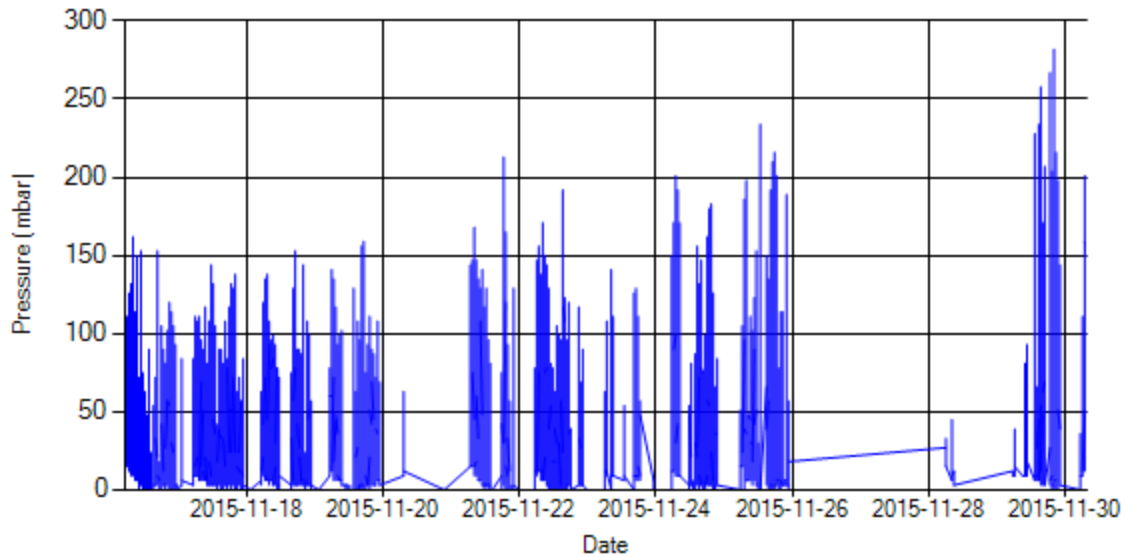


Figure 4- Pressure distribution over the period

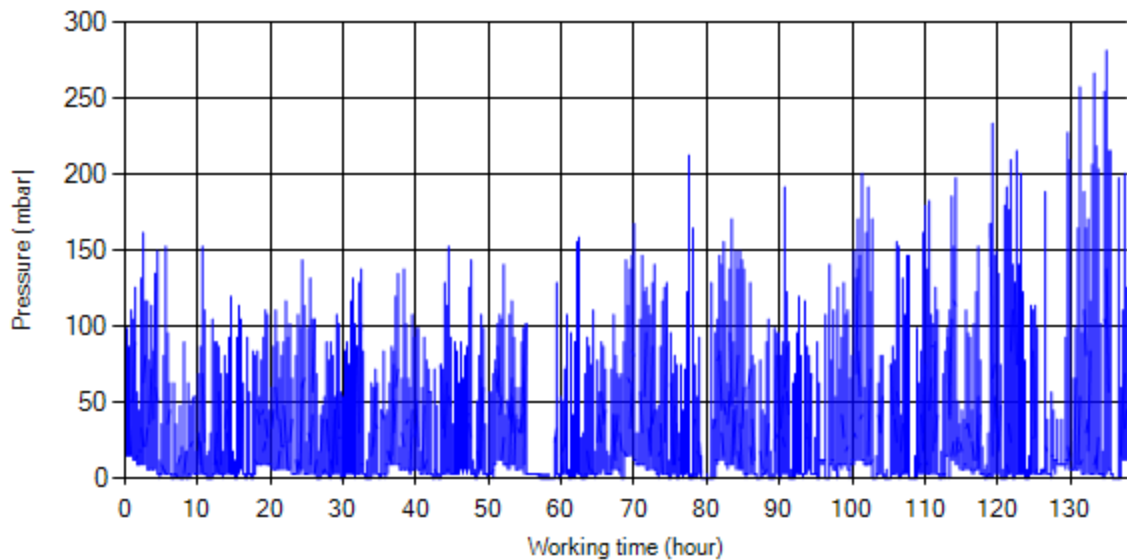


Figure 5- Pressure vs. working hours

Notice: Sharp pressure increment during this period was because of additive system problem.

## Detailed Temperature Analysis

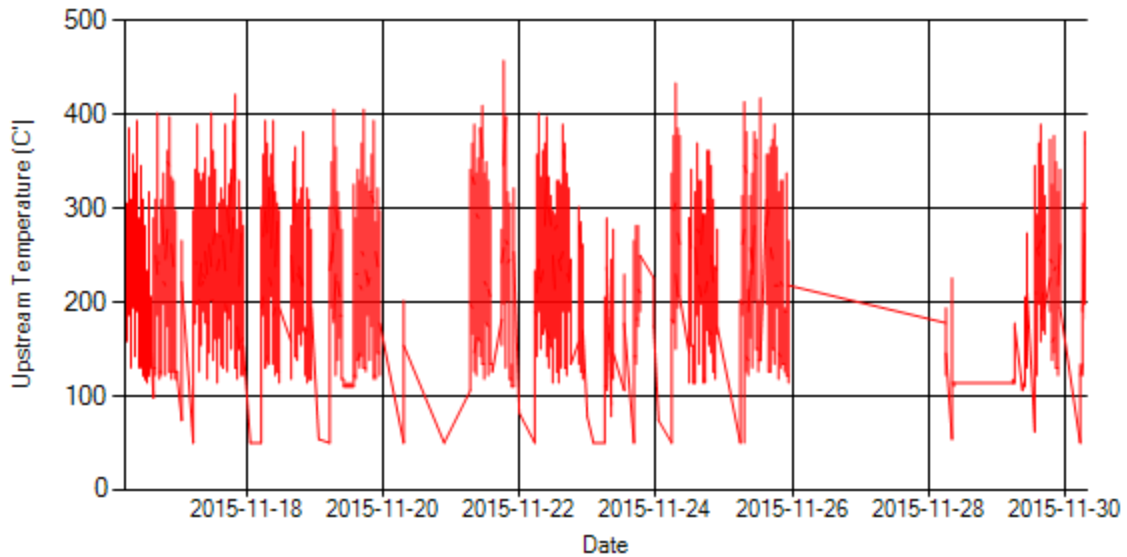


Figure 6- Temperature distribution over the period

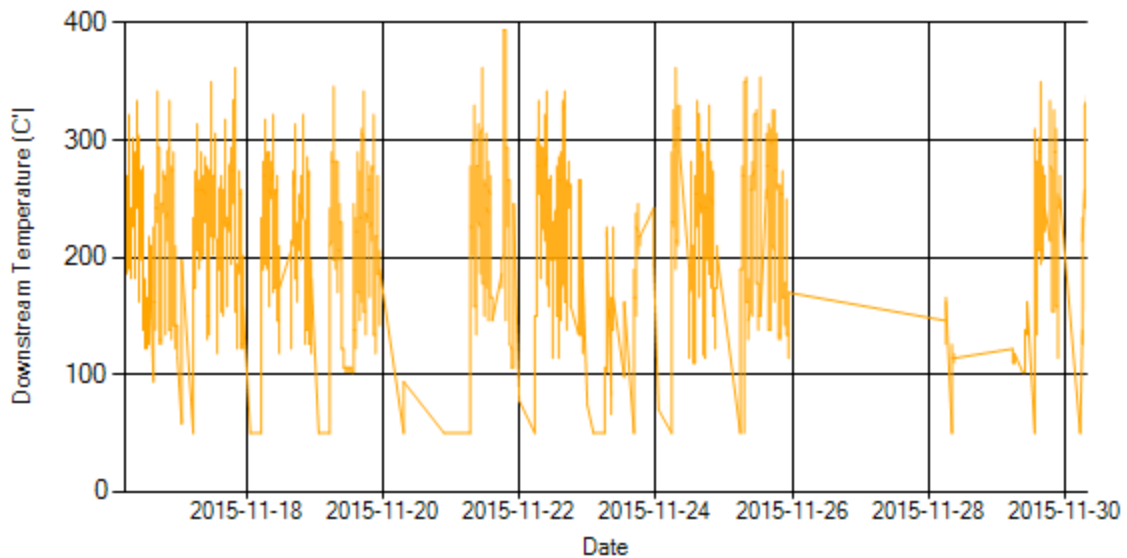
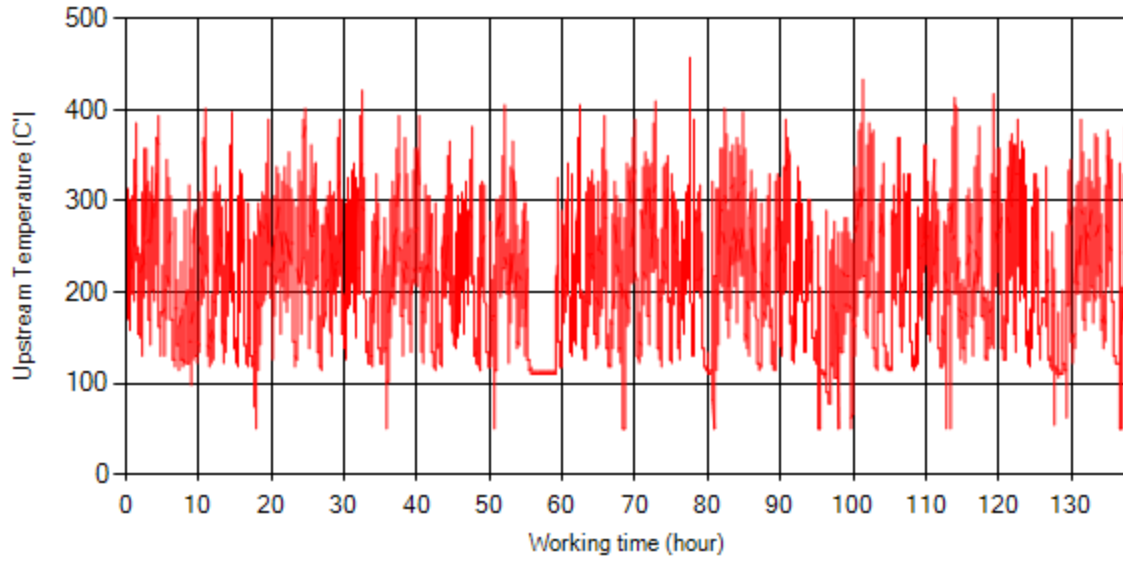
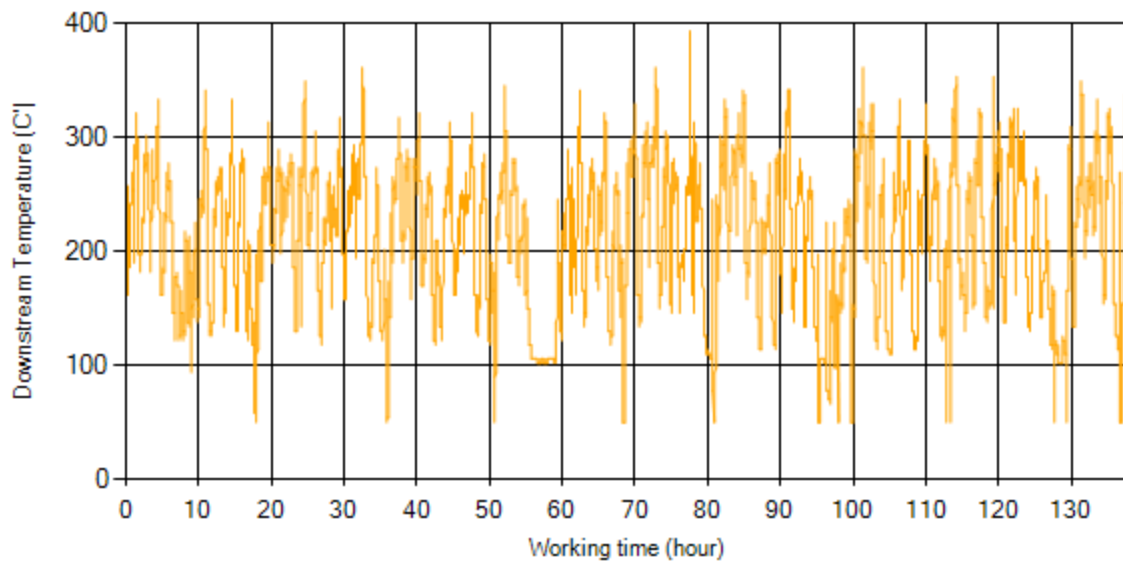


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

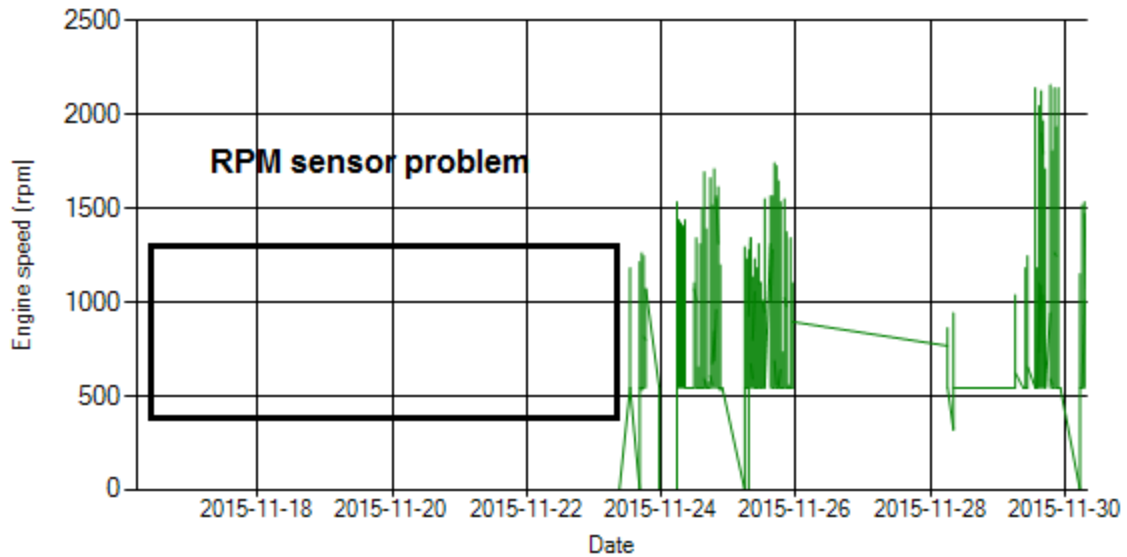


Figure 10- Engine speed distribution over the period

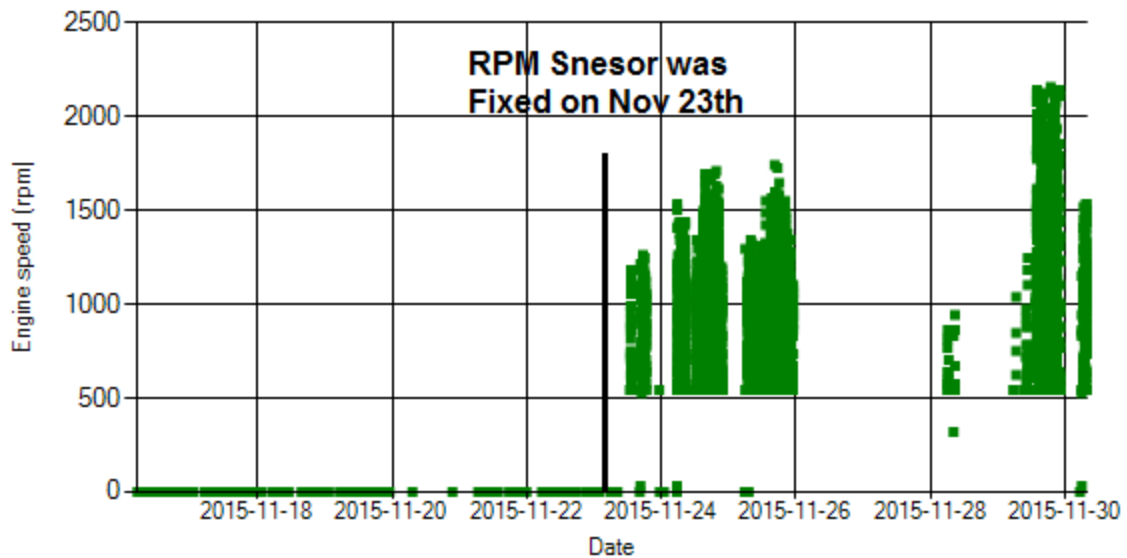


Figure 11- Engine speed diagram for calculating CPK's working days

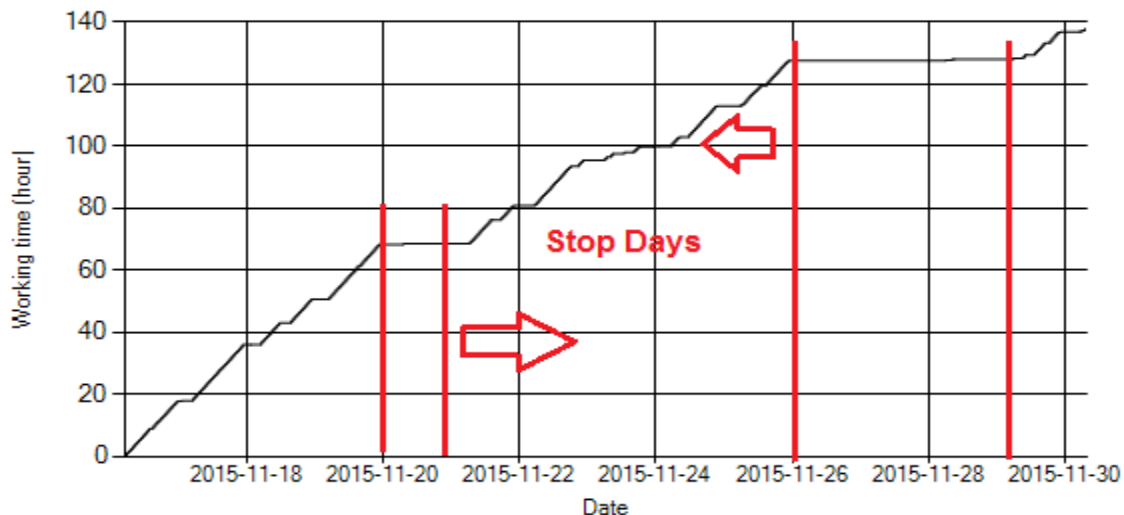


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12, bus was stationary for four days during this period.

### Pressure-Engine Speed diagrams

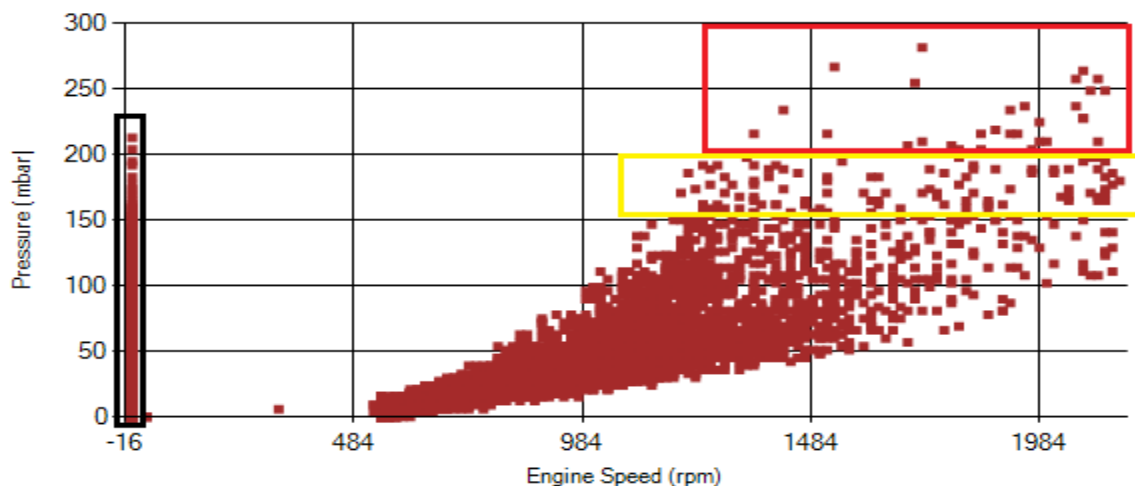


Figure 13- Pressure against engine speed

Notice: Red alarm (pressure>200 mbar) and yellow alarm (200>pressure>150) ranges were indicated in figure 13. Straight line (black region) was because of RPM sensor problem.

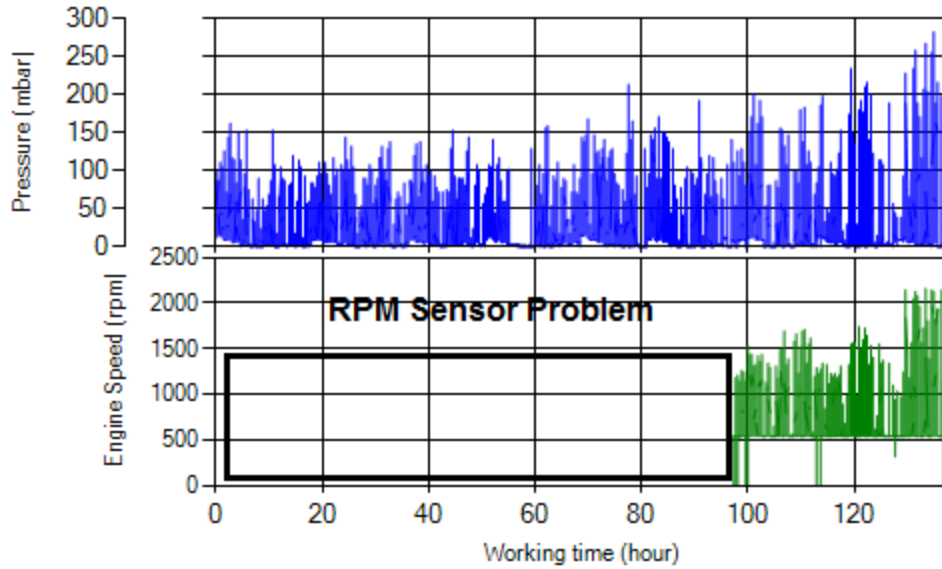


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

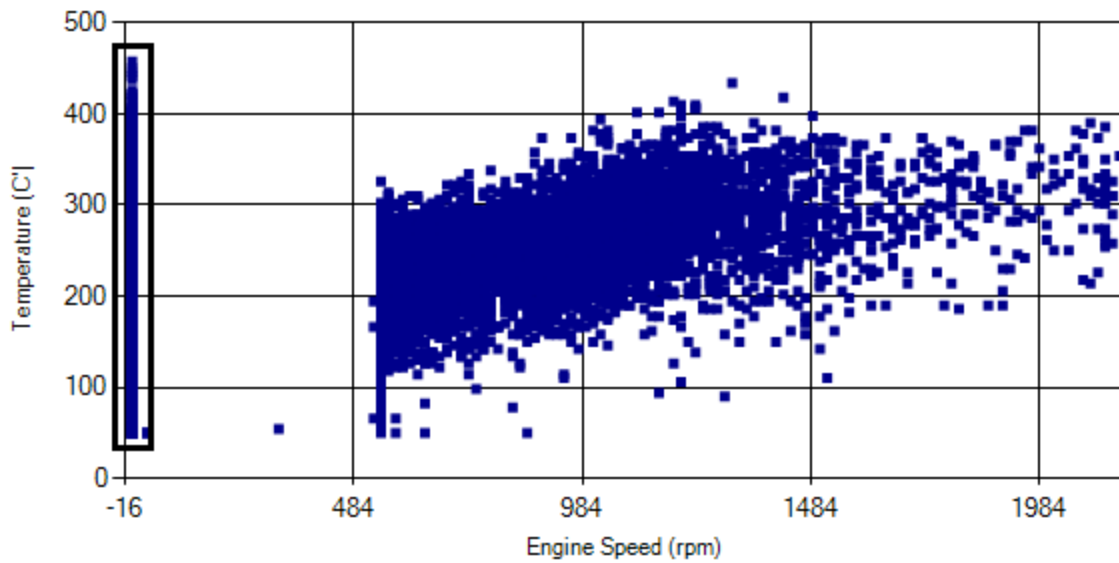


Figure 15- Temperature against engine speed

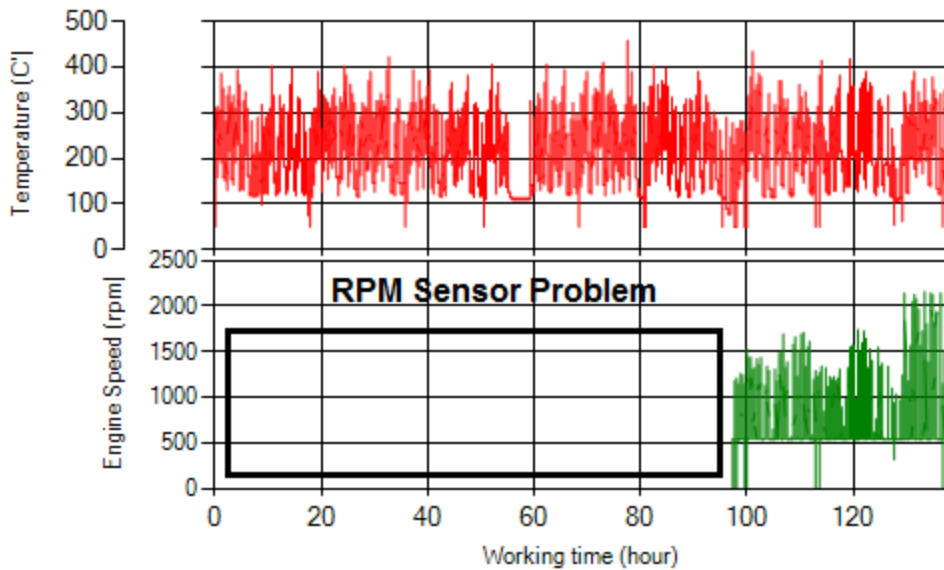


Figure 16- T, N distribution vs. working hours

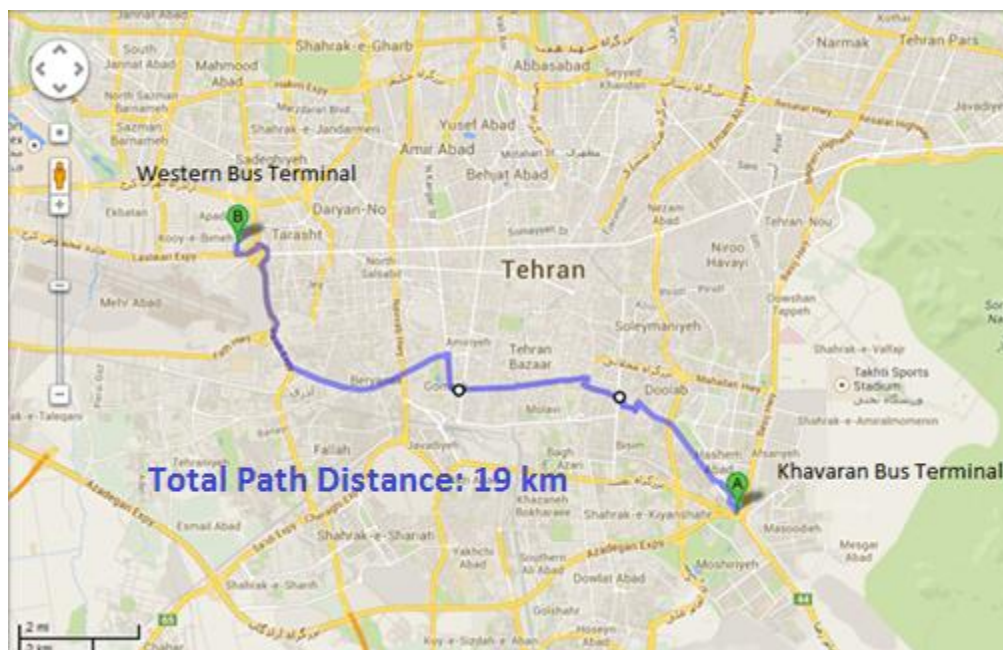
### Filter Operation Analysis

- As depicted in figure 1, 0.08% of total working time pressure is above 200 mbar and 0.39% above 150 mbar during this period. Comparing pressure values with first half of Nov, shows sharp increment. This sharp variation during this period was because of additive system's problem.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed only 0.01% of total working time temperature is above 350°C. This low temperature distribution was other effective parameter on pressure increment.

Filter operation status	Excellent <input checked="" type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input type="checkbox"/>	Failed <input type="checkbox"/>



Vehicle plate number	33637 (34119)
Bus line	Number 2 (west to east bus line)
DPF producer company	Dinex_02 (Passive system with FBC)



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**Notice: System was working over this period without DPF.**

## Overall Information

*Table1- Overall Information*

Vehicle plate number	33637 (34119)
CPK data logger number	LN: 001492, DN: 1933, Sim +989210000000
Bus line	Number 2 (west to east bus line)
Bus Terminals	Khavaran Bus Terminal - Western Bus Terminal
Total path distance	19 km
DPF company producer	Dinex_02 (Passive system with FBC)
Installation date	02/Jun/2015
Report period	01/Nov/2015 – 15/Nov/2015 (fifteen days)
K value - DPF upstream	1.90 [1/m]
K value – DPF downstream	0.04 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF has been removed after two weeks working on Jun 17 <sup>th</sup> . After receiving cleaning machine DPF was cleaned on Aug 10 <sup>th</sup> and was installed on Aug 22 <sup>nd</sup> but worked only for ten days. The last cleaning was done on Sep 24 <sup>th</sup> but cleaning issue was unavoidable after only three days working. Finally DPF was replaced by muffler on Sep 8 <sup>th</sup> and system have been working from that date without DPF.
Dosing status	Additive dosing was increased 60% of its initial value for tests two and three.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage over the period	1734 km
Working days over the period	11 days
Stop days	4 days
Data logger working days	11 days
Working hours over the period	164 hours 28 minutes
Average working hours per day (including stop days)	11hours 45 minutes
Bus average speed	10.54 km/hr
idle speed time to all working time ration	57.23 %
Total Bus fuel consumption over the period	1092 lit
Fuel consumption per hour	6.64 lit/hr
Average fuel consumption	0.63 lit/km

### Temperature, Pressure and Engine Speed Overview

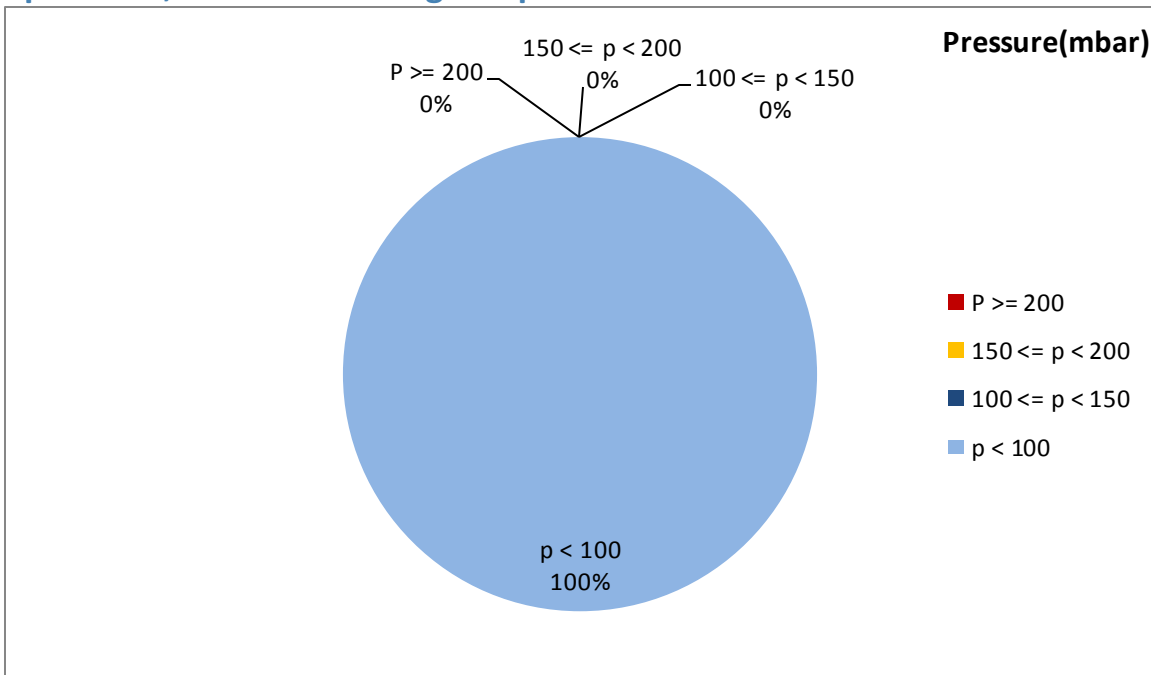


Figure 1- Pressure distribution over the working hours

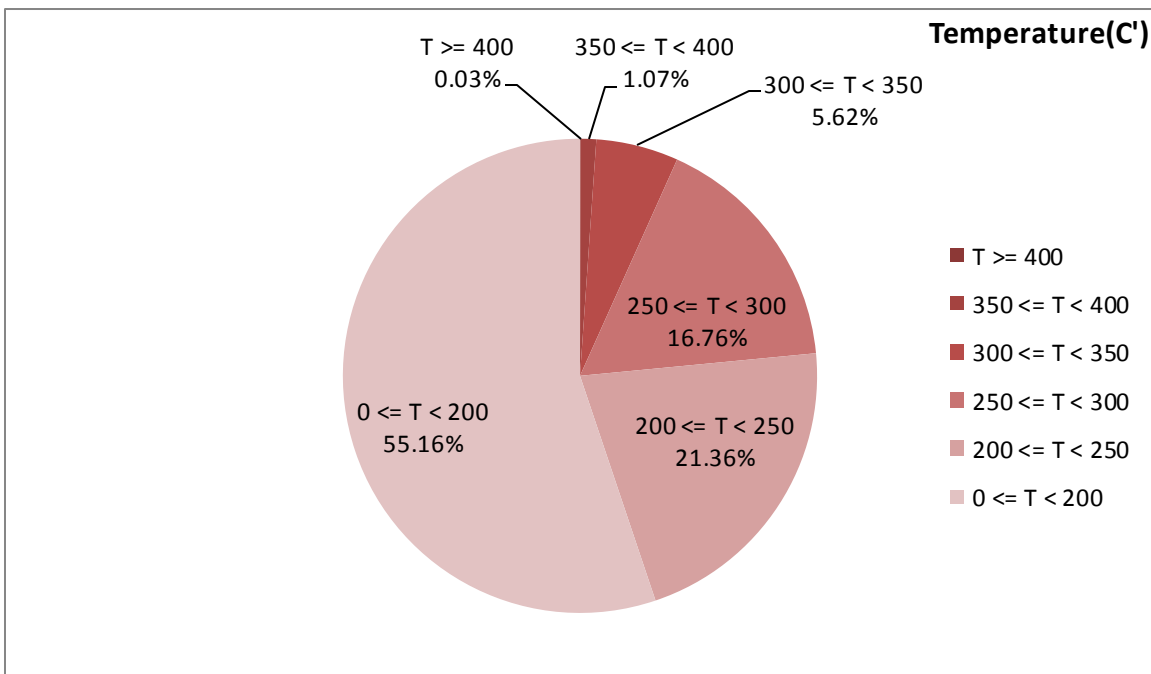


Figure 2-Temperature distribution over the working hours

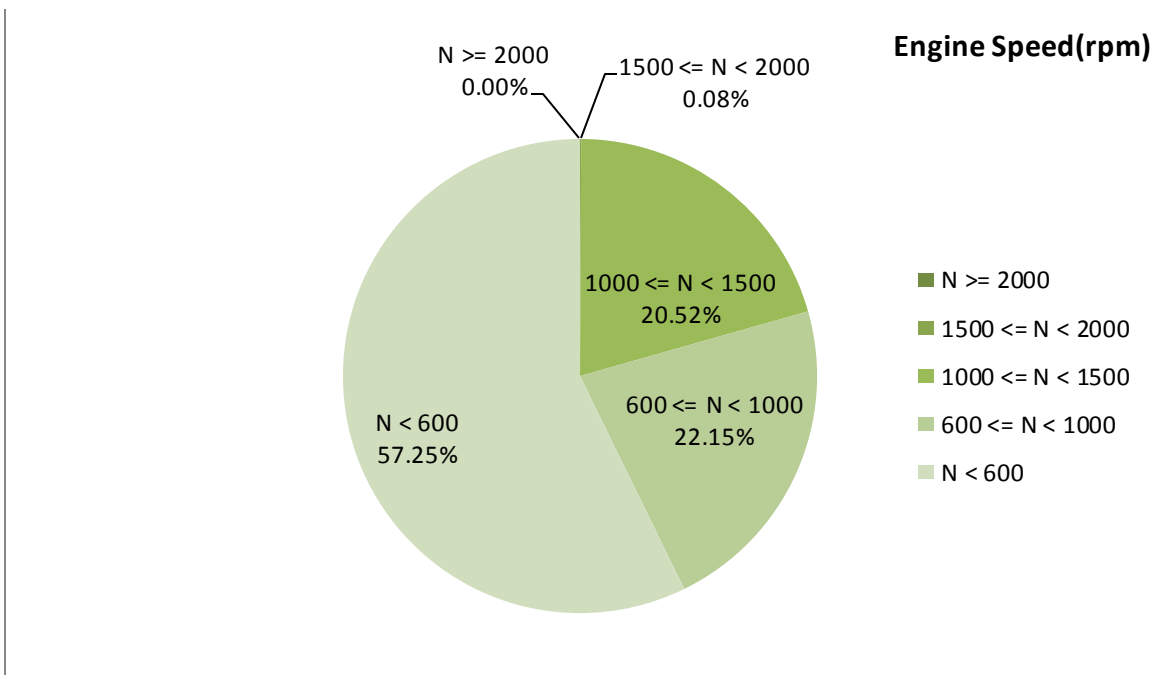


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
193.25	0.86	725

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
251.83	2.02	964

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
434-50	72-0	2112-256

## Detailed Pressure Analysis

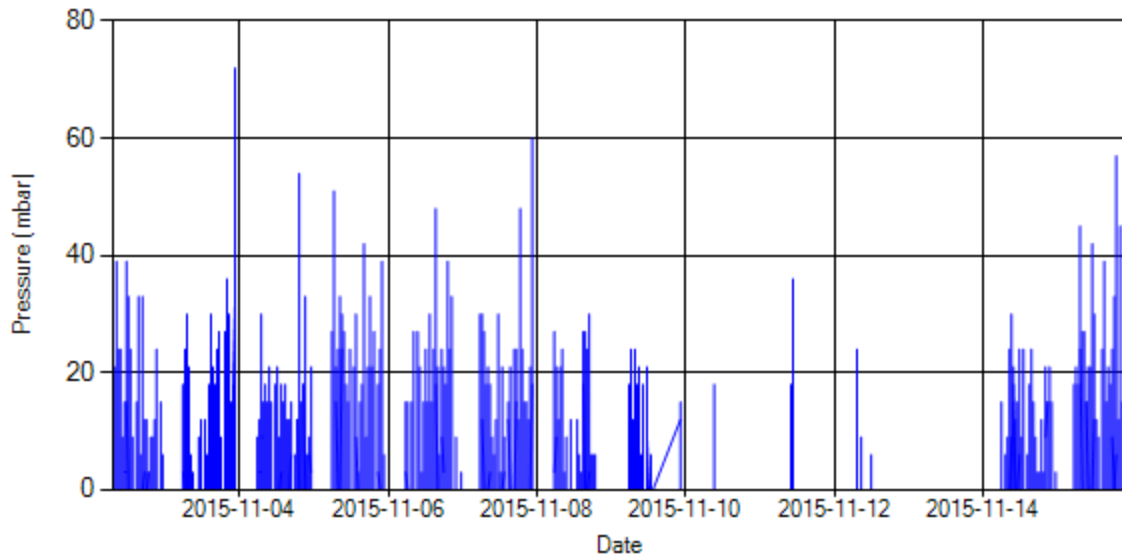


Figure 4- Pressure distribution over the period

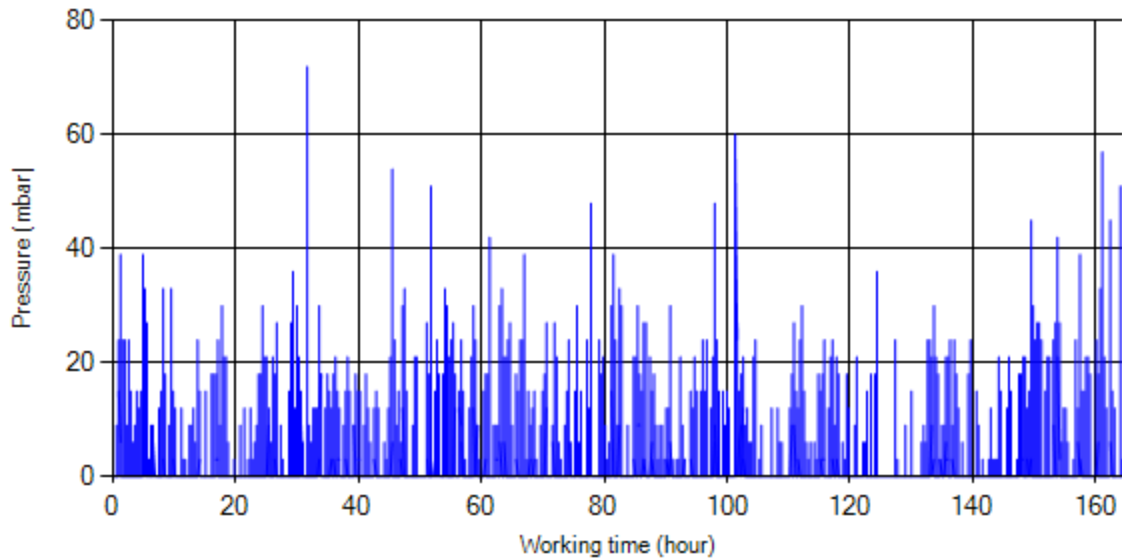


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

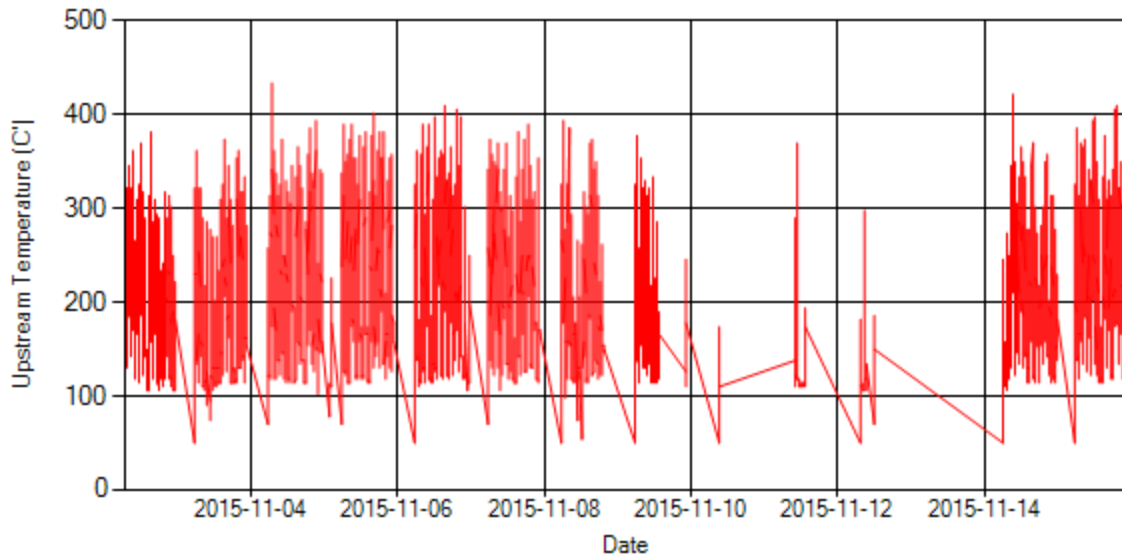


Figure 6- Temperature distribution over the period

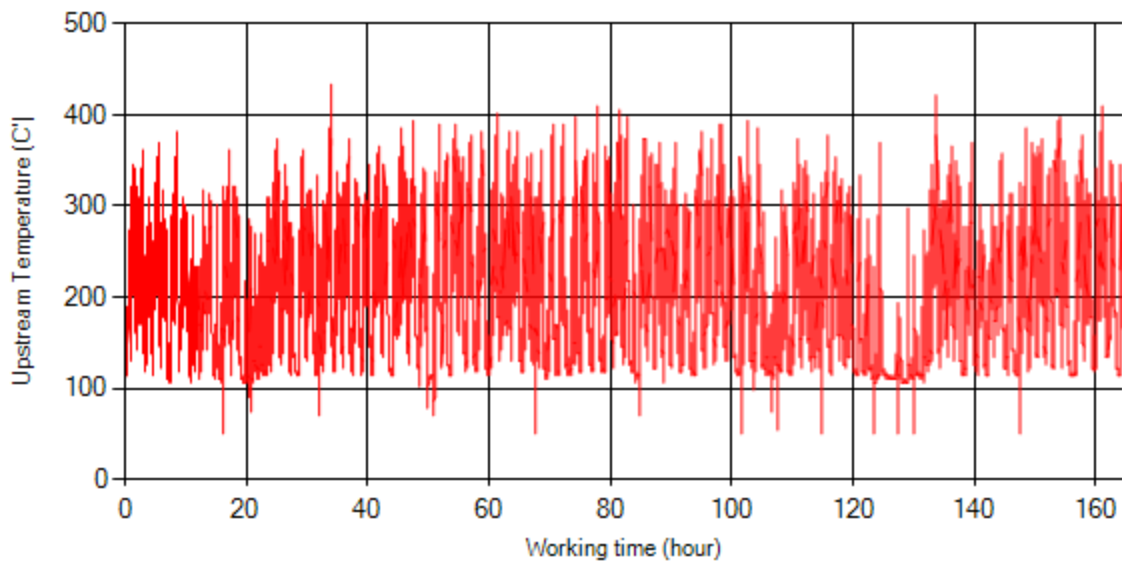


Figure 7- Temperature vs. working hours

### Engine Speed Diagrams

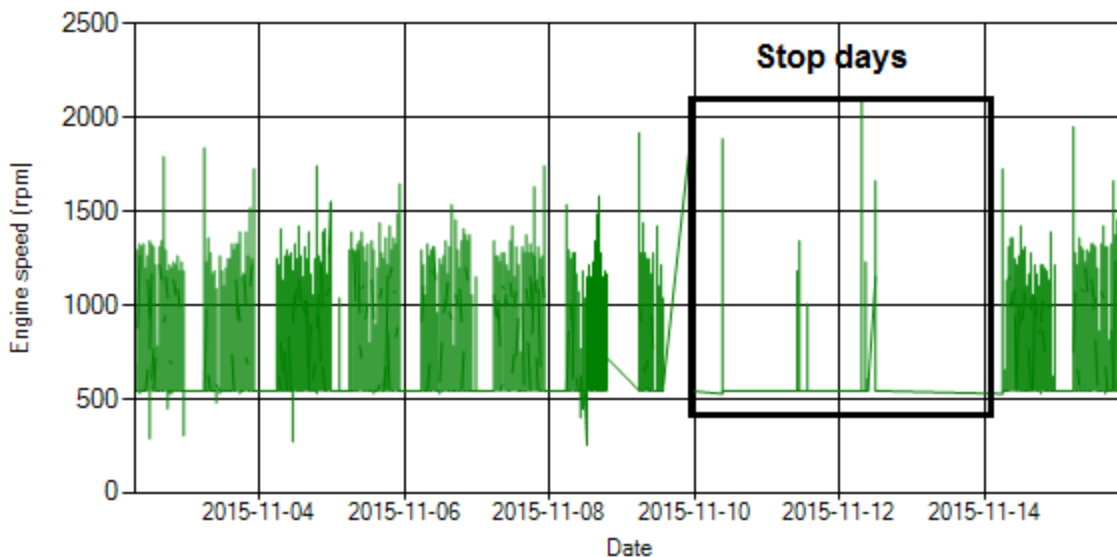


Figure 8- Engine speed distribution over the period

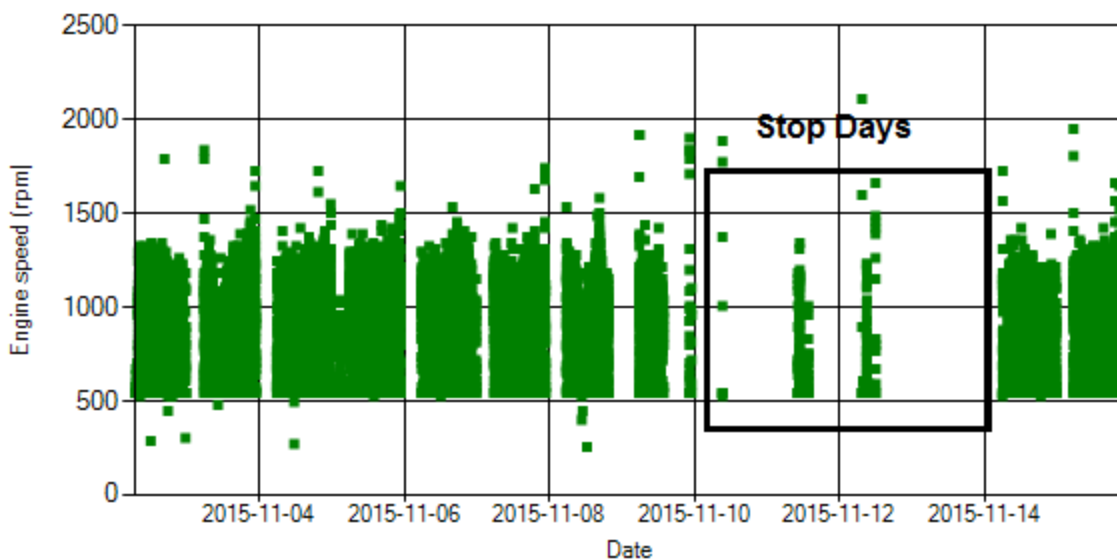


Figure 9- Engine speed diagram for calculating CPK's working days



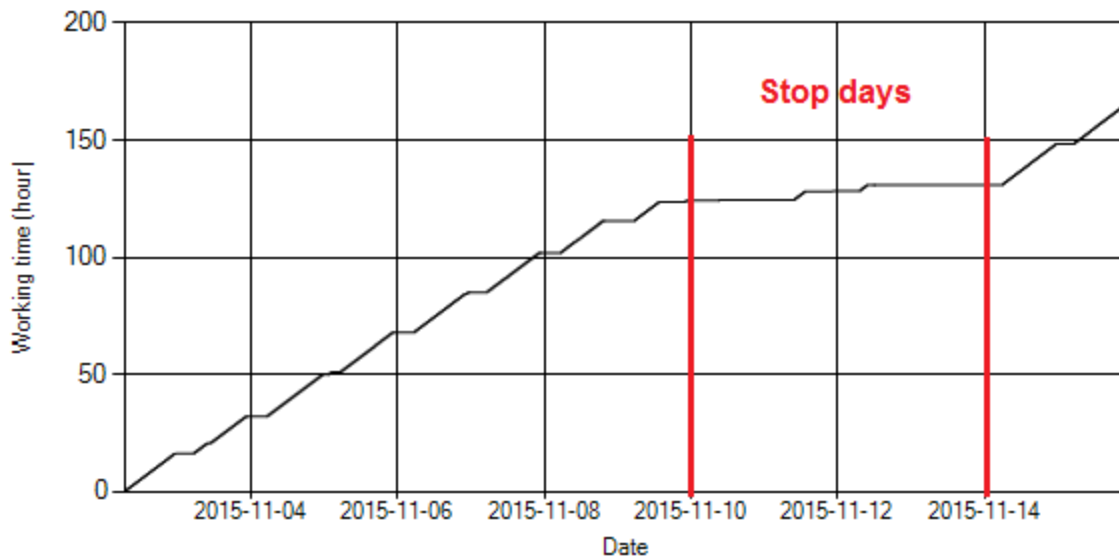


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12, bus was stationary from Nov 10<sup>th</sup> to 13<sup>th</sup>.

### Pressure-Engine Speed diagrams

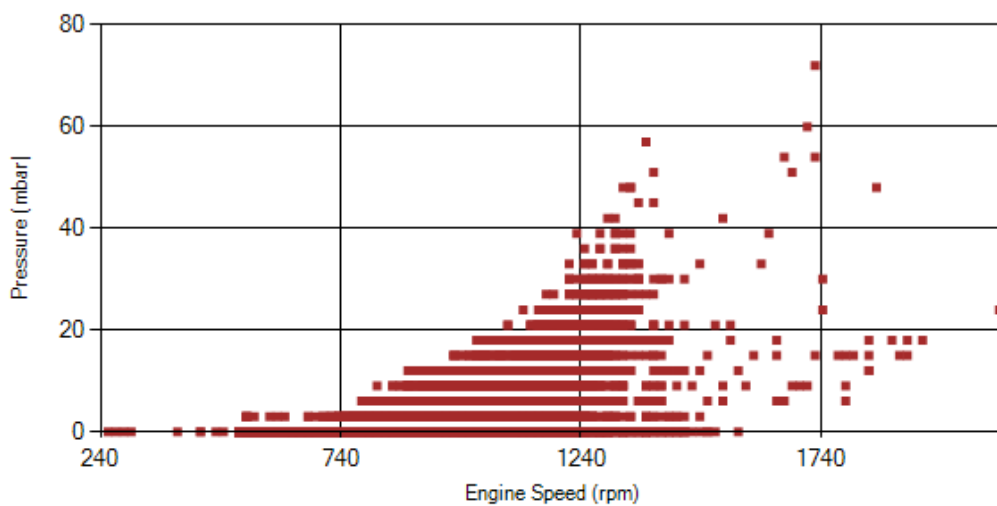


Figure 11- Pressure against engine speed

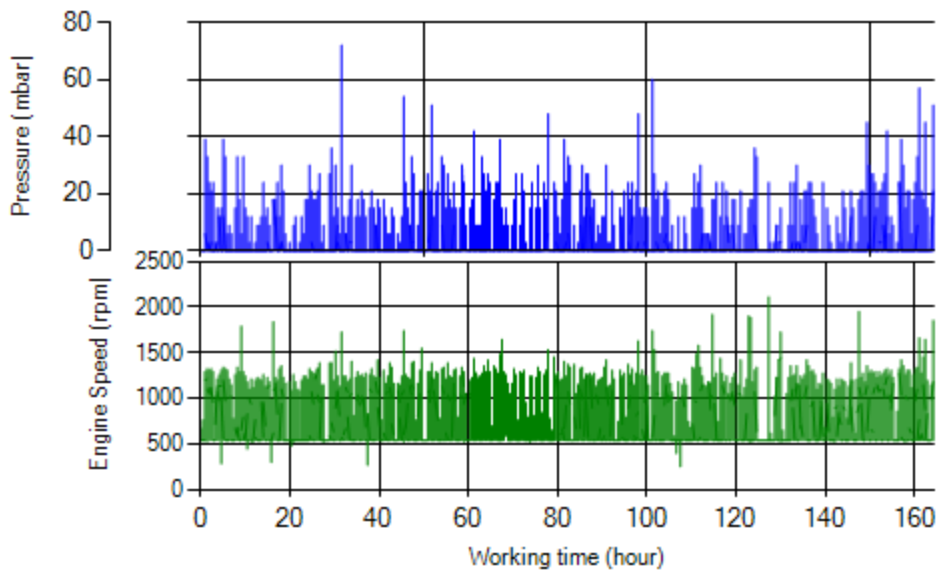


Figure 12- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

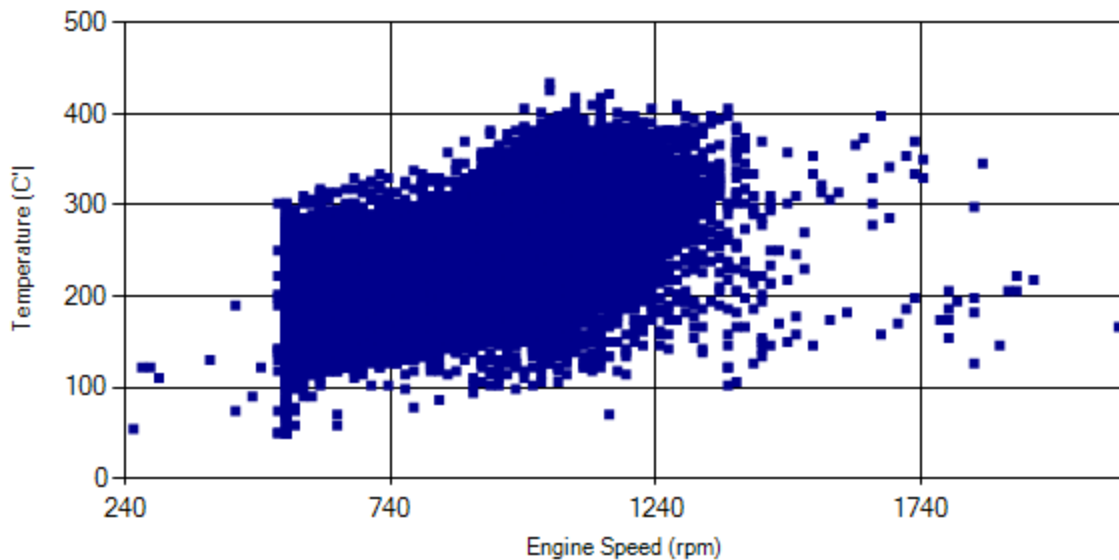
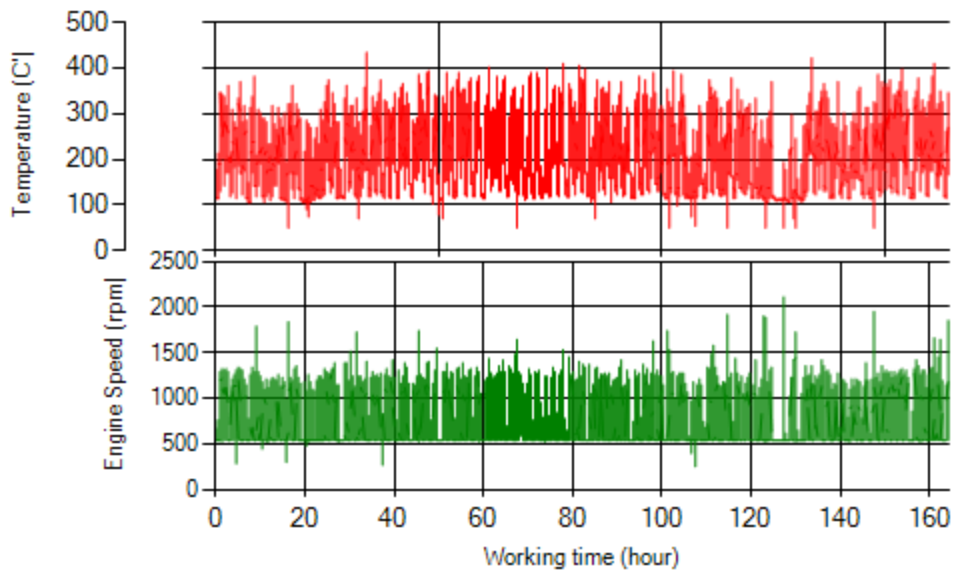


Figure 13- Temperature against engine speed



*Figure 14- T, N distribution vs. working hours*

## Filter Operation Analysis

**Notice:** System was working over this period without DPF.

**Notice: System was working over this period without DPF.**

## Overall Information

*Table1- Overall Information*

Vehicle plate number	33637 (34119)
CPK data logger number	LN: 001492, DN: 1933, Sim +989210000000
Bus line	Number 2 (west to east bus line)
Bus Terminals	Khavaran Bus Terminal - Western Bus Terminal
Total path distance	19 km
DPF company producer	Dinex_02 (Passive system with FBC)
Installation date	02/Jun/2015
Report period	16/Nov/2015 – 30/Nov/2015 (fifteen days)
K value - DPF upstream	1.90 [1/m]
K value – DPF downstream	0.04 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF has been removed after two weeks working on Jun 17 <sup>th</sup> . After receiving cleaning machine DPF was cleaned on Aug 10 <sup>th</sup> and was installed on Aug 22 <sup>nd</sup> but worked only for ten days. The last cleaning was done on Sep 24 <sup>th</sup> but cleaning issue was unavoidable after only three days working. Finally DPF was replaced by muffler on Sep 8 <sup>th</sup> and system have been working from that date without DPF.
Dosing status	Additive dosing was increased 60% of its initial value for tests two and three.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage over the period	2212 km
Working days over the period	15 days
Stop days	0 days
Data logger working days	15 days
Working hours over the period	7 days
Average working hours per day (including stop days)	-
Bus average speed	-
idle speed time to all working time ration	57.4 %
Total Bus fuel consumption over the period	1349 lit
Fuel consumption per hour	-
Average fuel consumption	0.61 lit/km

**Notice: Data logger got problem on Nov 22<sup>nd</sup>. So data from Nov 23<sup>rd</sup> to Nov 30<sup>th</sup> missed.**

**Notice: All charts and diagrams were calculated from data of Nov 15<sup>th</sup> to Nov 22<sup>nd</sup>**  
**Temperature, Pressure and Engine Speed Overview**

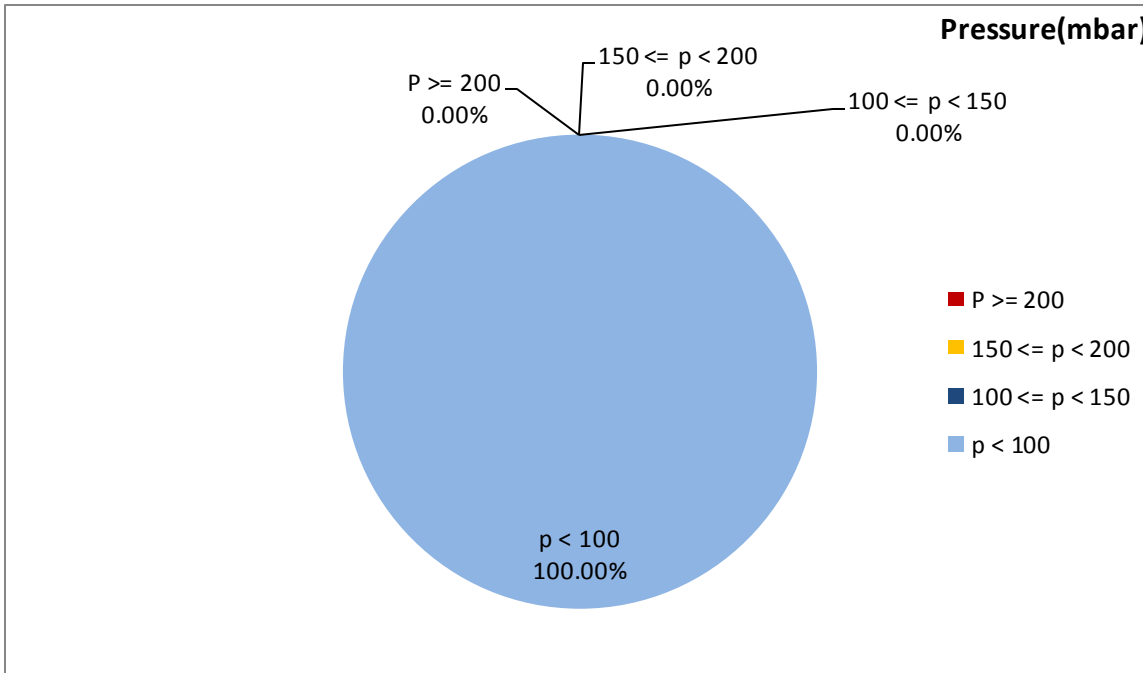


Figure 1- Pressure distribution over the working hours

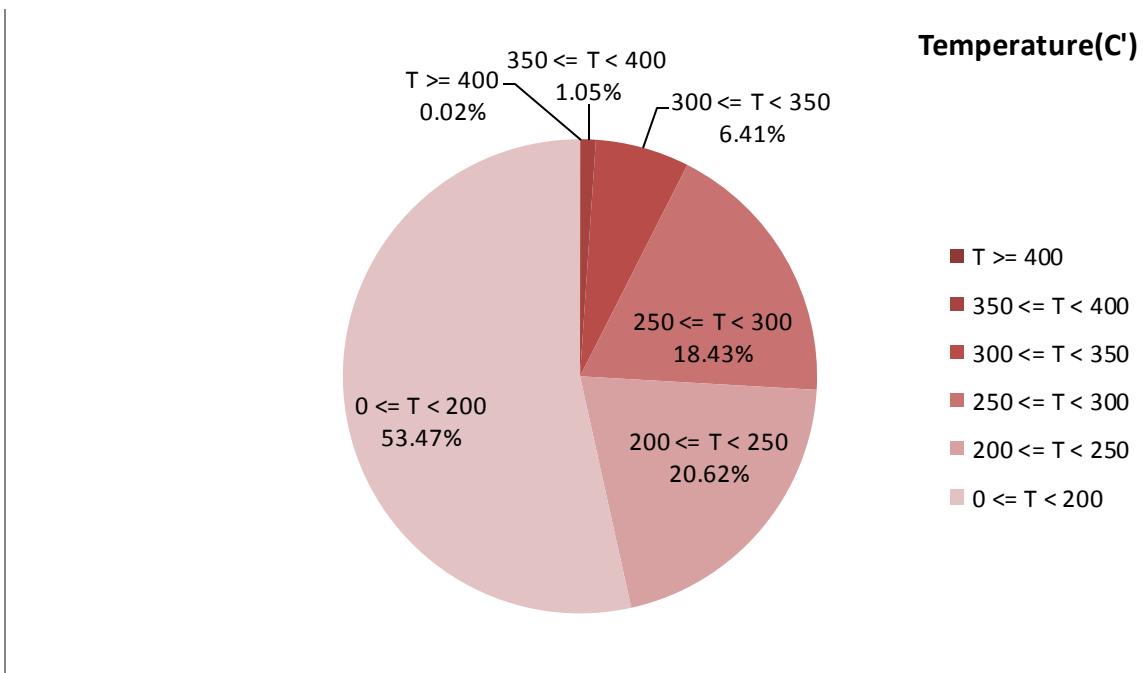


Figure 2-Temperature distribution over the working hours

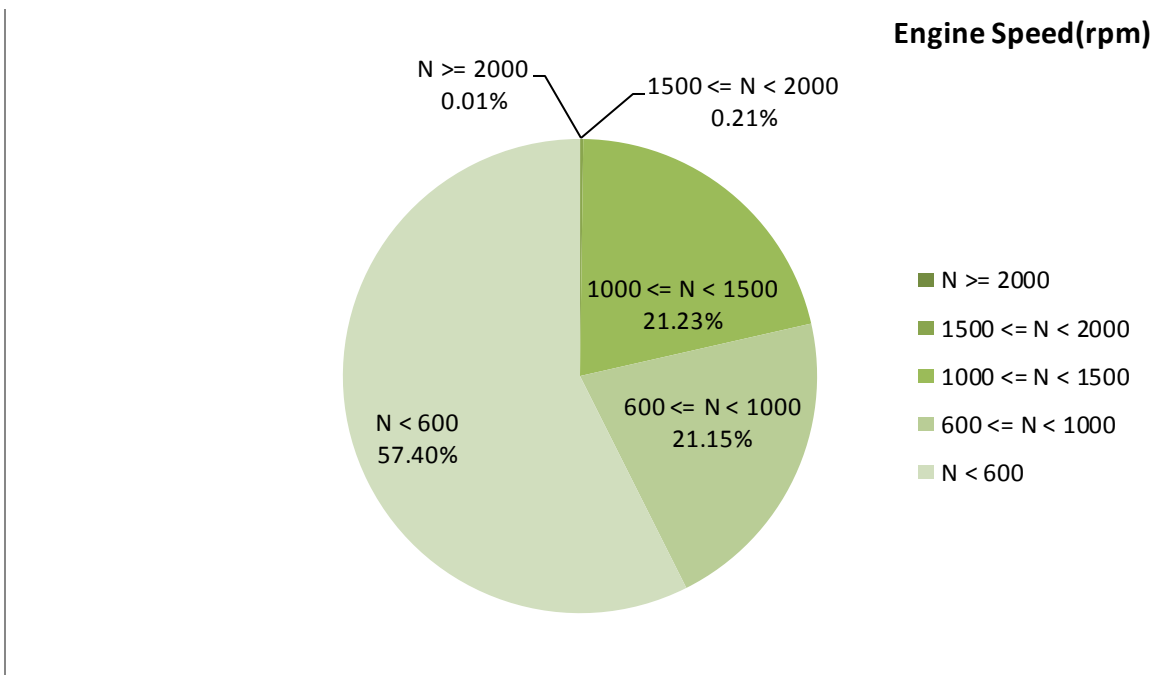


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
196.65	0.88	727

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
257.03	2.06	972

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
414-50	69-0	2080-256

## Detailed Pressure Analysis

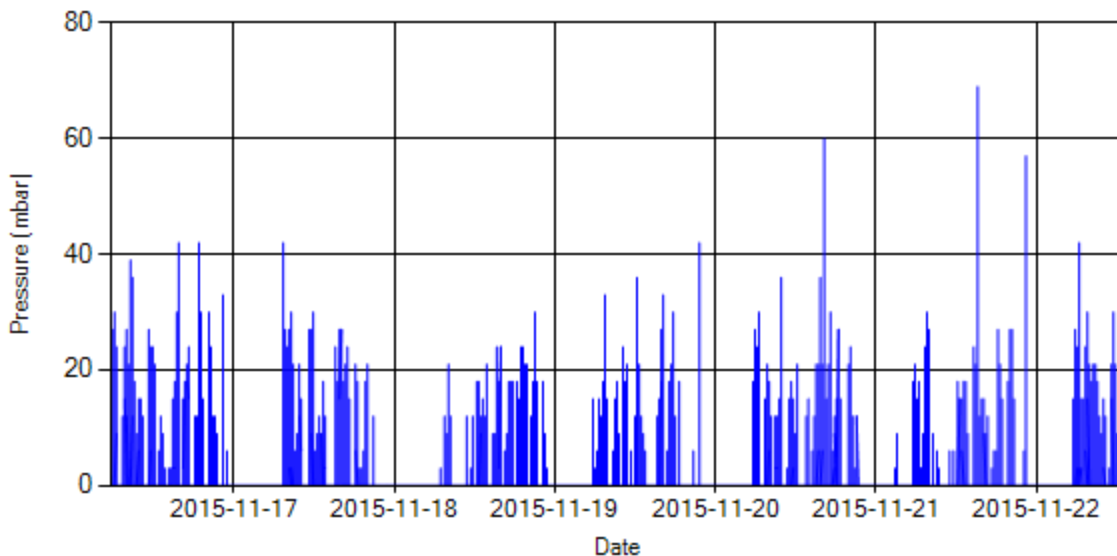


Figure 4- Pressure distribution over the period

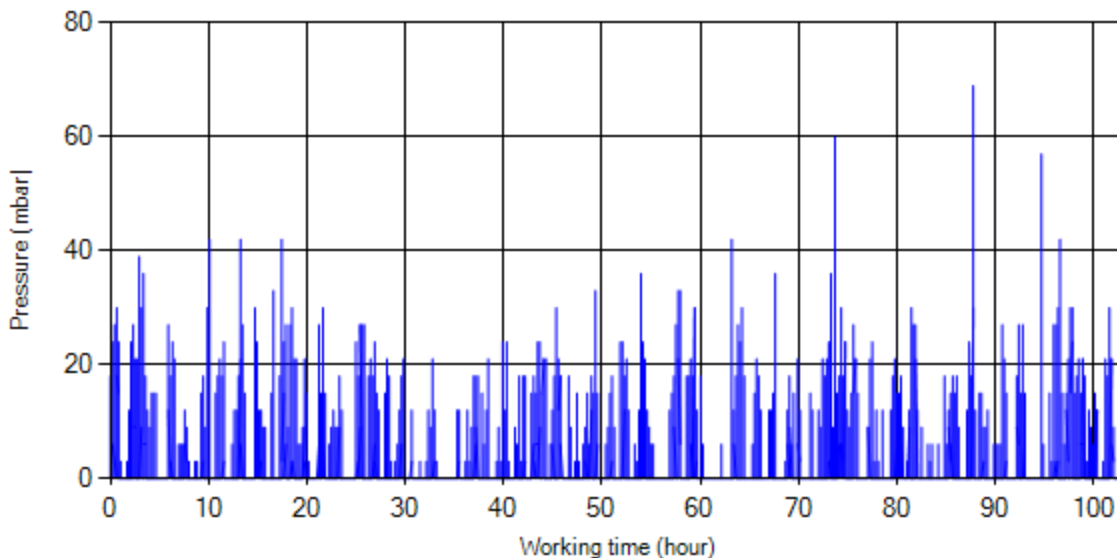


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.



## Detailed Temperature Analysis

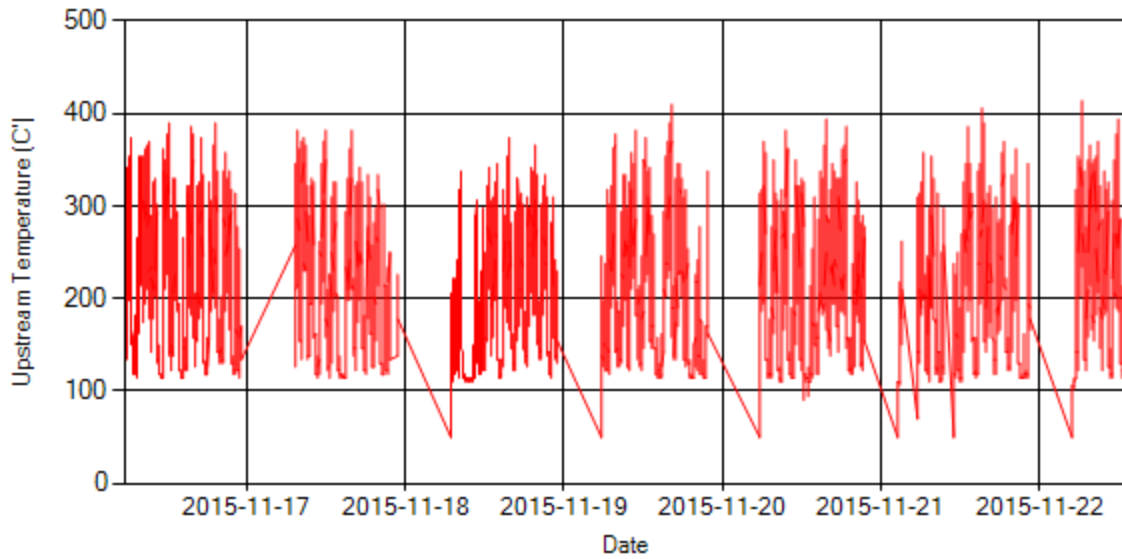


Figure 6- Temperature distribution over the period

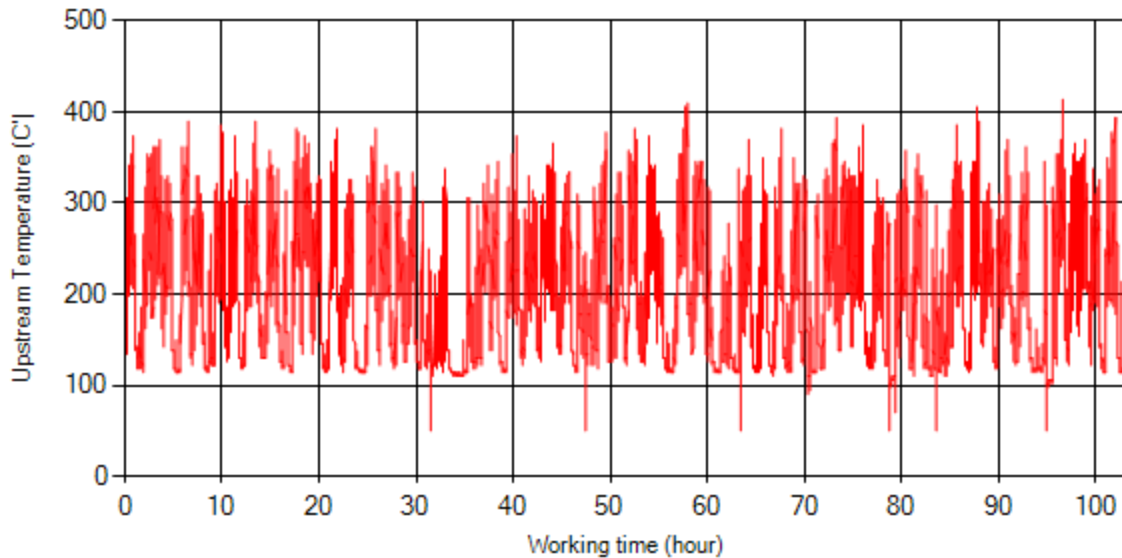
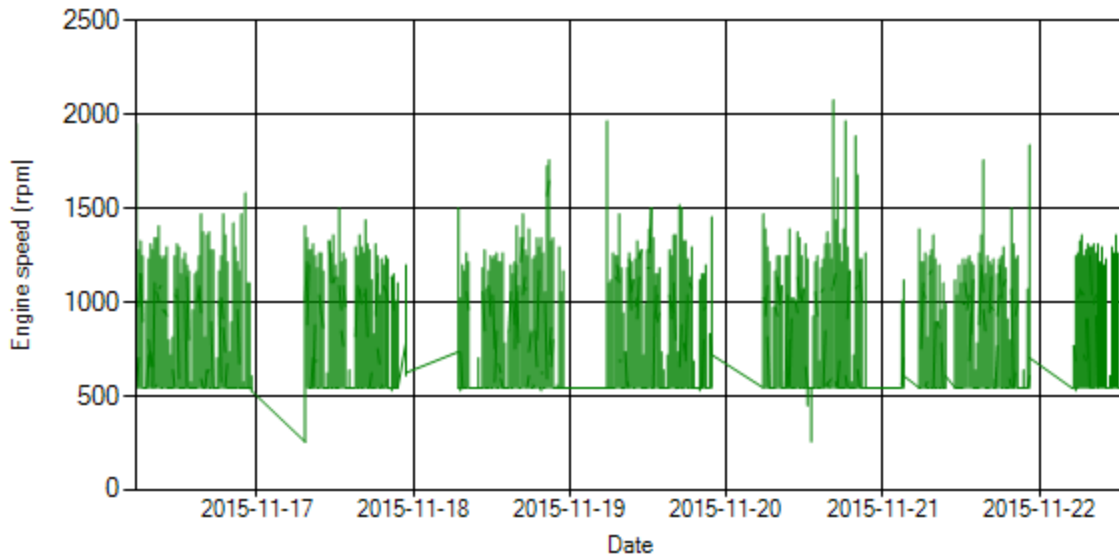
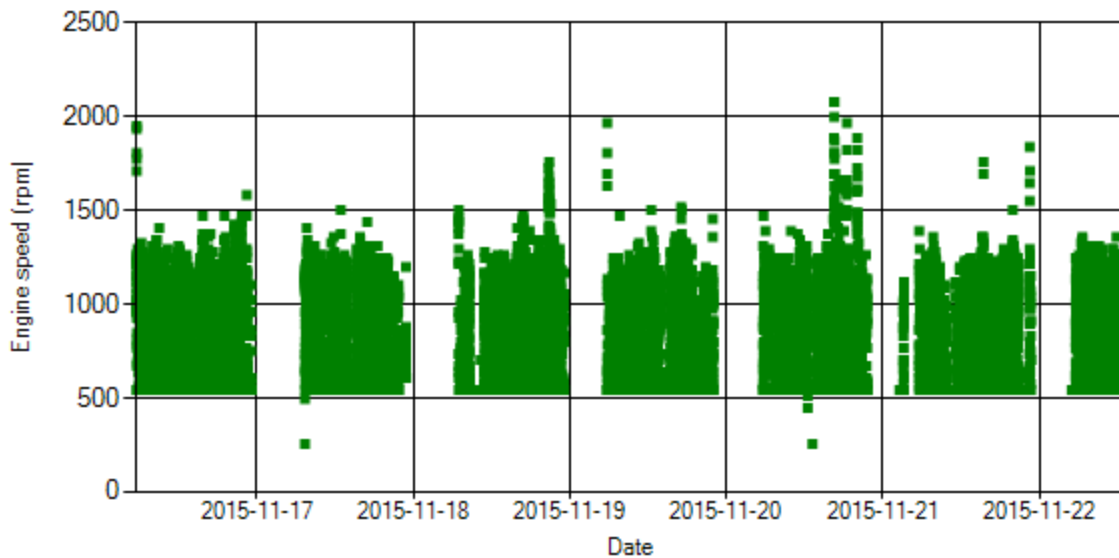


Figure 7- Temperature vs. working hours

## Engine Speed Diagrams



*Figure 8- Engine speed distribution over the period*



*Figure 9- Engine speed diagram for calculating CPK's working days*

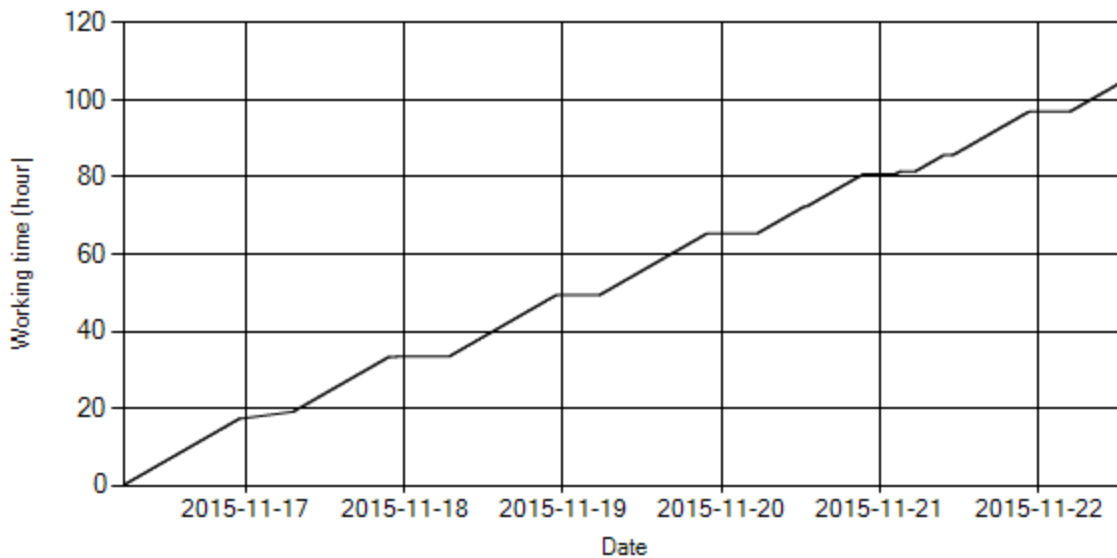


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12, bus was working for all days from Nov 15<sup>th</sup> to Nov 22<sup>nd</sup>.

### Pressure-Engine Speed diagrams

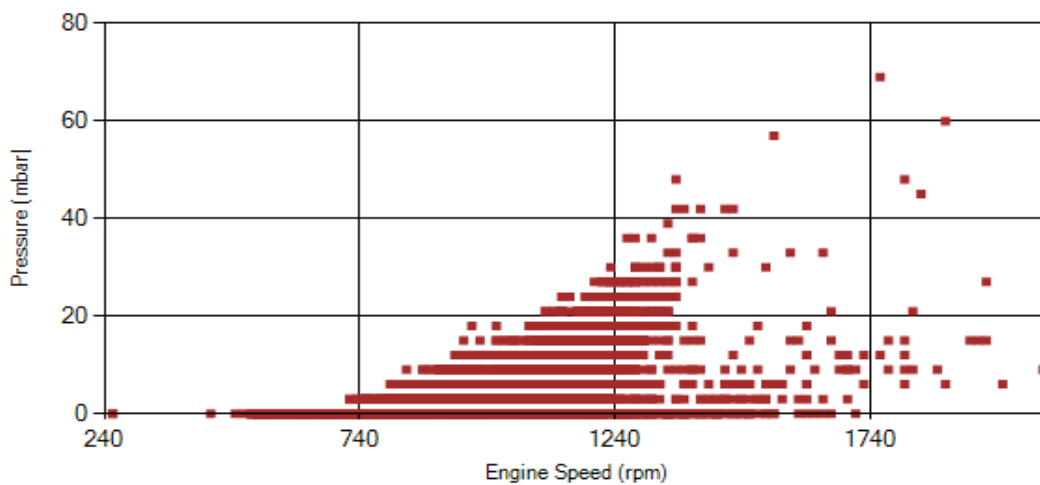


Figure 13- Pressure against engine speed

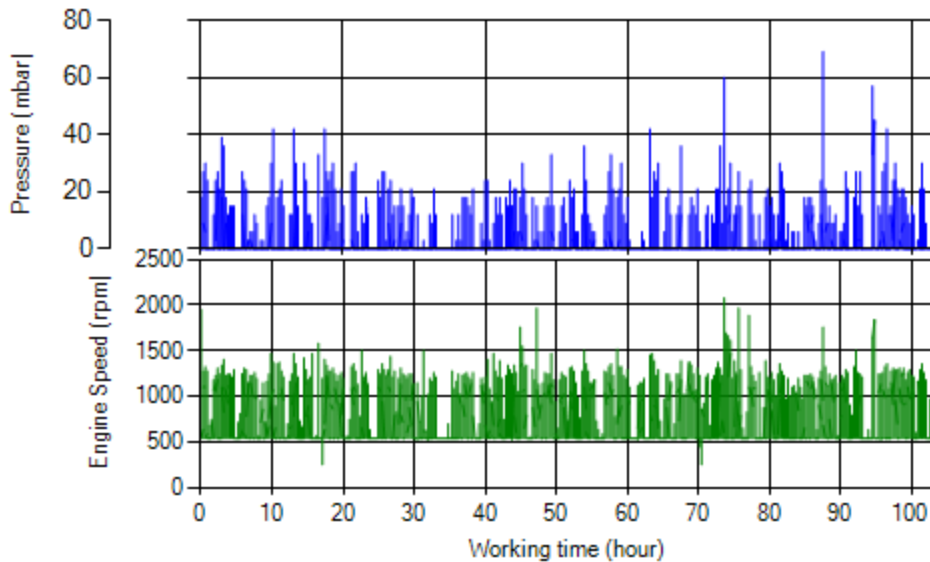


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

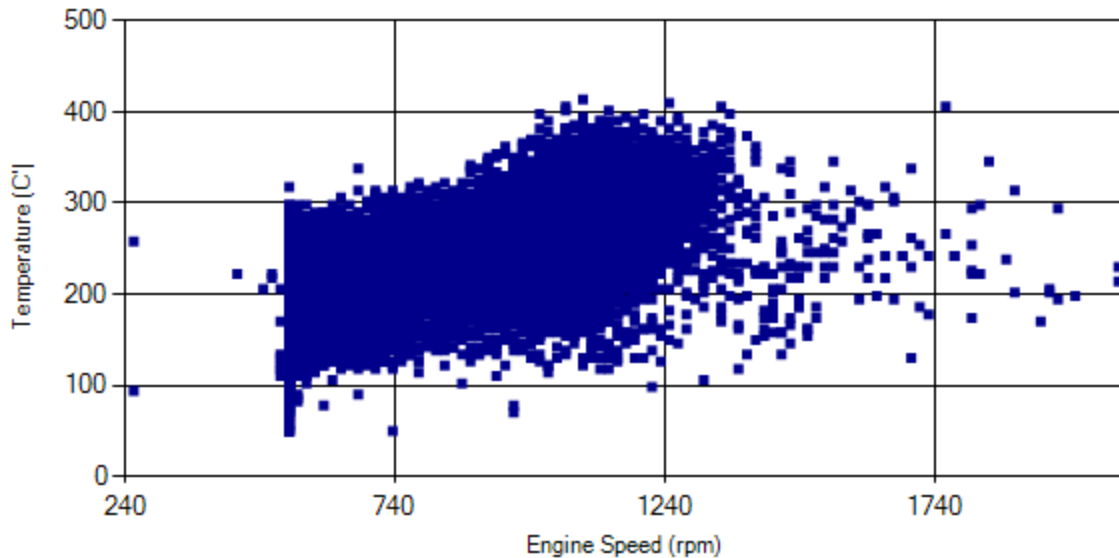
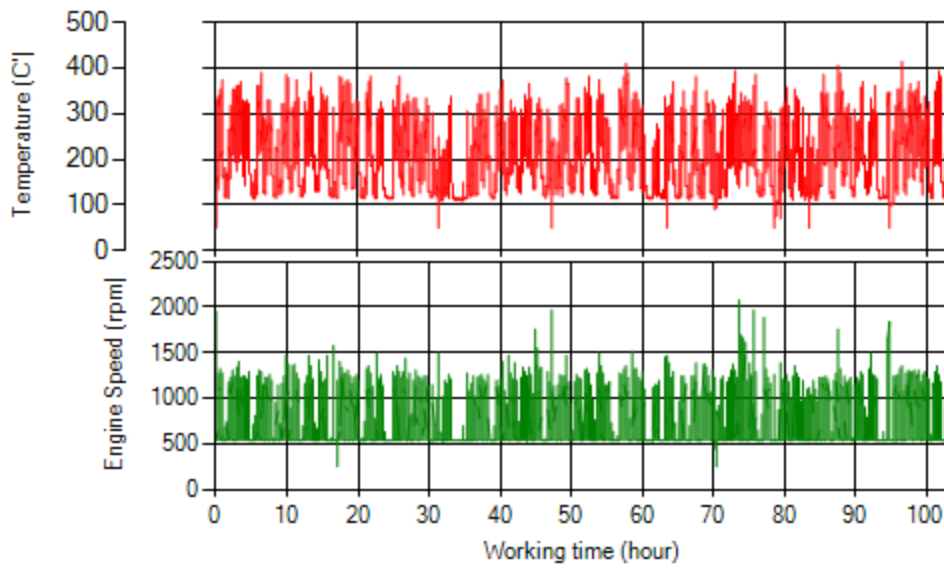


Figure 15- Temperature against engine speed

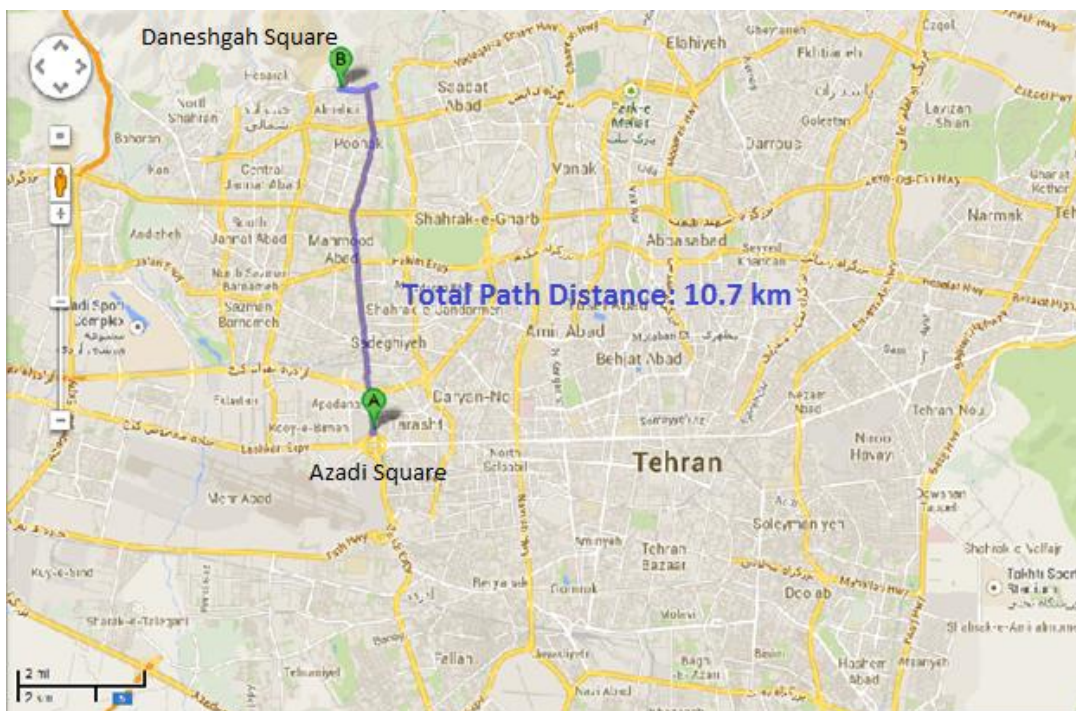


*Figure 16- T, N distribution vs. working hours*

## Filter Operation Analysis

**Notice:** System was working over this period without DPF.

Vehicle plate number	85476
Bus line	Number 10 (south to north Bus line)
DPF producer company	HJS_04 (Passive system with FBC)



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## Overall Information

*Table1- Overall Information*

Vehicle plate number	85476
CPK data logger number	LN: 001508, DN: 2003, Sim +989218469624
Bus line	Number 10 (south to north Bus line)
Bus Terminals	Azadi square - Daneshgah square
Total path distance	10.7 km
DPF producer company	HJS_04 (Passive system with FBC)
Installation date	23/Feb/2015
Report period	01/Nov/2015 – 15/Nov/2015 (fifteen days)
K value - DPF upstream	1.90 [1/m]
K value – DPF downstream	0.04 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF was cleaned on 22 <sup>nd</sup> Jul.
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	40340 km
Bus mileage over the period	2127 km
Working days over the period	15 days
Stop days	0 days
Data logger working days	8 days
Working hours over the period	-
Average working hours per day (including stop days)	-
Bus average speed	-km/hr
idle speed time to all working time ration	57.91 %
Total Bus fuel consumption over the period	1350 lit
Fuel consumption per hour	-lit/hr
Average fuel consumption	0.63 lit/km
Total Bus additive consumption over the period	0.55 lit
Average additive consumption	259 cc/km
Additive consumption to fuel ration	407 cc/1000lit

Notice: Due to data logger problem, 7 working days' data was missed (got problem on Nov 2<sup>nd</sup> and was fixed on Nov 8<sup>th</sup>). So some parameters like working hours and its related parameters were left blank.



## Temperature, Pressure and Engine Speed Overview

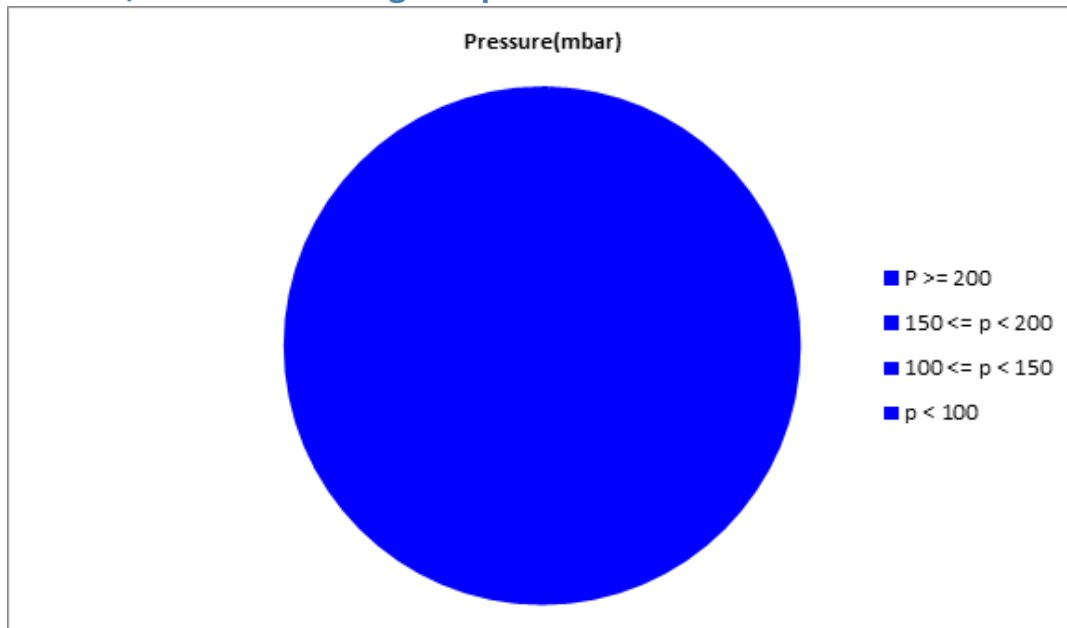


Figure 1- Pressure distribution over the working hours

Notice: Pressure sensor got problem on Nov 11th and was not fixed until the end of this period. Considering this problem besides data logger problem, pressure pie diagram was left blank due to data leakage.

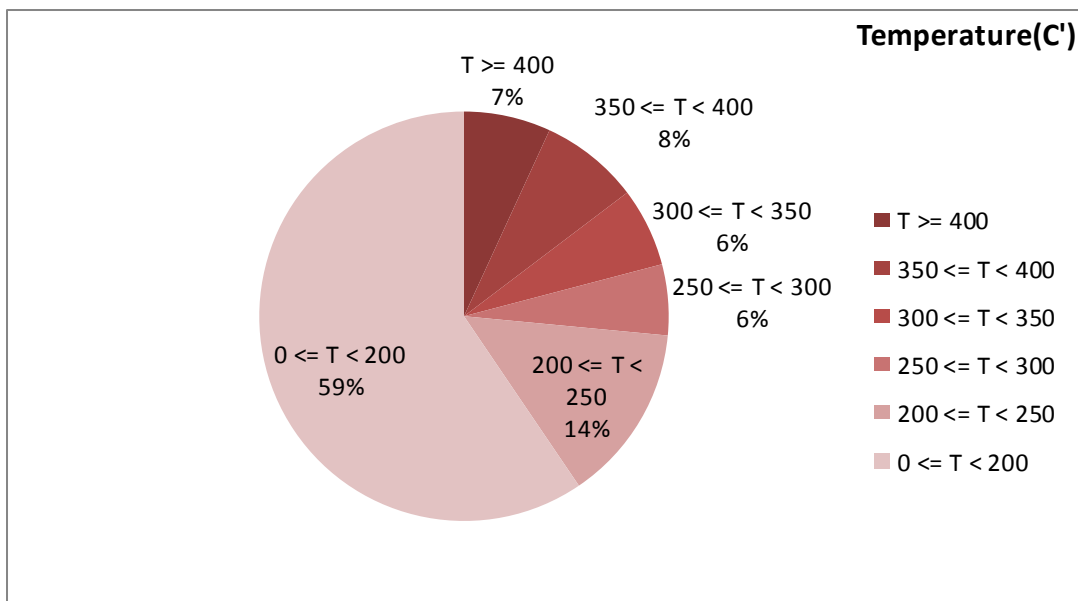


Figure 2-Temperature distribution over the working hours

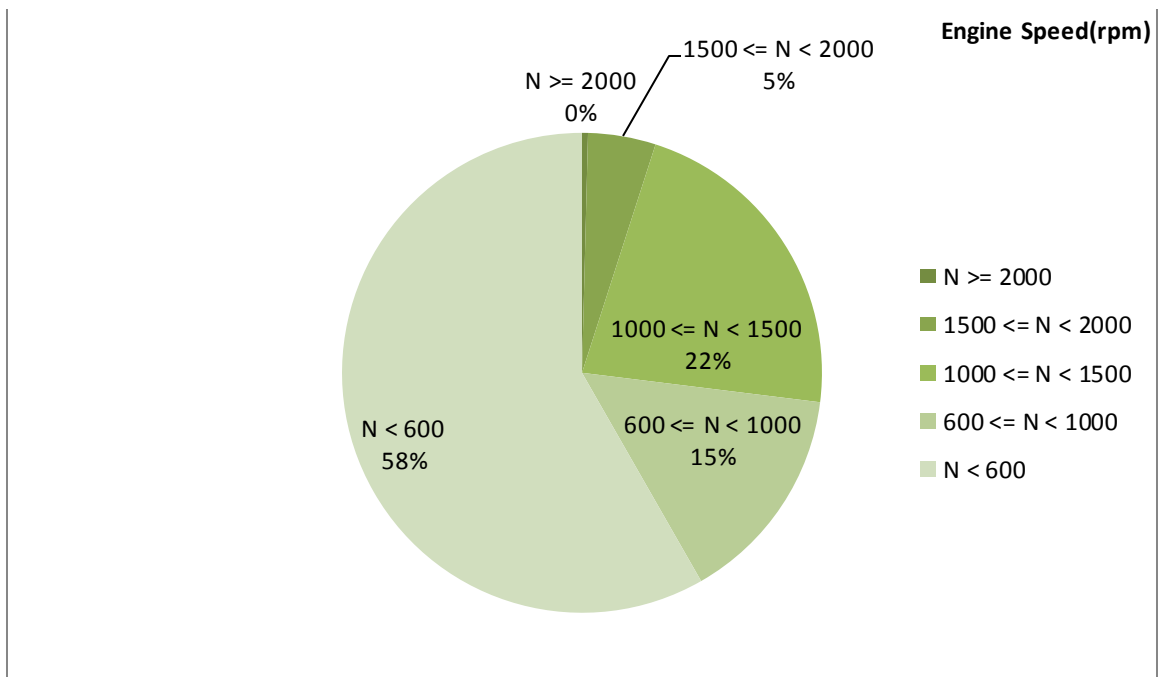


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
215.38	-	798

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
263.94	-	1111

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
510-54	-	2384-336

Notice: pressure values were left blank due to data leakage.

## Detailed Pressure Analysis

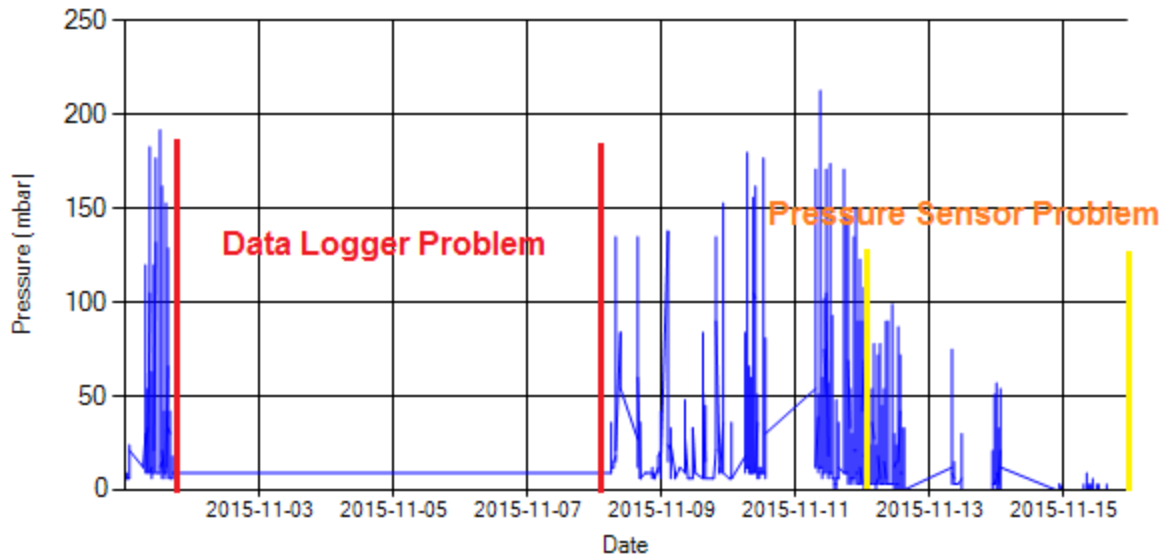


Figure 4- Pressure distribution over the period

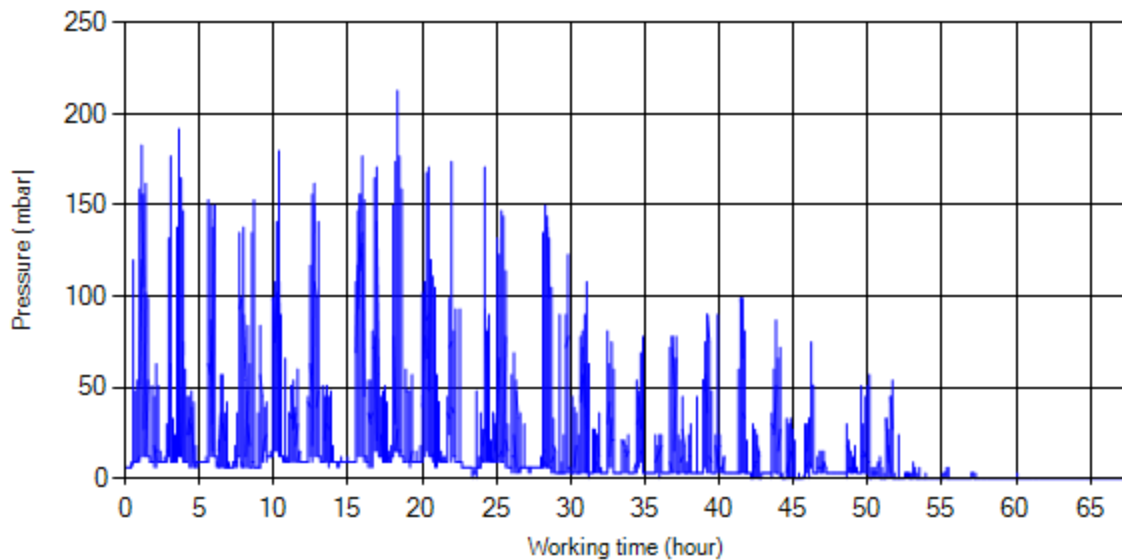


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

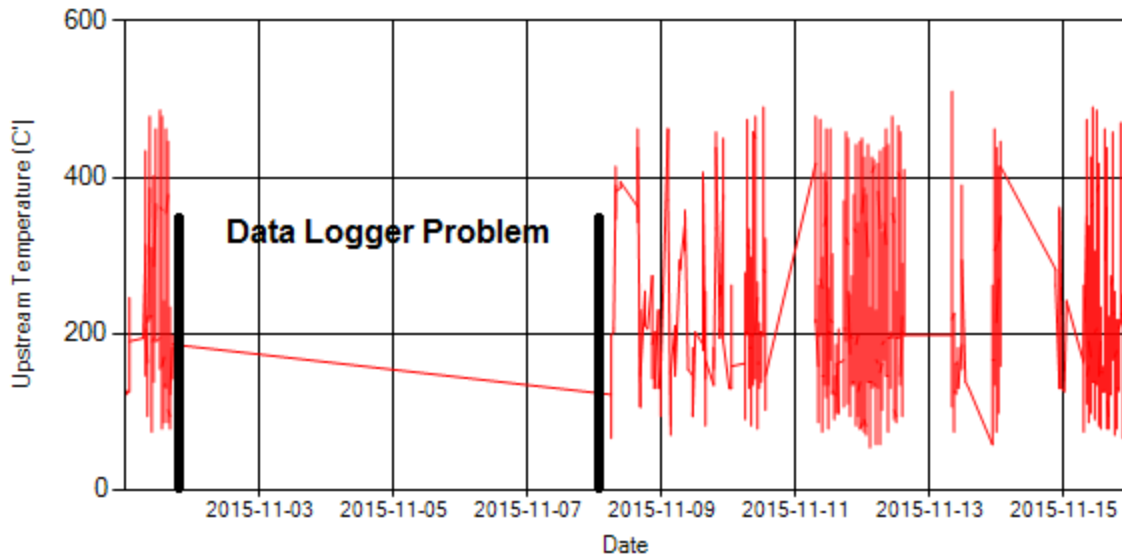


Figure 6- Temperature distribution over the period

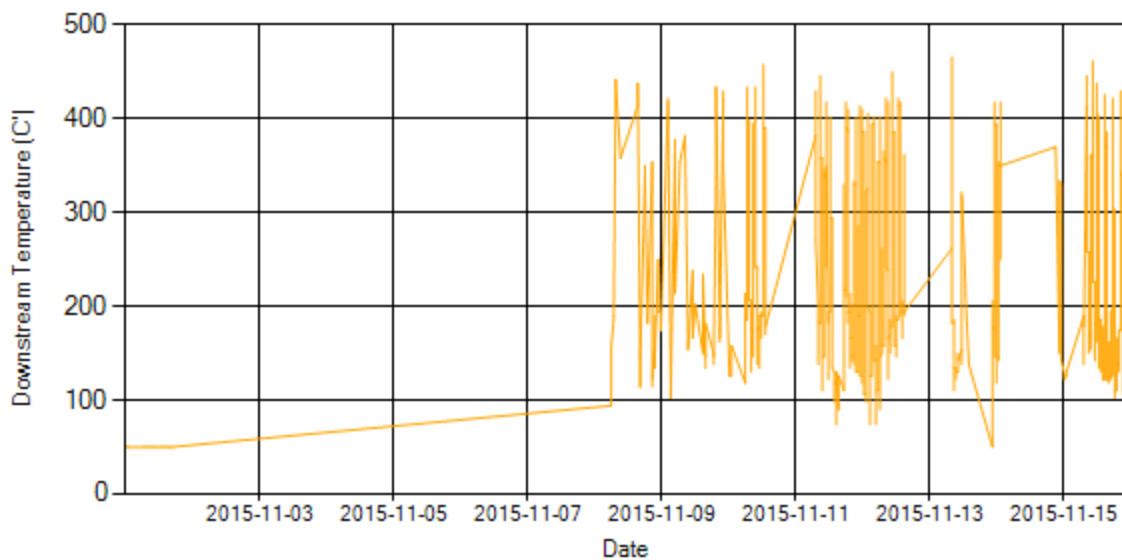


Figure 7- Temperature distribution over the period

Notice: Temp 2 sensor was installed on Nov 8<sup>th</sup>.

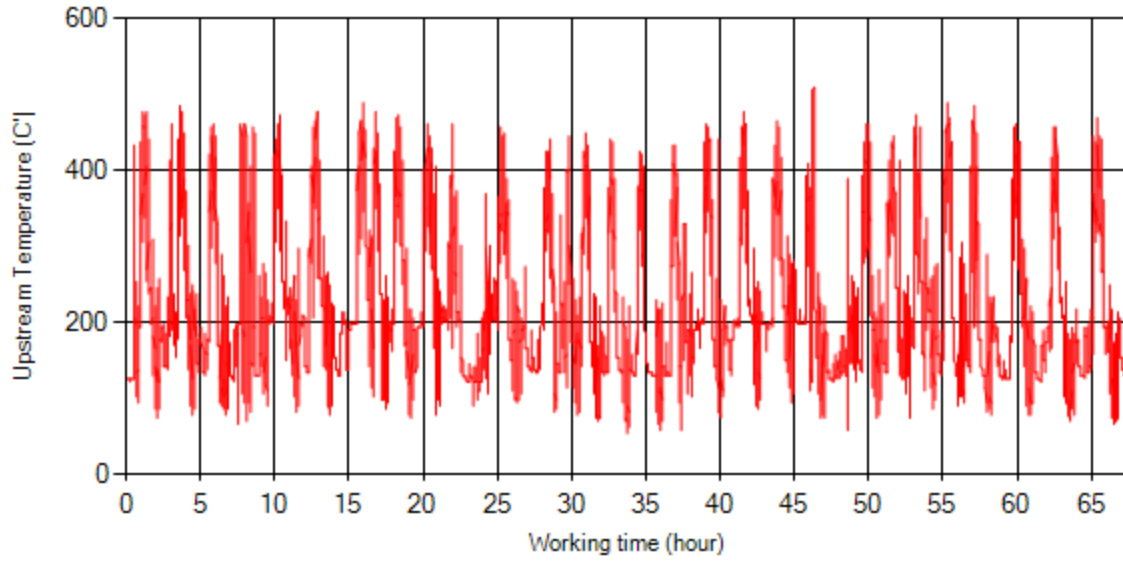


Figure 8- Temperature vs. working hours

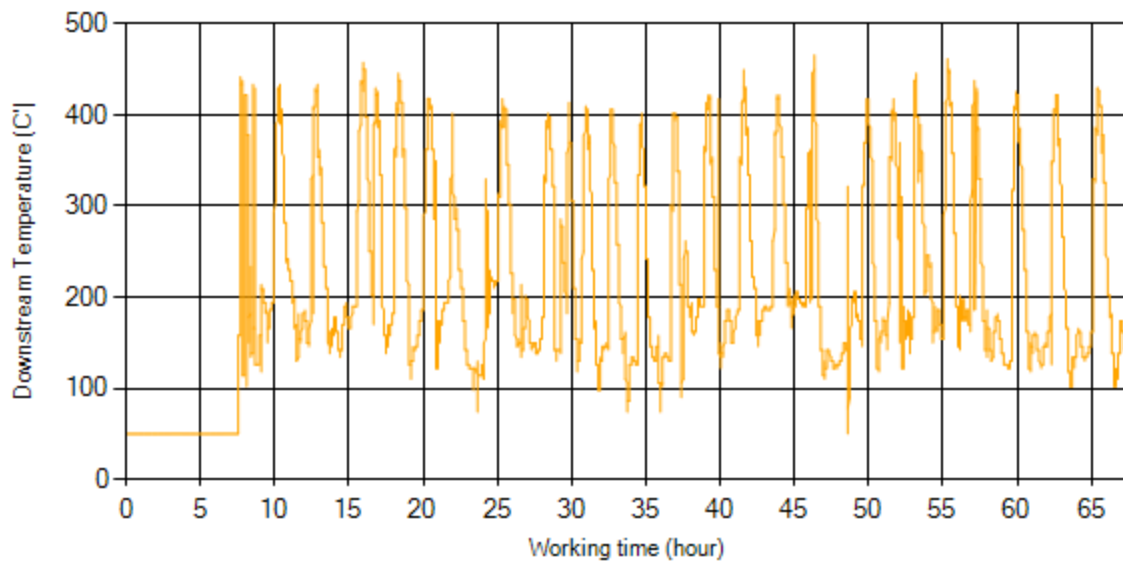


Figure 9- Temperature vs. working hours

## Engine Speed Diagrams

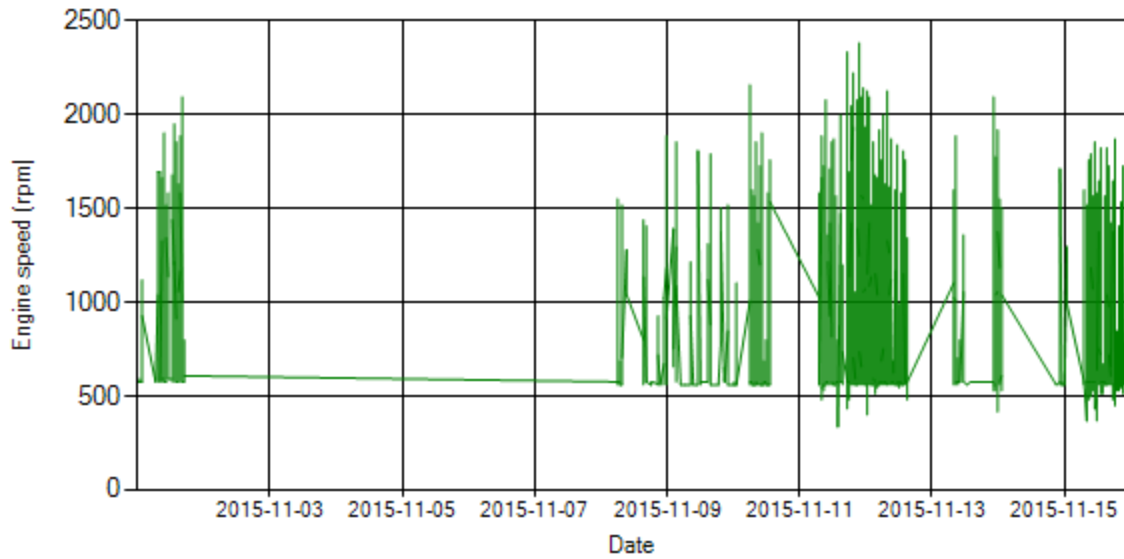


Figure 10- Engine speed distribution over the period

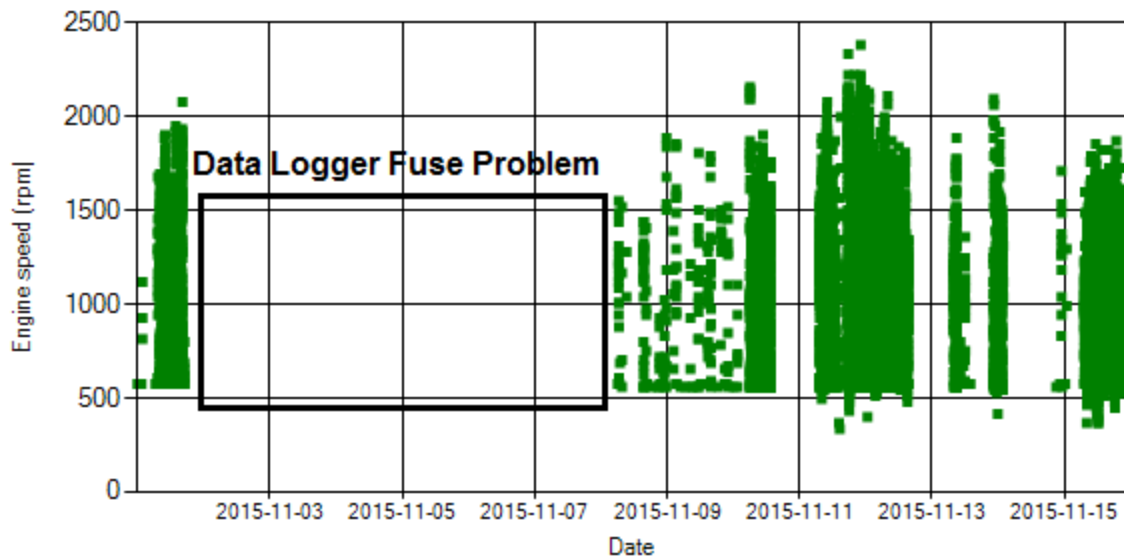


Figure 11- Engine speed diagram for calculating CPK's working days

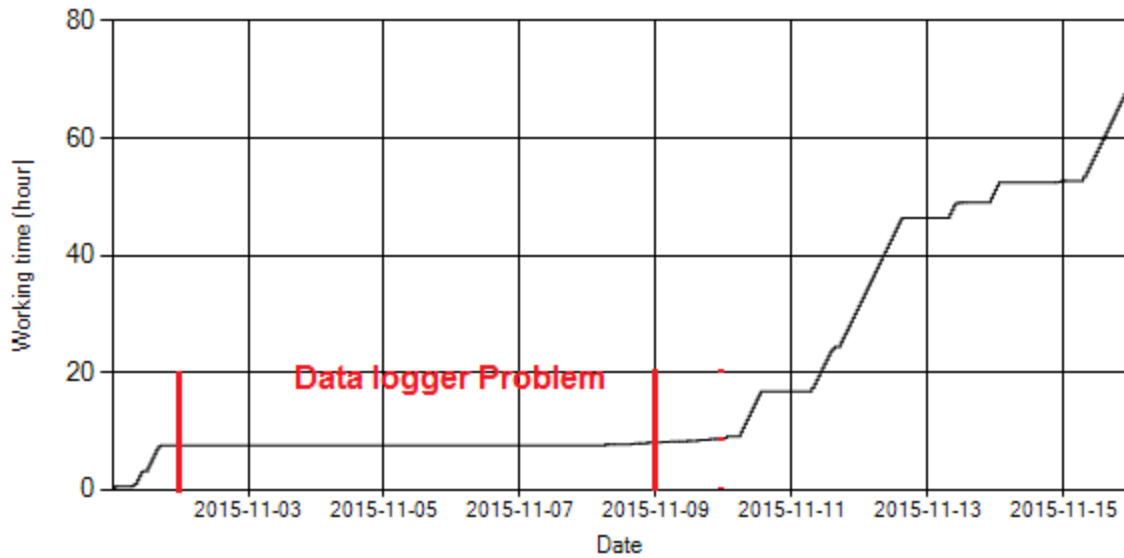


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data.

### Pressure-Engine Speed diagrams

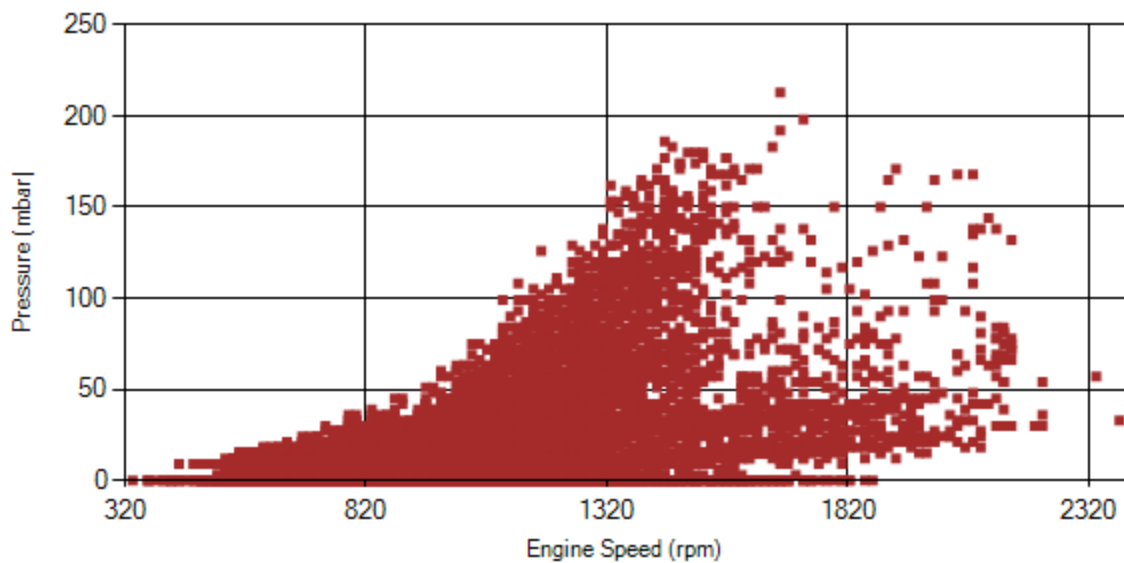


Figure 13- Pressure against engine speed

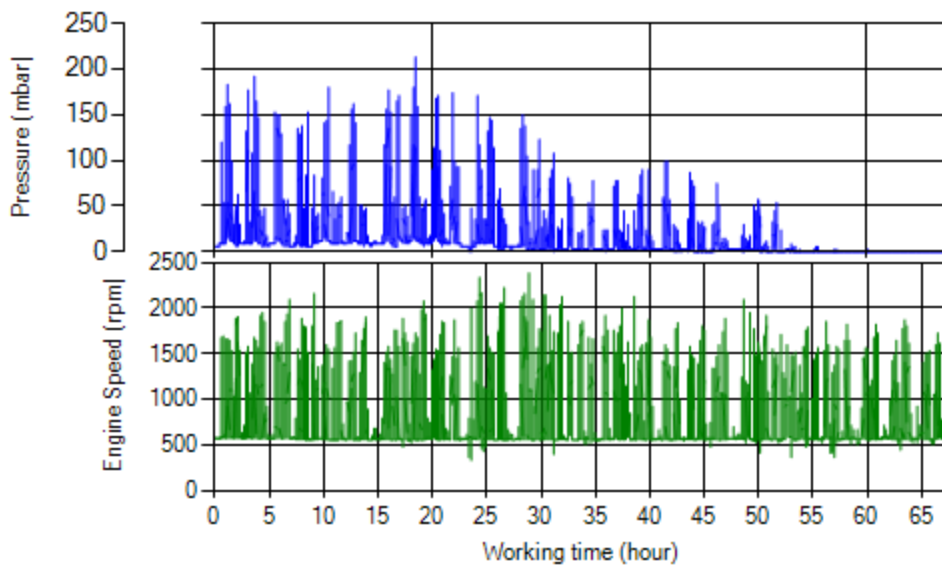


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

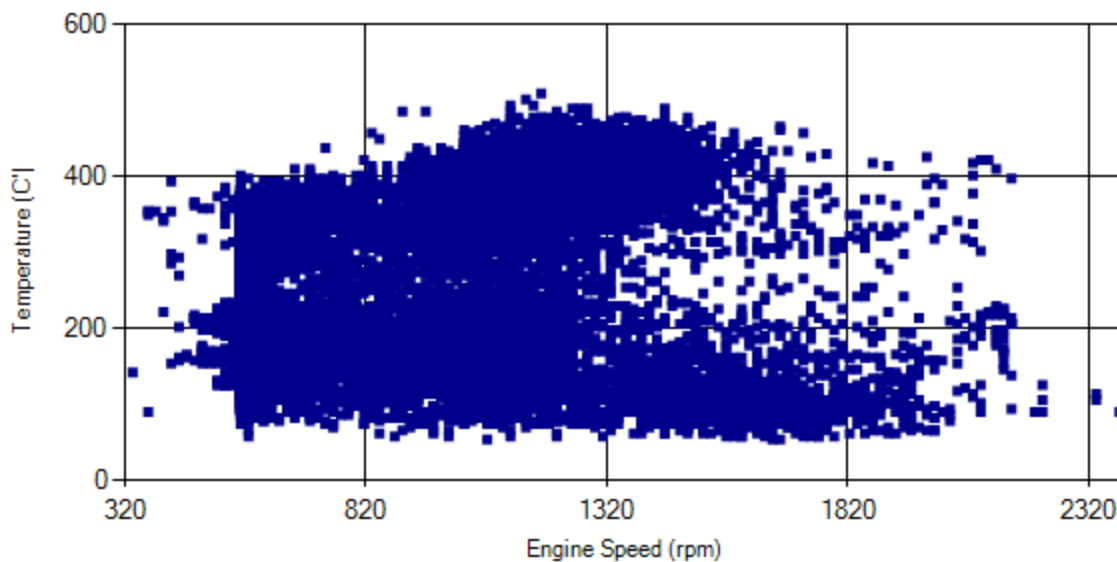


Figure 15- Temperature against engine speed



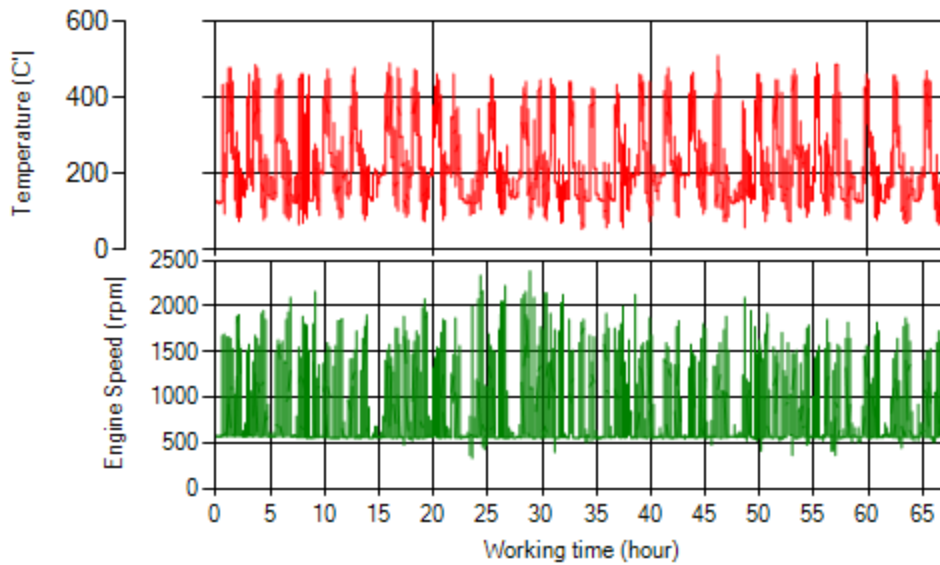


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, there wasn't enough data to evaluate DPF operation status exactly because of pressure sensor and data logger problem (**excellent or good**).
- it can be obviously observed that 7% of total working-time temperature is above 400 °C and 15% above 350°C.

Filter operation status	Excellent <input type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input type="checkbox"/>	Failed <input type="checkbox"/>

## Overall Information

*Table1- Overall Information*

Vehicle plate number	85476
CPK data logger number	LN: 001508, DN: 2003, Sim +989218469624
Bus line	Number 10 (south to north Bus line)
Bus Terminals	Azadi square - Daneshgah square
Total path distance	10.7 km
DPF producer company	HJS_04 (Passive system with FBC)
Installation date	23/Feb/2015
Report period	16/Nov/2015 – 30/Nov/2015 (fifteen days)
K value - DPF upstream	1.90 [1/m]
K value – DPF downstream	0.04 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	DPF was cleaned on 22 <sup>nd</sup> Jul.
Dosing status	Dosing value has been kept constant from installation date until now.

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	42066 km
Bus mileage over the period	1726 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	127 hours 13 minutes
Average working hours per day (including stop days)	8 hours 28 minutes
Bus average speed	13.57 km/hr
idle speed time to all working time ration	64.87 %
Total Bus fuel consumption over the period	1100 lit
Fuel consumption per hour	8.65 lit/hr
Average fuel consumption	0.64 lit/km
Total Bus additive consumption over the period	0.5 lit
Average additive consumption	290 cc/km
Additive consumption to fuel ration	455 cc/1000lit

## Temperature, Pressure and Engine Speed Overview

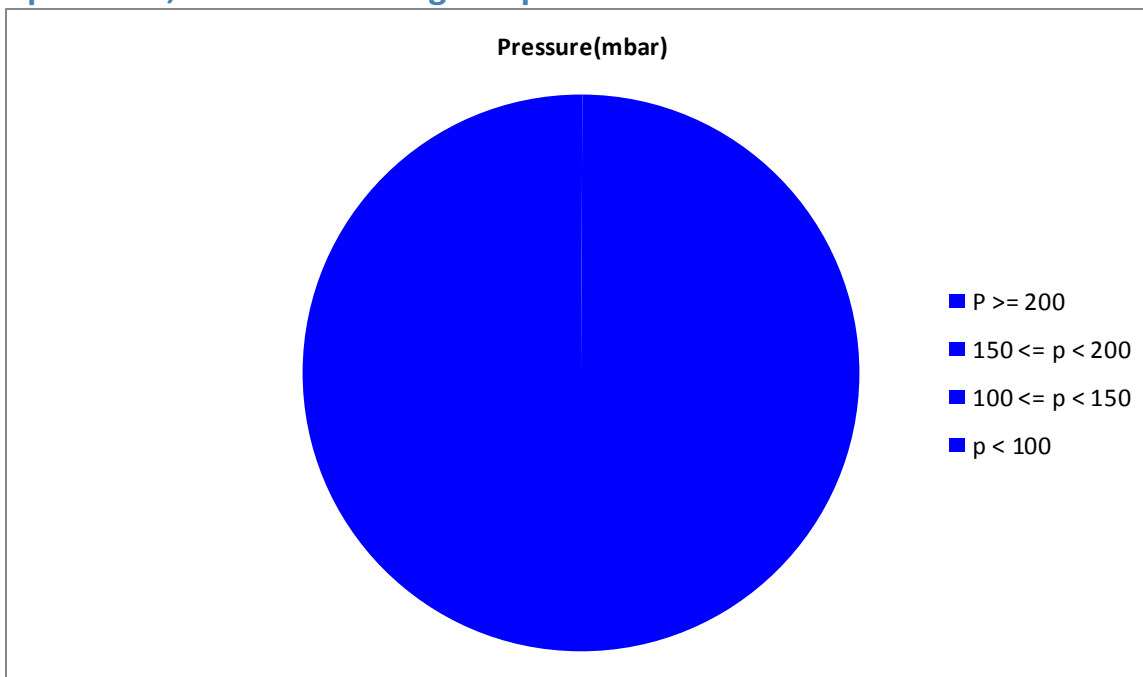


Figure 1- Pressure distribution over the working hours

Notice: Pressure sensor got problem on Nov 11th and was fixed on Nov 29<sup>th</sup>. So pressure pie diagram was left blank due to data leakage.

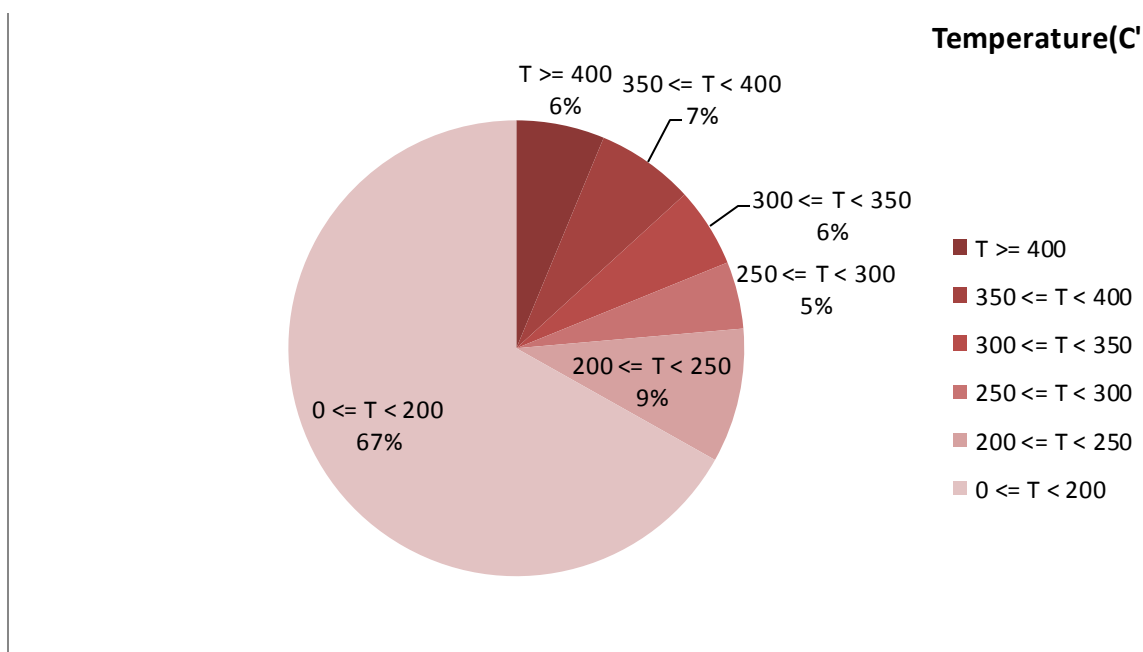


Figure 2-Temperature distribution over the working hours

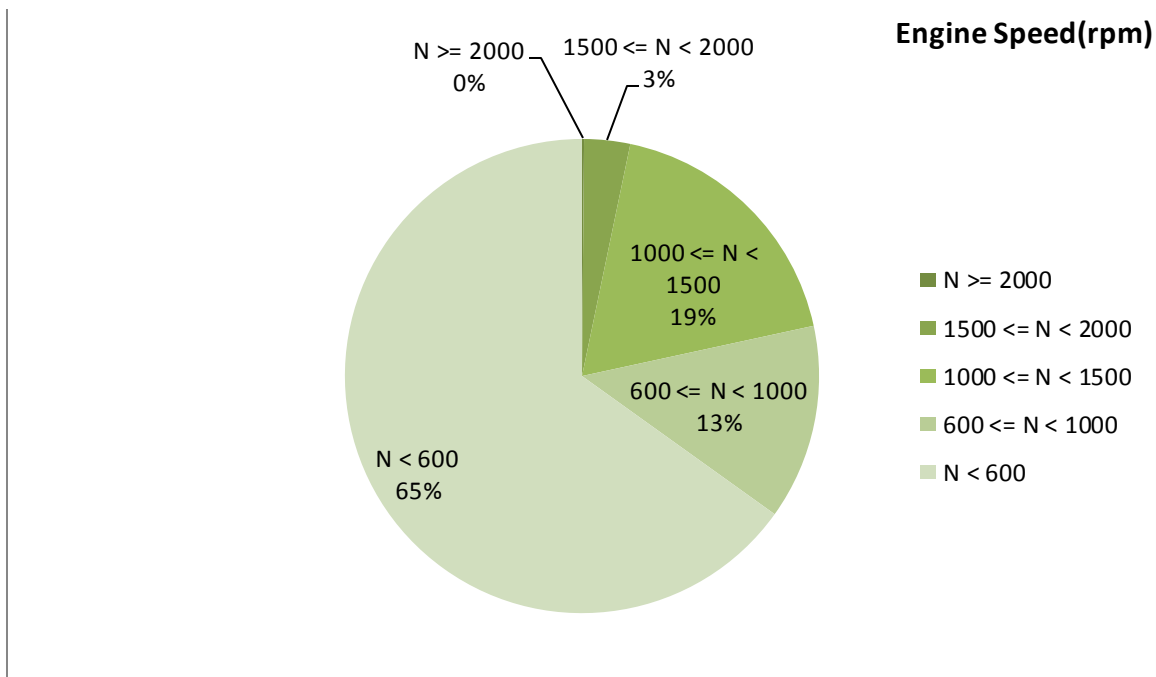


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
204.57	-	750

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
271.74	-	1083

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
506-50	-	2320-256

Notice: pressure values were left blank due to data leakage.

## Detailed Pressure Analysis

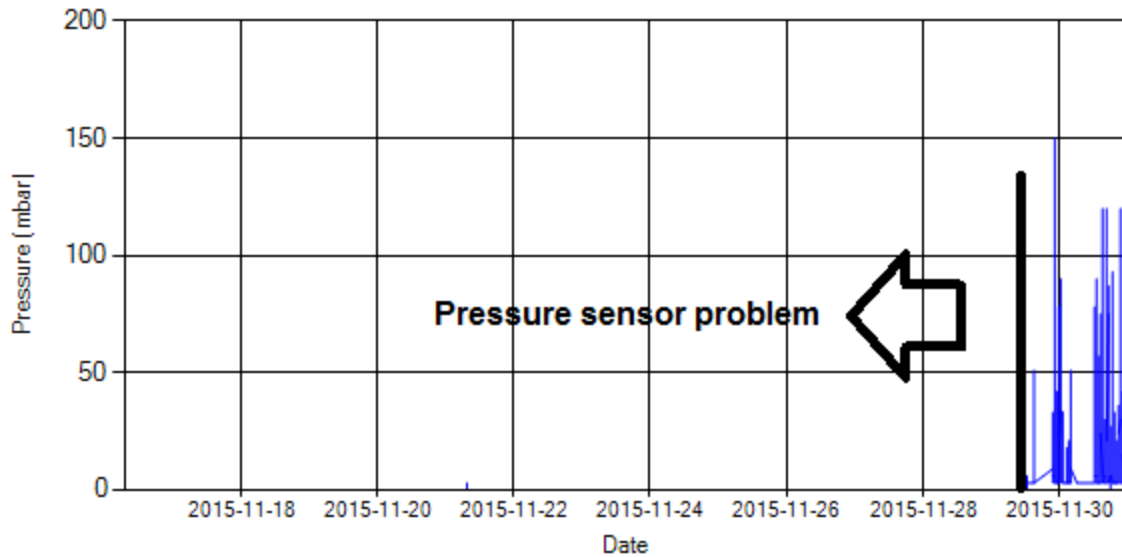


Figure 4- Pressure distribution over the period

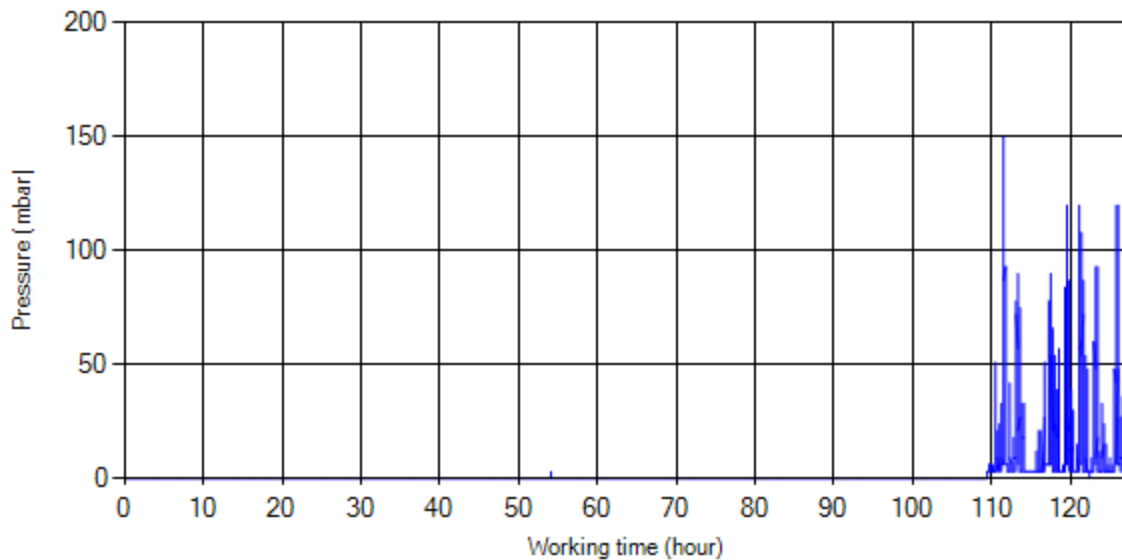


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

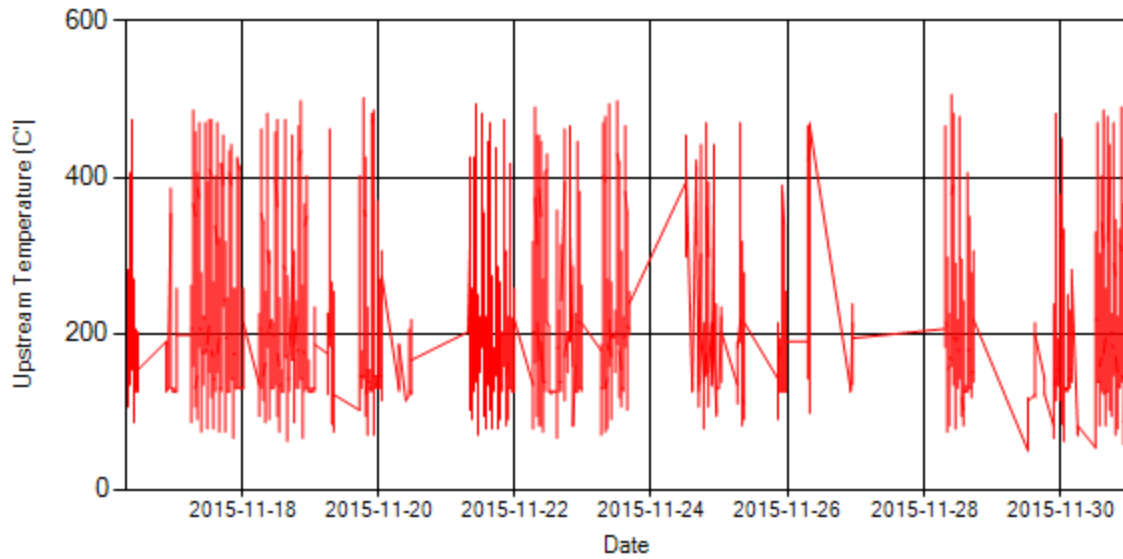


Figure 6- Temperature distribution over the period

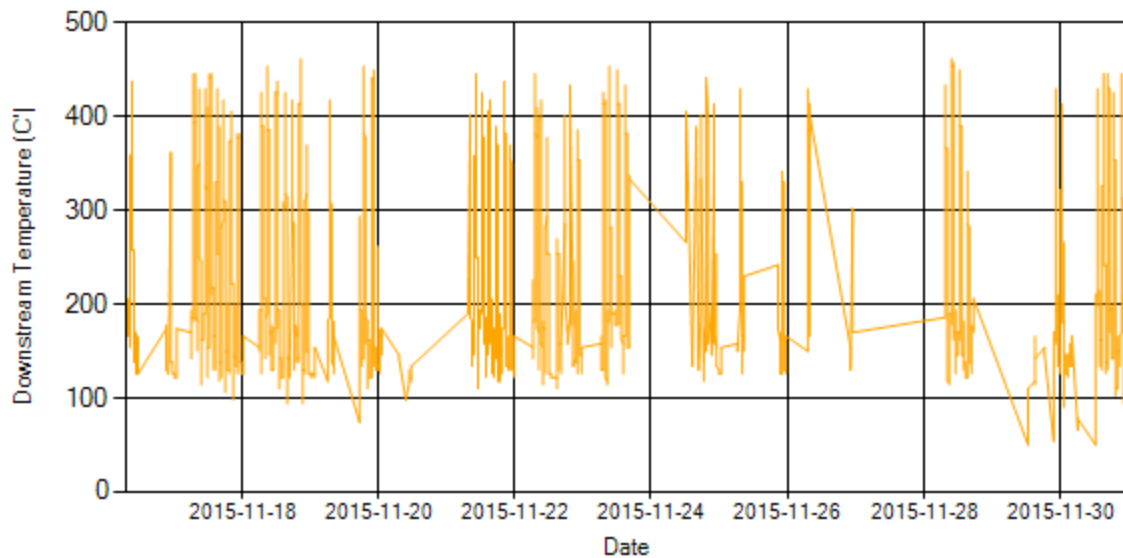


Figure 7- Temperature distribution over the period

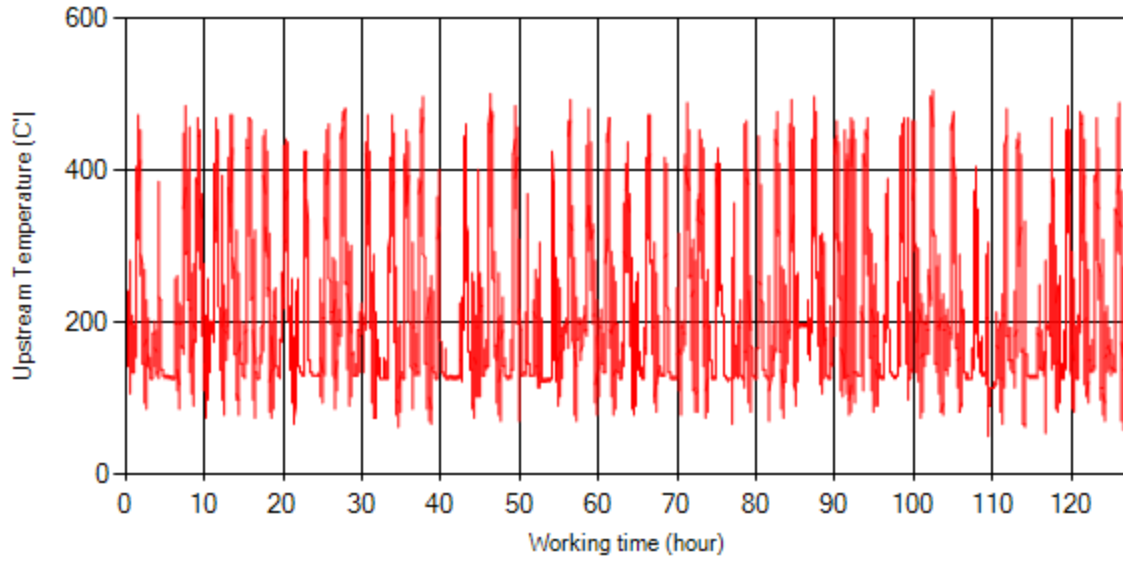


Figure 8- Temperature vs. working hours

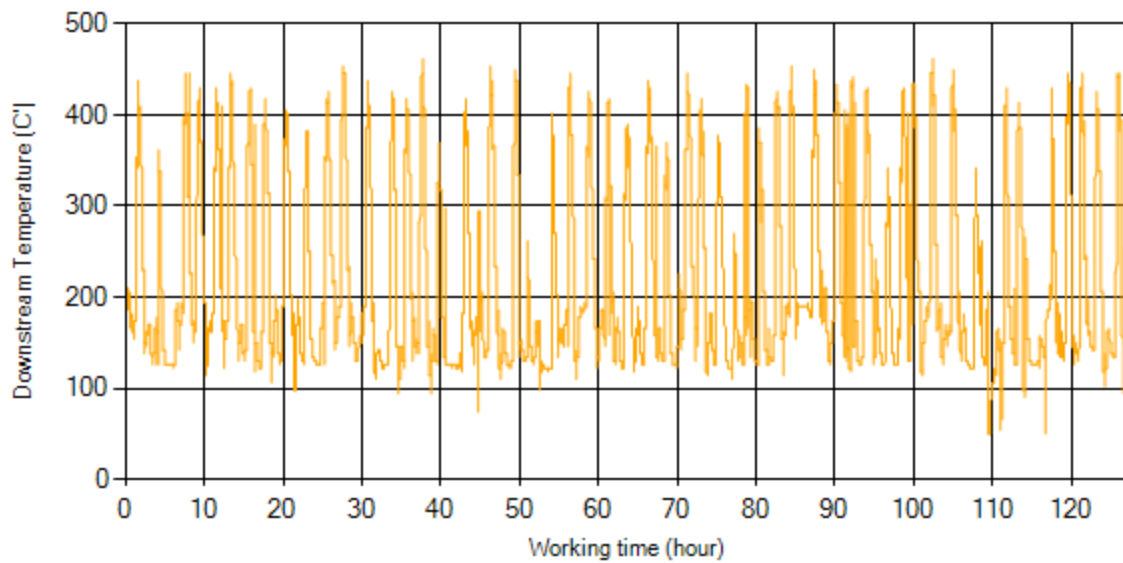


Figure 9- Temperature vs. working hours



## Engine Speed Diagrams

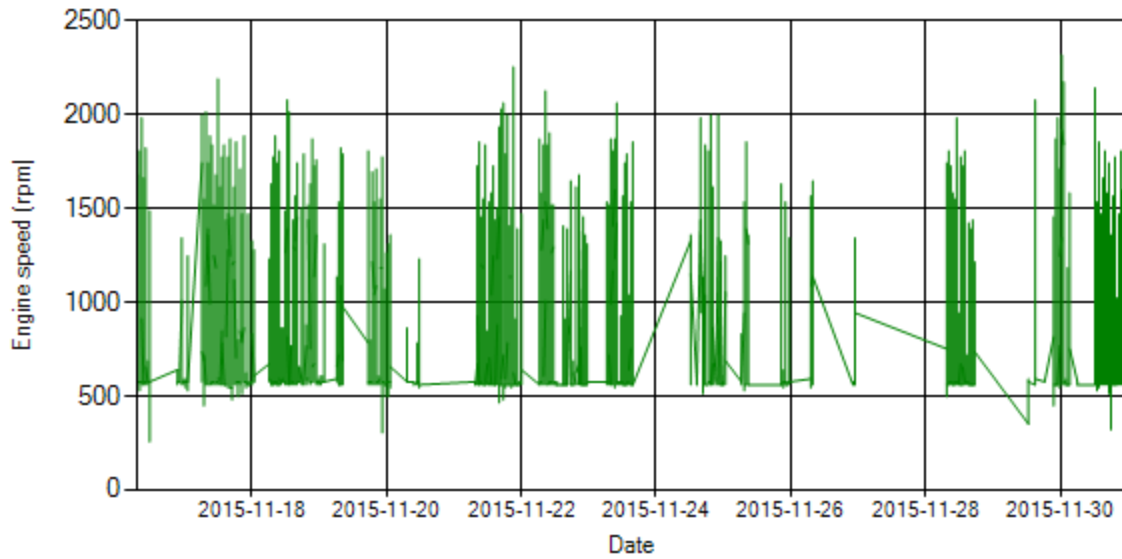


Figure 10- Engine speed distribution over the period

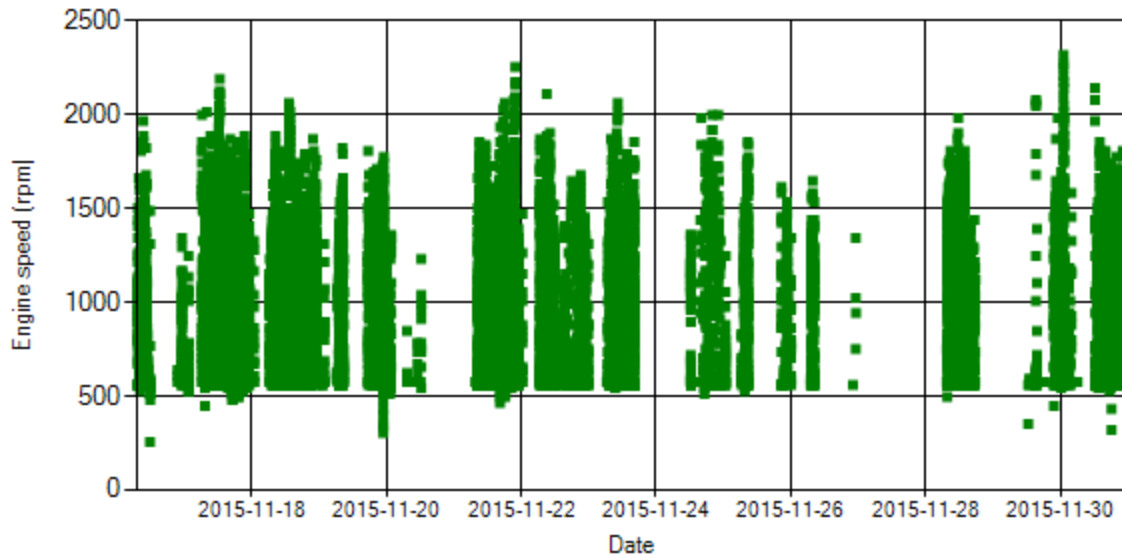


Figure 11- Engine speed diagram for calculating CPK's working days

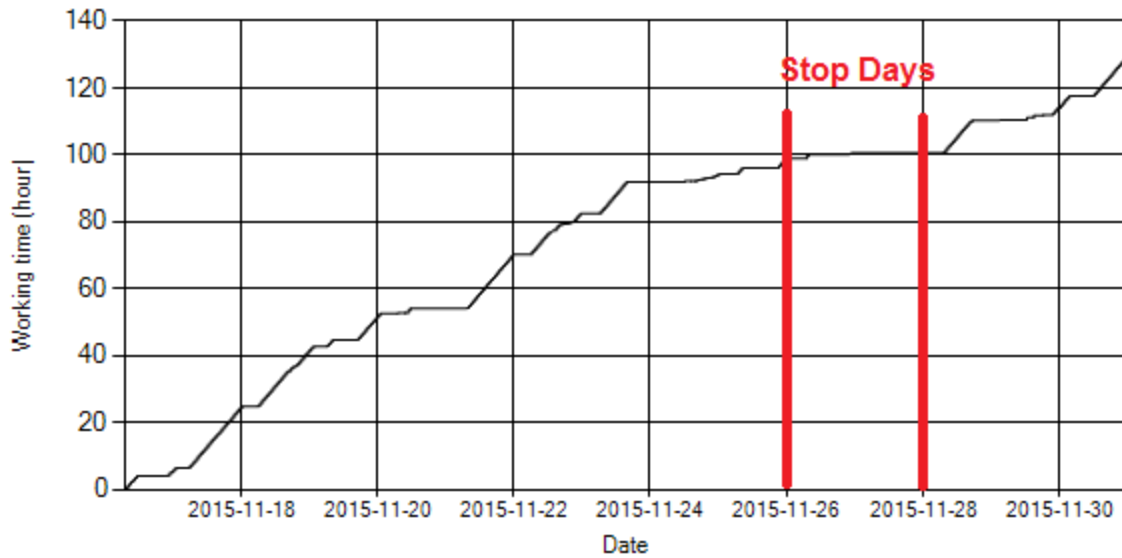


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data.

### Pressure-Engine Speed diagrams

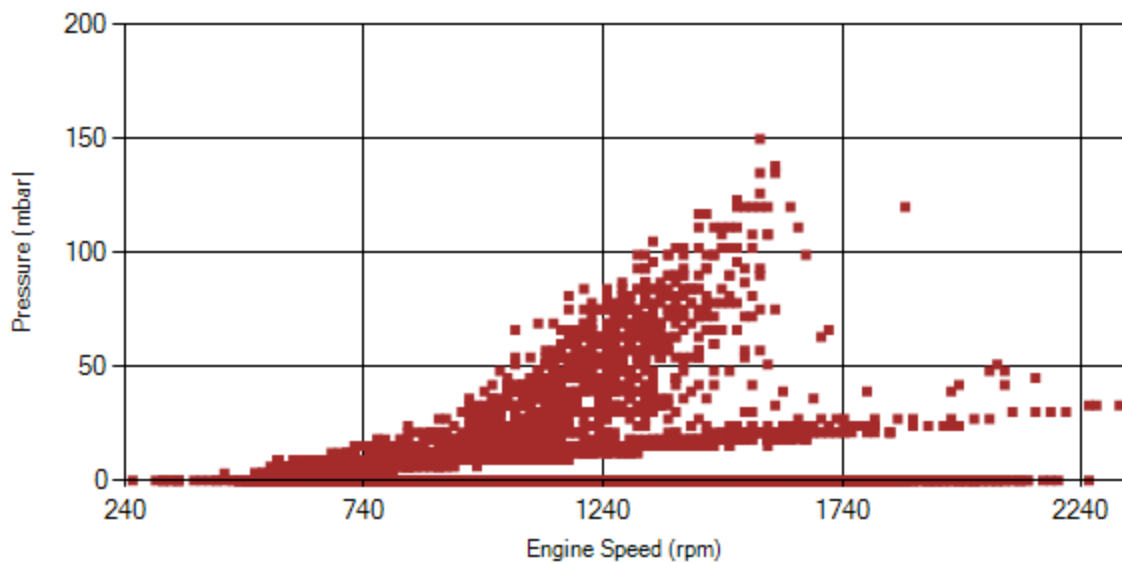


Figure 13- Pressure against engine speed

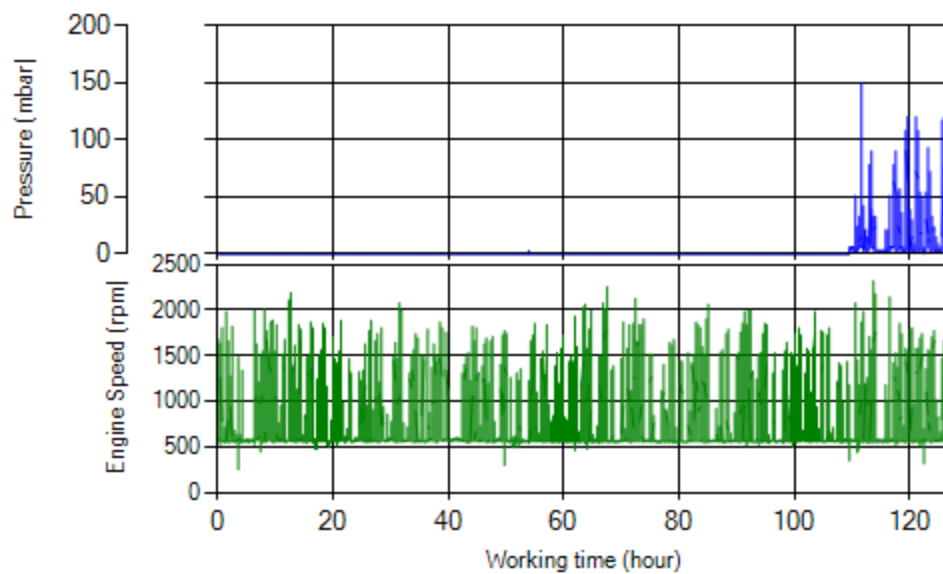


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

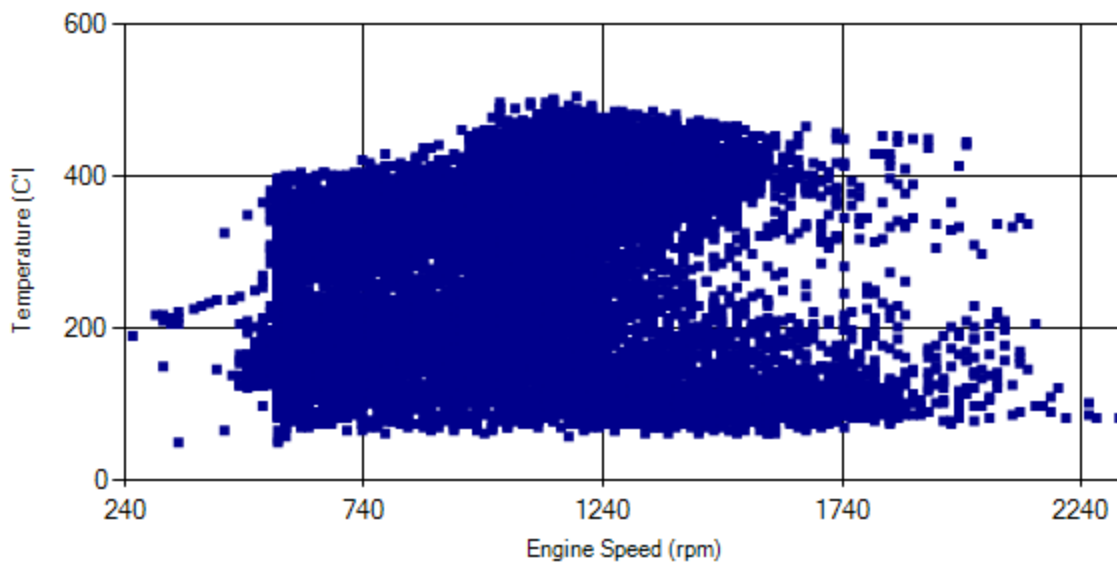


Figure 15- Temperature against engine speed

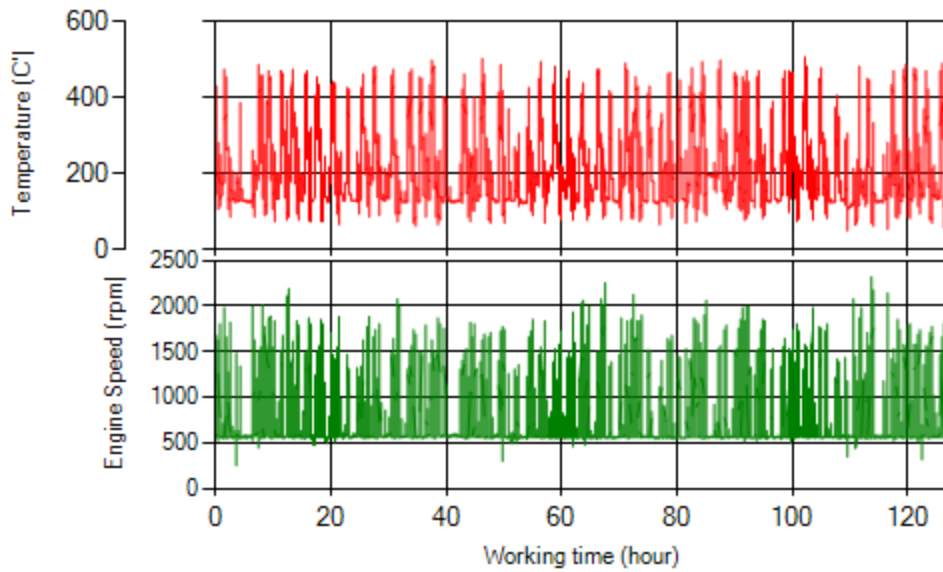


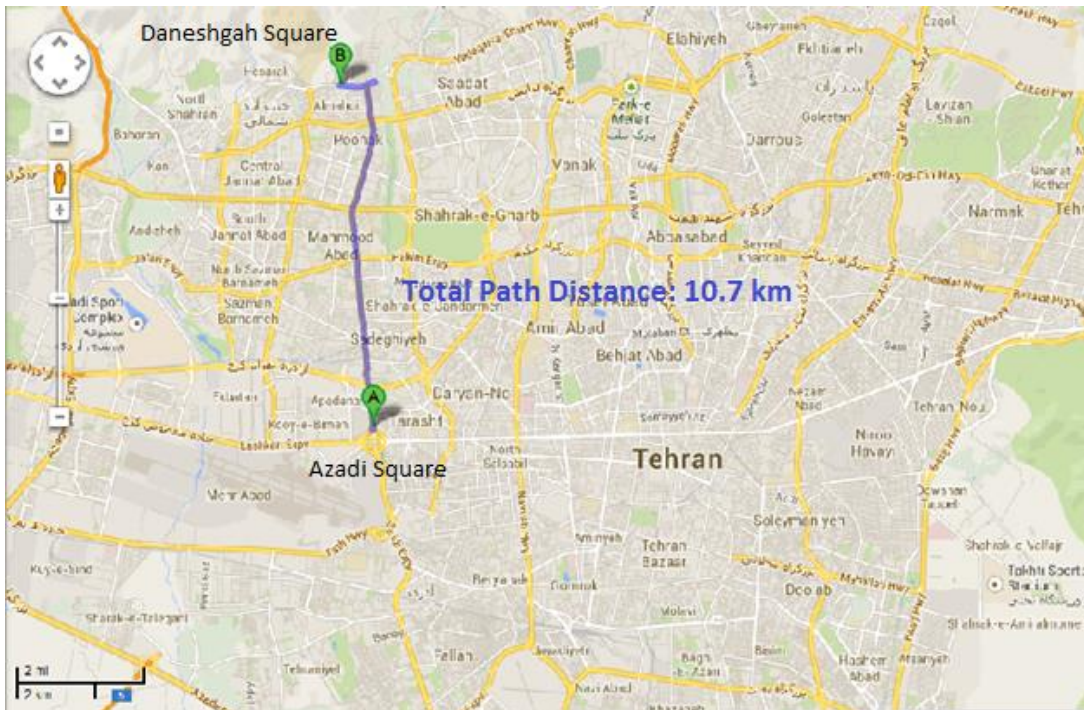
Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, there wasn't enough data to evaluate DPF operation status exactly because of pressure sensor problem (**excellent or good**).
- Considering October last ten days (figure 2), it can be obviously observed that 6% of total working-time temperature is above 400 °C and 13% above 350°C.

Filter operation status	Excellent <input type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input type="checkbox"/>	Failed <input type="checkbox"/>

Vehicle plate number	85182
Bus line	Number 10 (south to north Bus line)
DPF producer company	Tehag_01 (Catalyzed DPF)



## Overall Information

*Table1- Overall Information*

Vehicle plate number	85182
CPK data logger number	LN: 001502, DN: 1999
Bus line	Number 10 (south to north Bus line)
Bus Terminals	Azadi square - Daneshgah square
Total path distance	10.7 km
DPF producer company	Tehag_01 (Catalyzed DPF)
Installation date	24/Sep/2015
Report period	01/Nov/2015 – 15/Nov/2015 (fifteen days)
K value - DPF upstream	1.70 [1/m]
K value – DPF downstream	0.00 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	Filter have been working from installation date without any cleaning.
Dosing status	This system doesn't use additive

*Table 3- Fuel and Additive Consumption Information*

Bus mileage (from DPF installation date)	5132 km
Bus mileage over the period	1361 km
Working days over the period	11 days
Stop days	4 days
Data logger working days	11 days
Working hours over the period	134 hours 28 minutes
Average working hours per day (including stop days)	12 hours 13 minutes
Bus average speed	10.12 km/hr
idle speed time to all working time ration	60.06 %
Total Bus fuel consumption over the period	870 lit
Fuel consumption per hour	6.47 lit/hr
Average fuel consumption	0.64 lit/km
Total Bus additive consumption over the period	- lit
Average additive consumption	- cc/km
Additive consumption to fuel ration	- cc/1000lit

Notice: This system doesn't use additive (CDPF).

### Temperature, Pressure and Engine Speed Overview

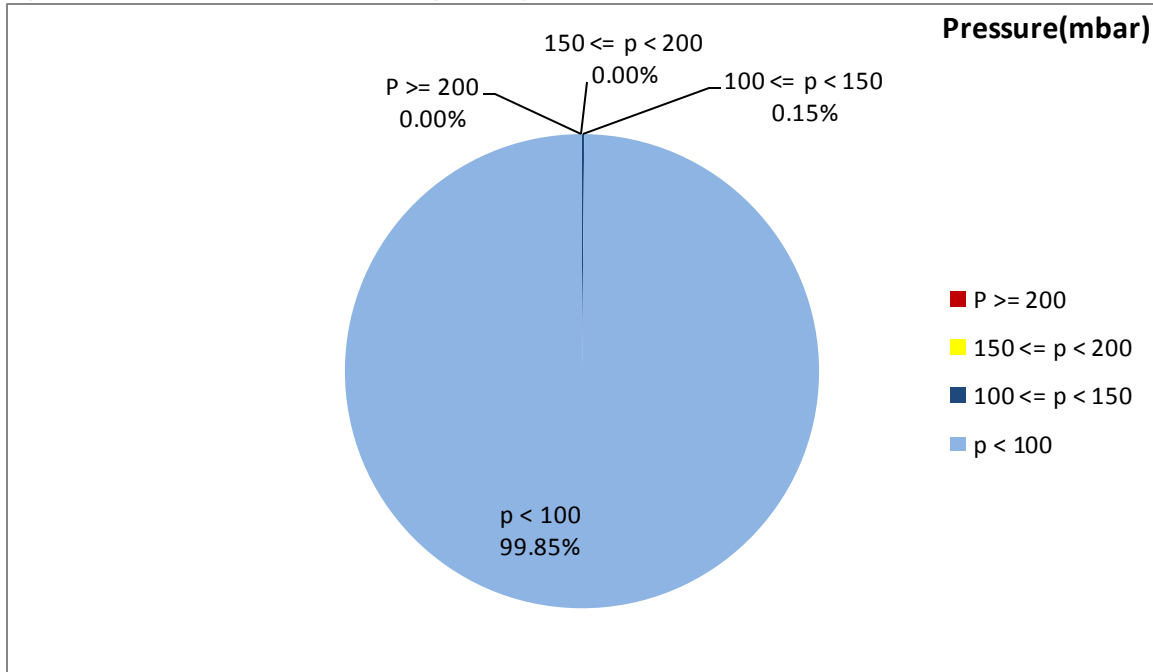


Figure 1- Pressure distribution over the working hours

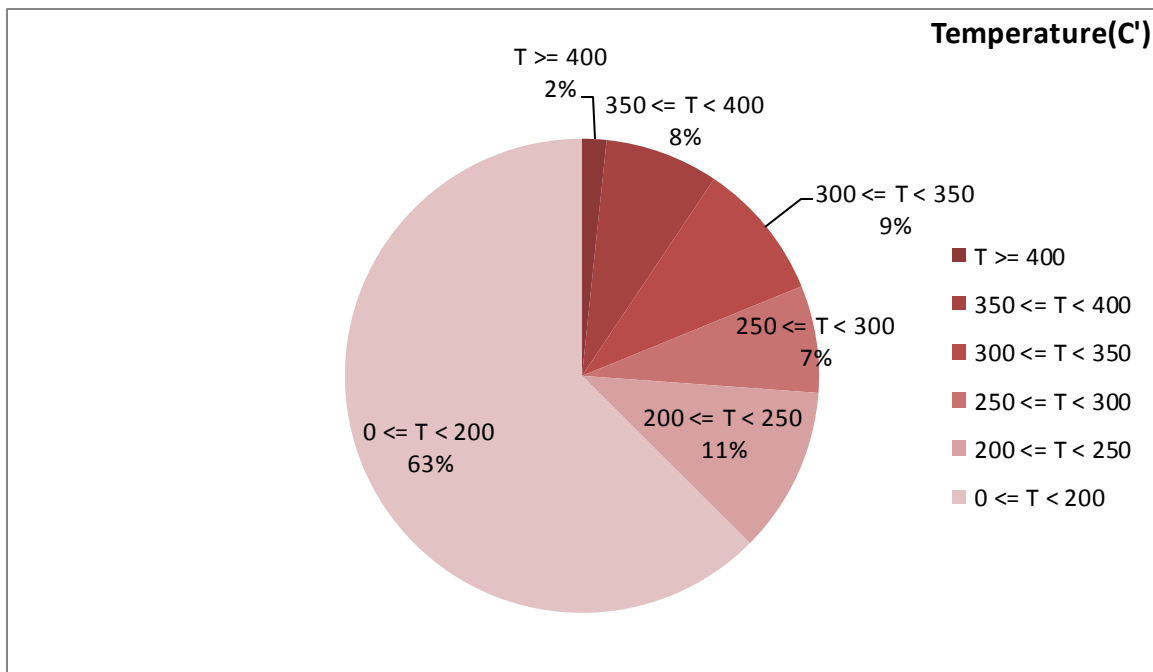


Figure 2-Temperature distribution over the working hours



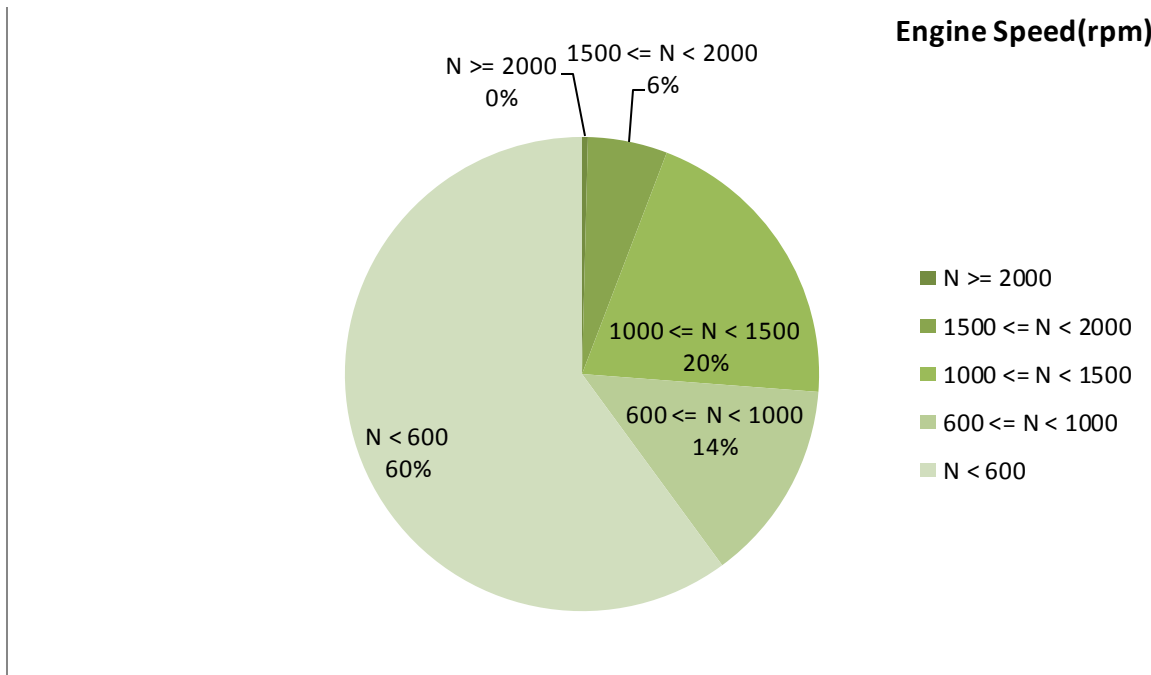


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
205.9	7.76	790

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
250.97	18.47	1147

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
446-50	117-0	2256-288

## Detailed Pressure Analysis

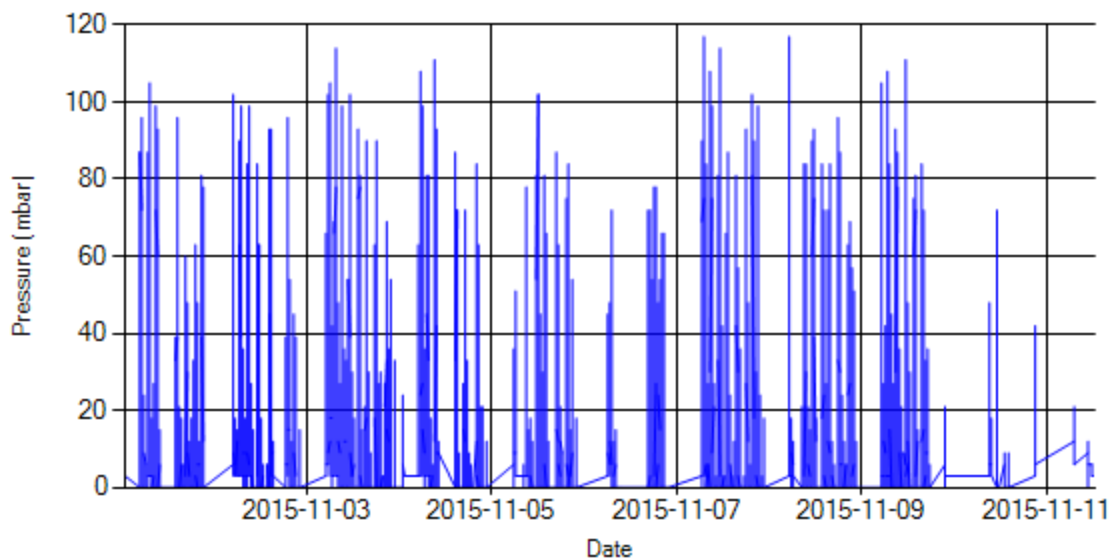


Figure 4- Pressure distribution over the period

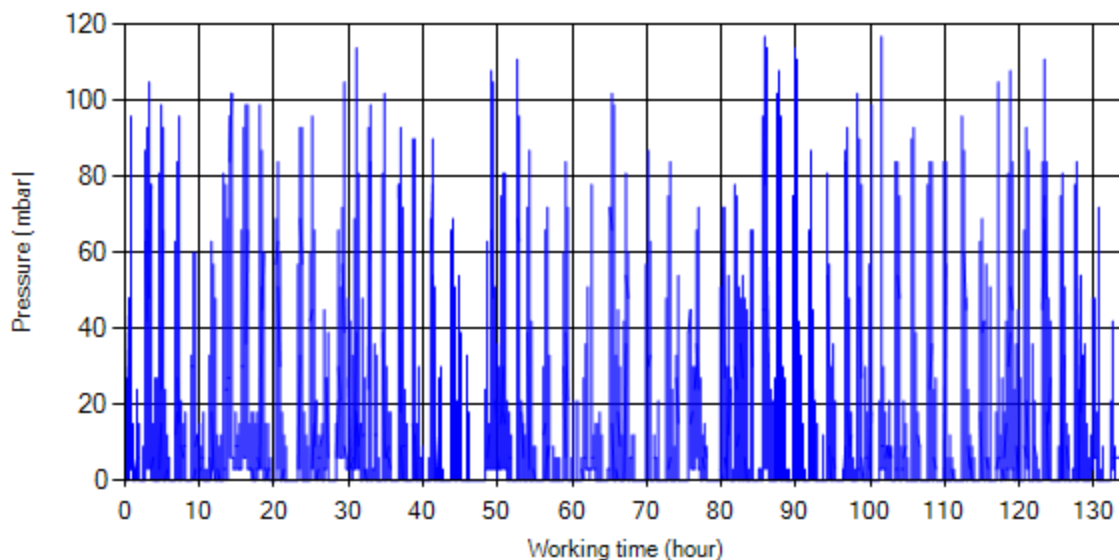


Figure 5- Pressure vs. working hours

Notice: backpressure distribution was shown into two diagrams. As obvious in figure 5, stop-working periods were eliminated and pressure was displayed along working hours.

## Detailed Temperature Analysis

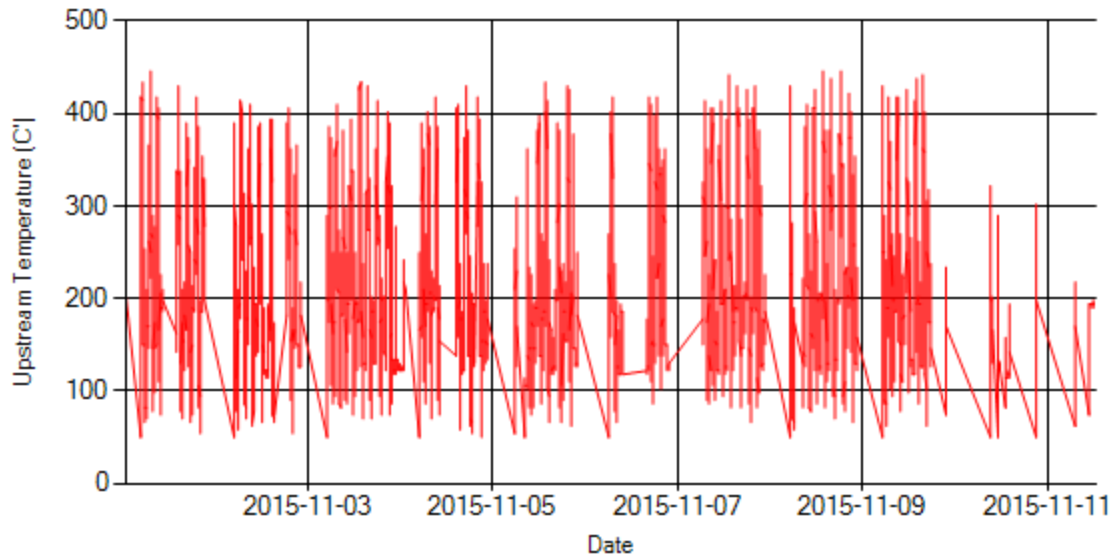


Figure 6- Temperature distribution over the period

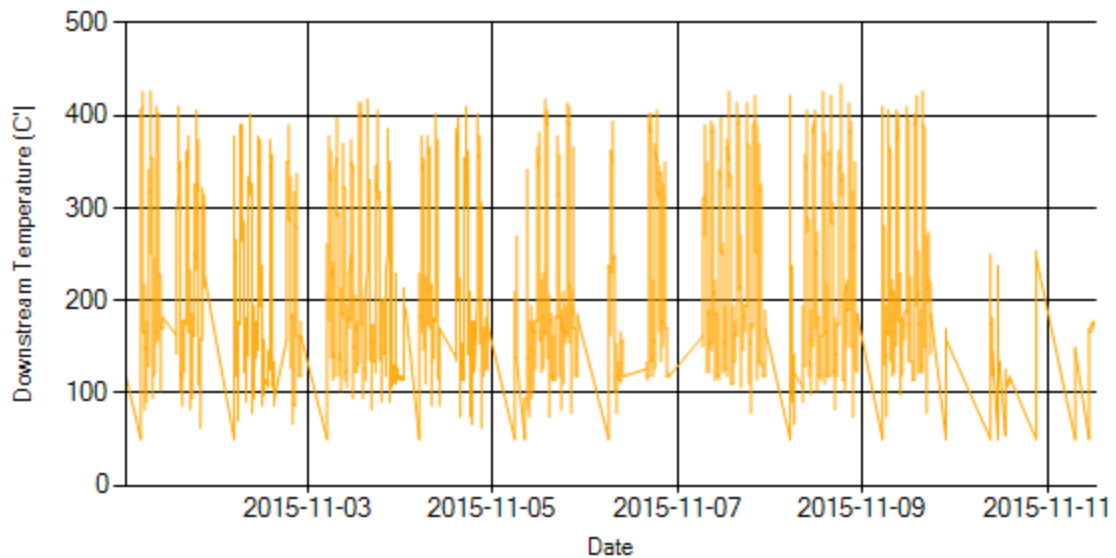
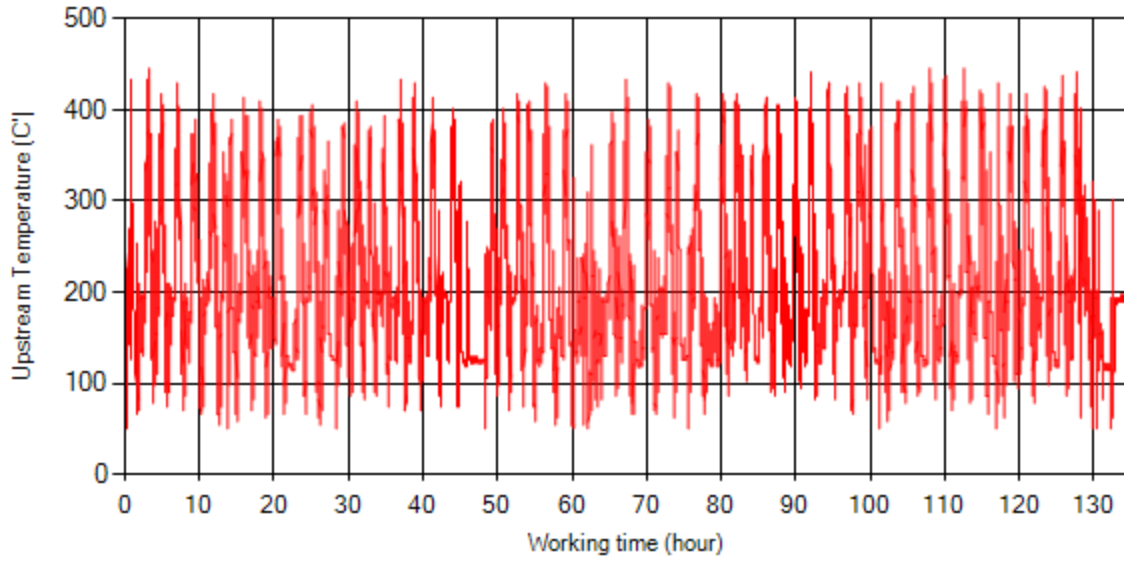
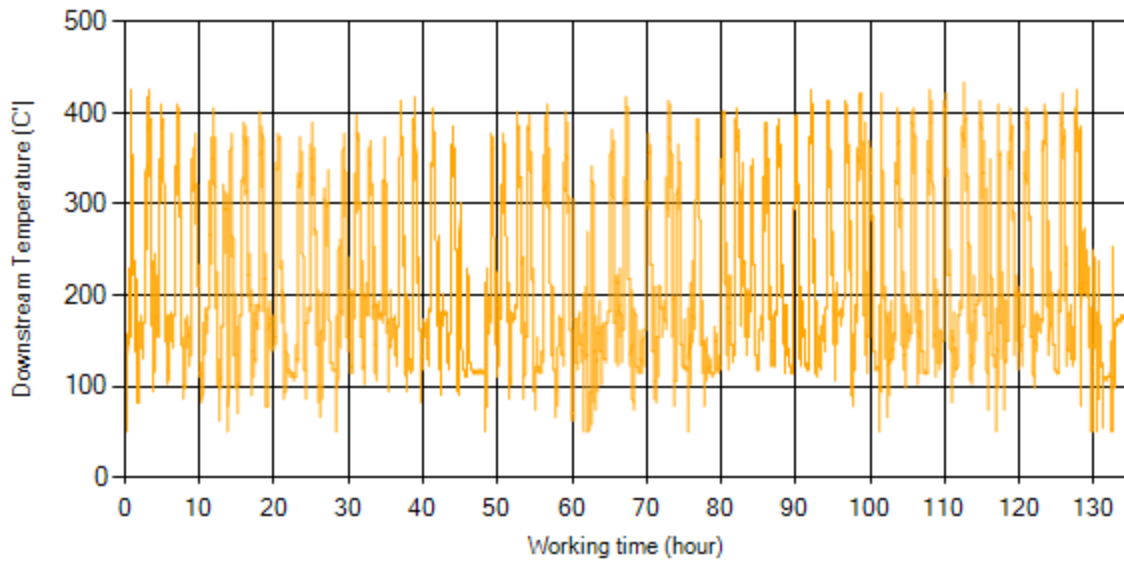


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

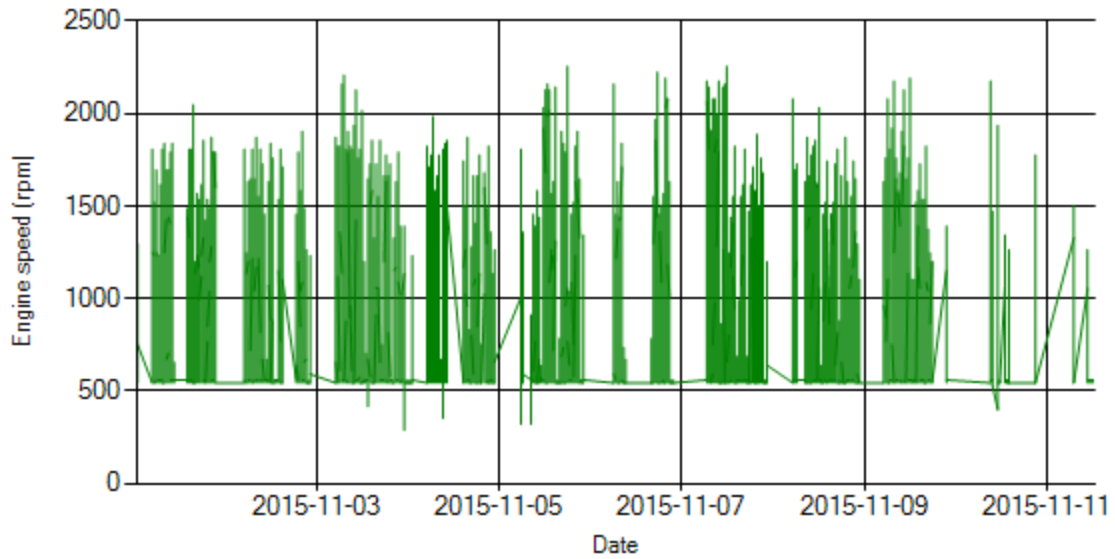


Figure 10- Engine speed distribution over the period

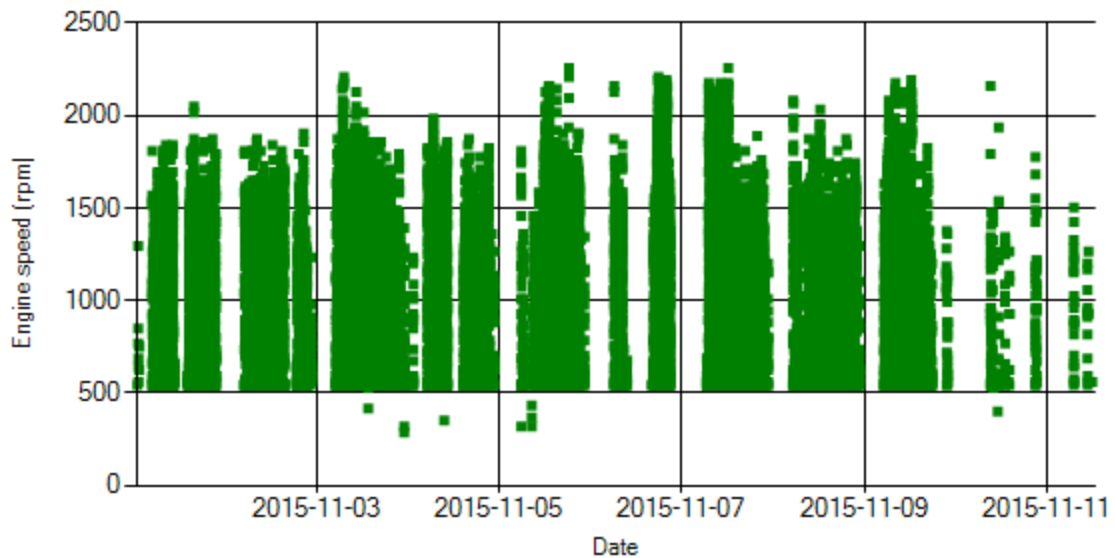


Figure 11- Engine speed diagram for calculating CPK's working days

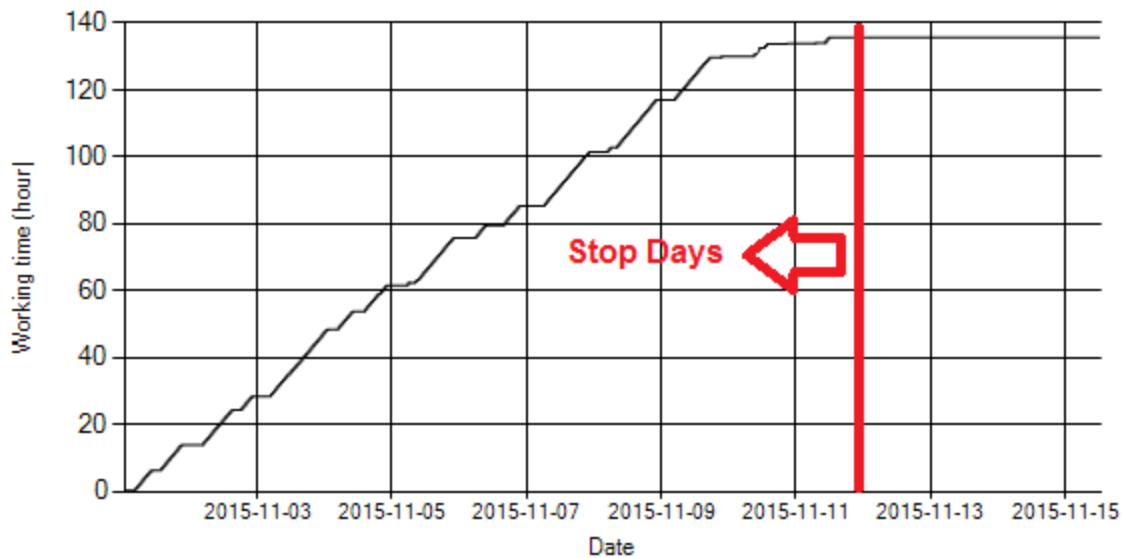


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12, bus was stationary for 4 days during this period.

### Pressure-Engine Speed diagrams

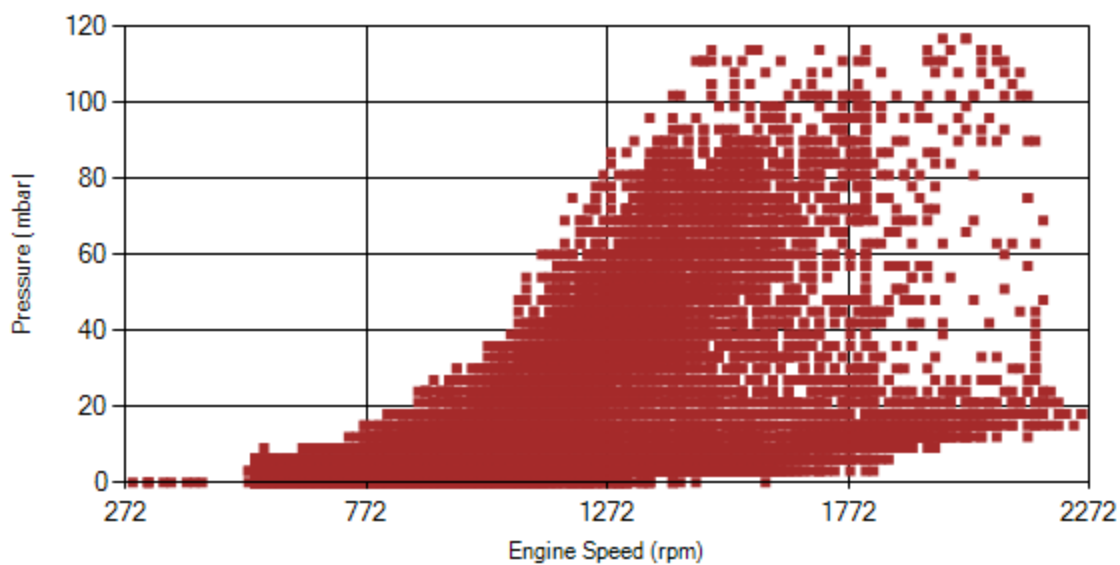


Figure 13- Pressure against engine speed

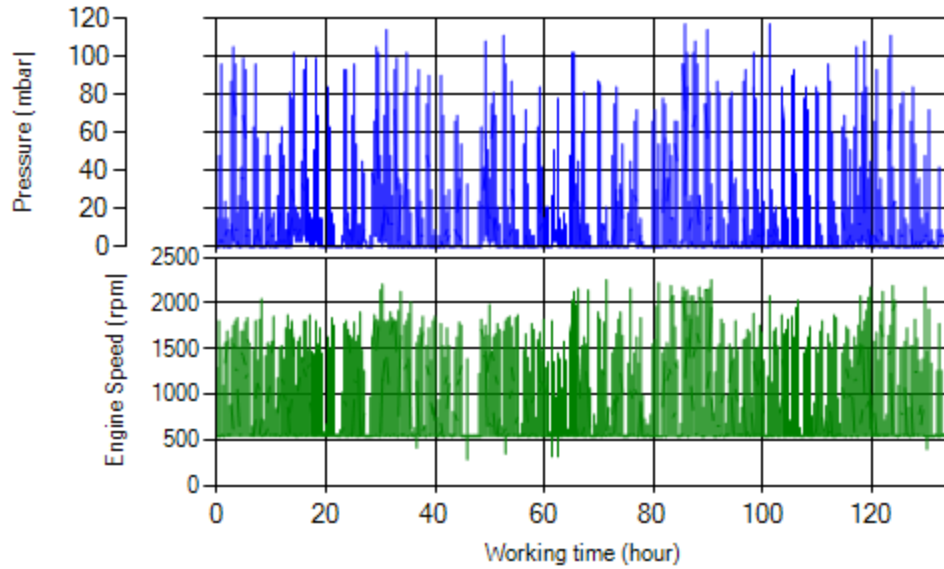


Figure 14- P, N distribution vs. working hours

## Temperature-Engine Speed diagrams

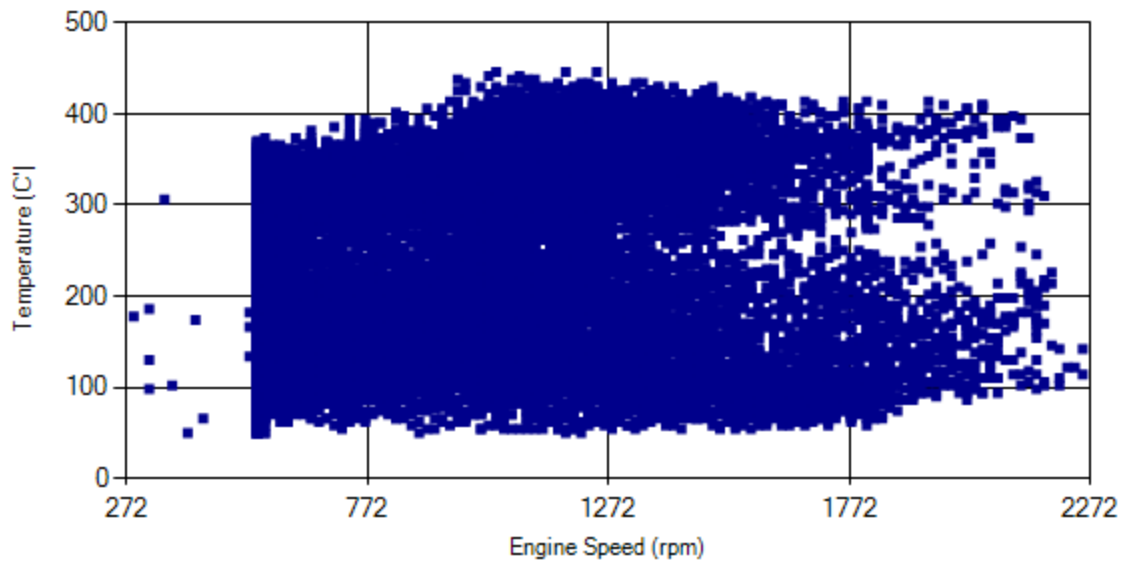


Figure 15- Temperature against engine speed

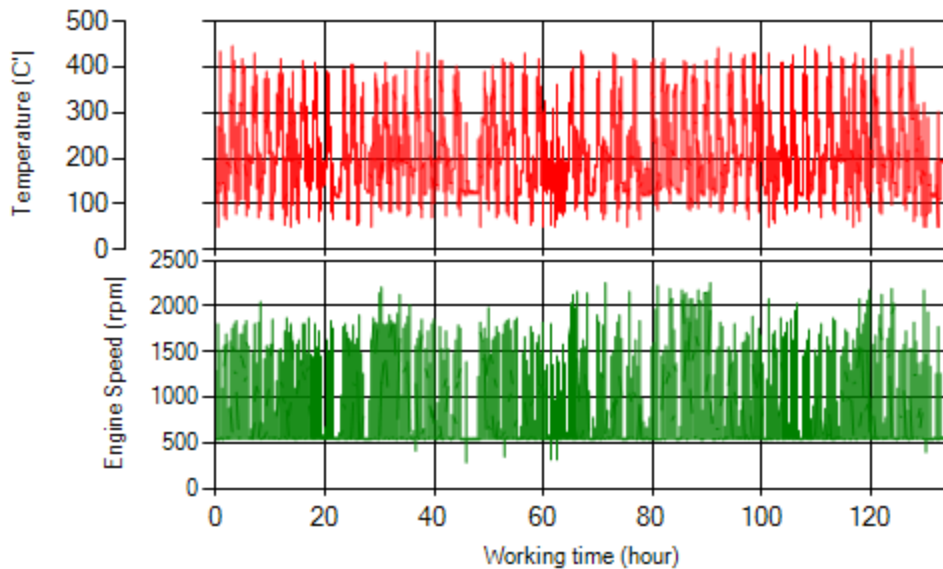


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, only 0.15% of working time pressure was above 100 mbar during this period.
- Figure 2, 17 display flow temperature distribution for DPF's upstream. It can be obviously observed that 10% of total working-time temperature is above 350 °C and 25.6% above 250°C. Considering DPF company recommended operable situation (30% above 250°C), temperature profile distribution was relatively suitable for the DPF excellent operation.

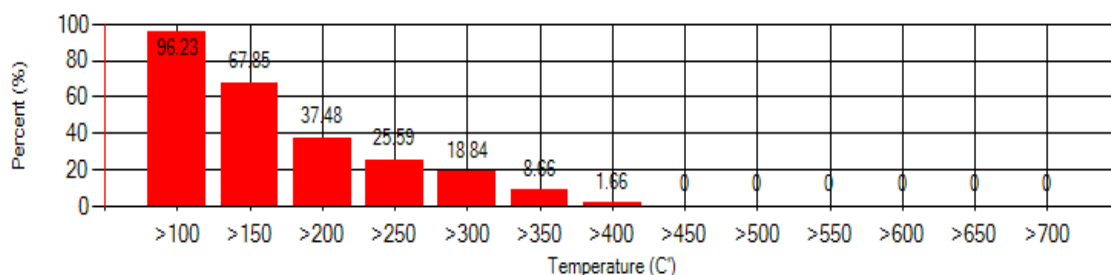


Figure 17. Cumulative diagram of exhaust gas temperature

Filter operation status	Excellent <input checked="" type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input type="checkbox"/>	Failed <input type="checkbox"/>



## Overall Information

*Table1- Overall Information*

Vehicle plate number	85182
CPK data logger number	LN: 001502, DN: 1999
Bus line	Number 10 (south to north Bus line)
Bus Terminals	Azadi square - Daneshgah square
Total path distance	10.7 km
DPF producer company	Tehag_01 (Catalyzed DPF)
Installation date	24/Sep/2015
Report period	16/Nov/2015 – 30/Nov/2015 (fifteen days)
K value - DPF upstream	1.70 [1/m]
K value – DPF downstream	0.00 [1/m]

*Table 2- DPF Maintenance History*

Filter maintenance date	Filter have been working from installation date without any cleaning.
Dosing status	This system doesn't use additive

**Notice: Bus has been stopped from Nov 11<sup>th</sup> until now. Due to technical problems (related to Bus Company). So there was no data to providing November's second half report.**

# Diesel Particulate Filter

an effective way to control solid particulate



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