

# Diesel Particulate Filters' Feasibility Study Report

Report's Period:

2015/12/01 - 2015/12/31

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 آلاینده‌ها



## 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/Dec/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	477 days	76117 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	436 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.) Bus have been stationary from Sep 9 <sup>th</sup> due to technical problems
<b>PURitech</b> (Passive system with FBC) V. ID: 78524 (line 4)	28/Jan/2015	338 days	49044 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 <sup>th</sup> .

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

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

<b>HJS_02</b> <b>(Active system with FBC - Electrical Heater)</b> <b>V.ID: 85423 (line 4)</b>	19/Feb/2015	316 days	52372 km	DPF has been working from installation date until now without any cleaning.
<b>HJS_03</b> <b>(Active system with FBC - Electrical Heater)</b> <b>V.ID: 33572 (line 2)</b>	19/Feb/2015	316 days	42525 km	DPF core was cleaned on Oct 5th after about 30801 km, for the first time. The second cleaning was done on Dec 19 <sup>th</sup> .
<b>HJS_04</b> <b>(Passive system with FBC)</b> <b>V.ID:85476 (line 10)</b>	23/Feb/2015	312 days	46255 km	DPF was cleaned on 22 <sup>nd</sup> Jul for the first time and on 15 <sup>th</sup> Dec for the second time after 44355 km mileage from installation date.
<b>Dinex_02</b> <b>(Passive system with FBC)</b> <b>V.ID: 33637 (line 2)</b>	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.
<b>Tehag_01</b> <b>(Catalyzed DPF)</b> <b>V.ID: 85182 (line 2)</b>	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 December. DPFs detailed information could be found in the next section.

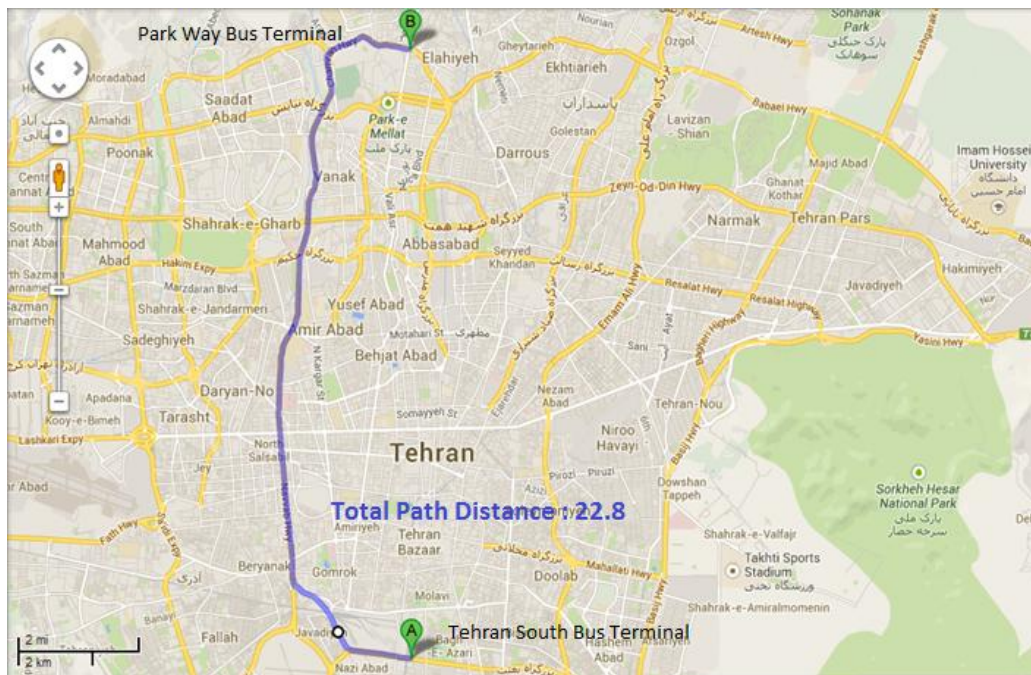
Table 3. DPFs' operation status during Dec

Vehicle ID	DPF Producer Company	Operation Status	
		Dec/01/2015	Dec/16/2015
		Dec/15/2015	Dec/31/2015
78514 (line 4)	HJS_01	1	1
85423 (line 4)	HJS_02	2	1
78515 (line 4)	Dinex_01	6	6
78524 (line 4)	PURltech	5	5
33572 (line 2)	HJS_03	2	3
33637 (line 2)	Dinex_02	5	5
85476 (line 10)	HJS_04	3	1
85182 (line 10)	Tehag_01	6	6

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)



All right reserved by ASA company – confidential no passing to third parties.

## 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/Dec/2015 – 15/Dec/2015 (fifteen days)
K value - DPF upstream	1.9 [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)	72706 km
Bus mileage over the period	2027 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	164 hours 4 minutes
Average working hours per day (including stop days)	10 hours 56 minutes
Bus average speed	12.35 km/hr
idle speed time to all working time ration	58.88 %
Total Bus fuel consumption over the period	1216 lit
Fuel consumption per hour	7.4 lit/hr
Average fuel consumption	0.60 lit/km
Total Bus additive consumption over the period	0.540 lit
Average additive consumption	266 cc/km
Additive consumption to fuel ration	444 cc/1000lit



### Temperature, Pressure and Engine Speed Overview

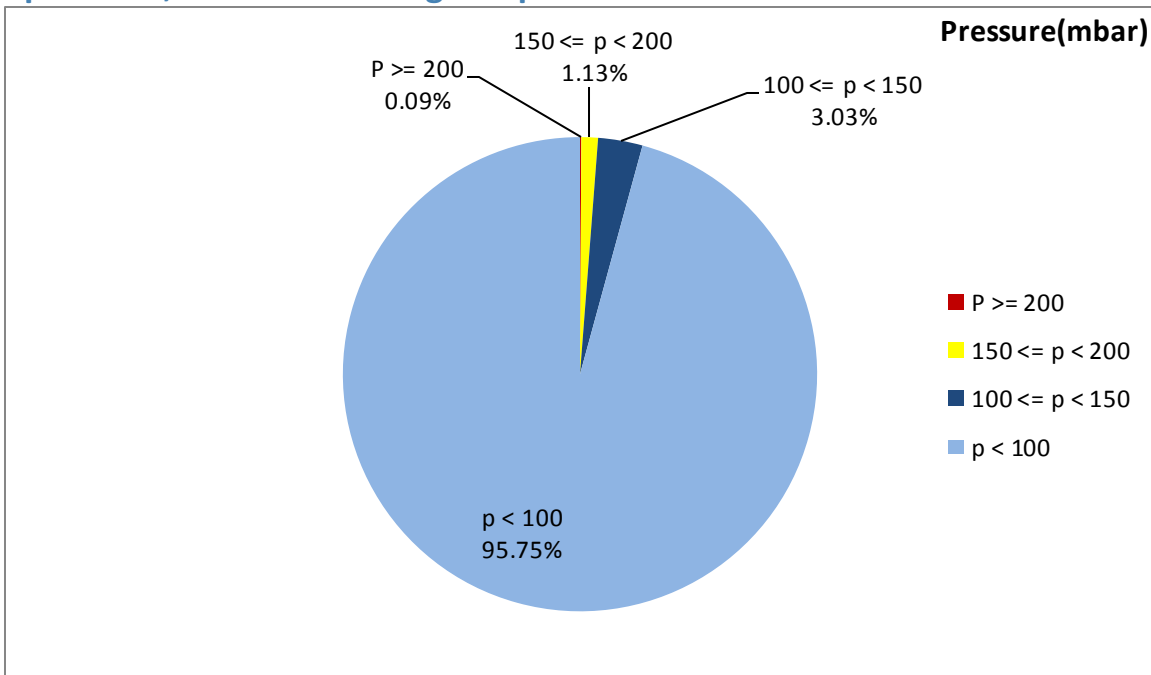


Figure 1- Pressure distribution over the working hours

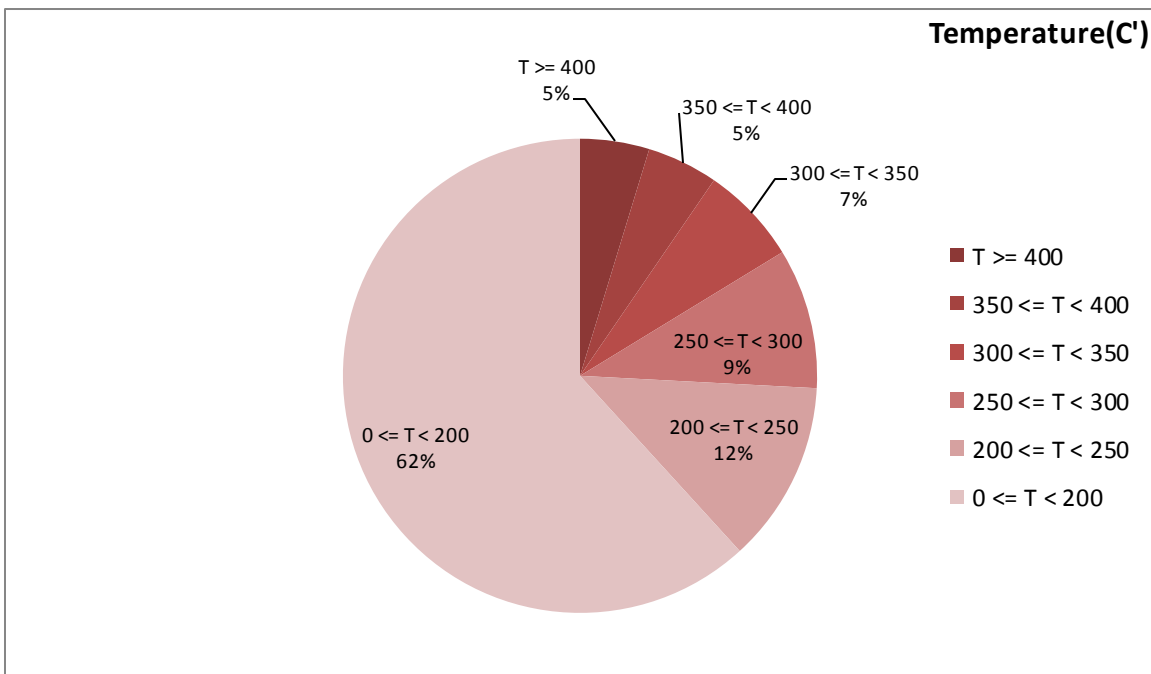


Figure 2-Temperature distribution over the working hours

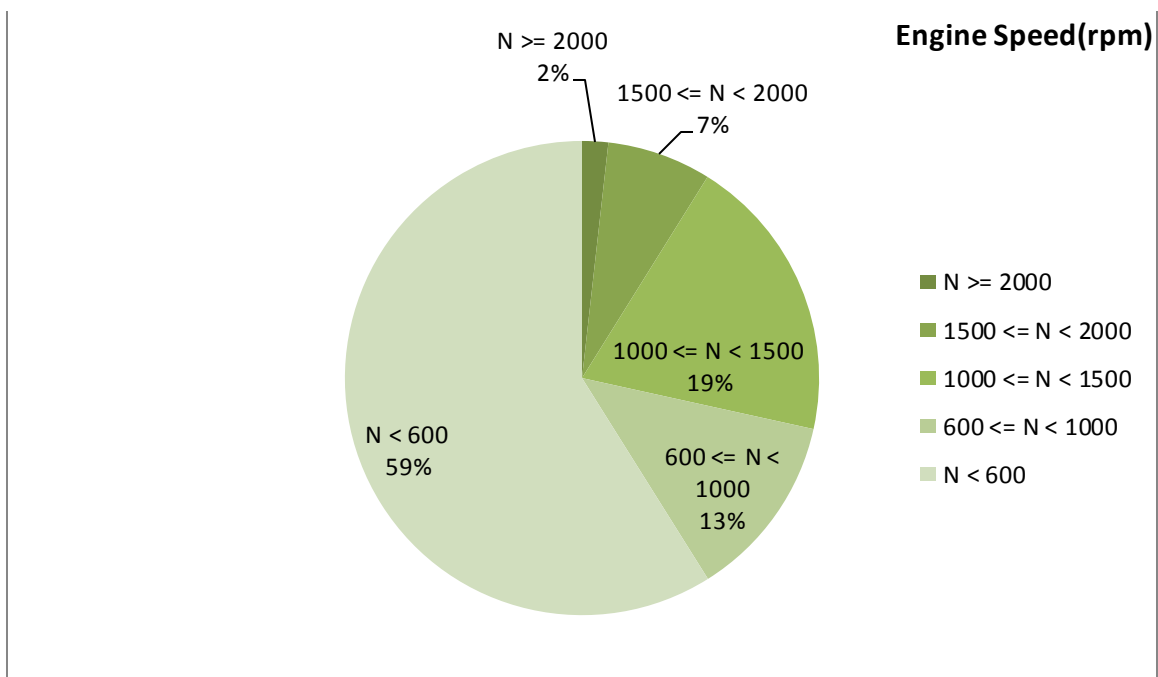


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
199.48	25.21	817

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
263.02	46.89	1207

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
506-50	243-0	2496-256

## Detailed Pressure Analysis

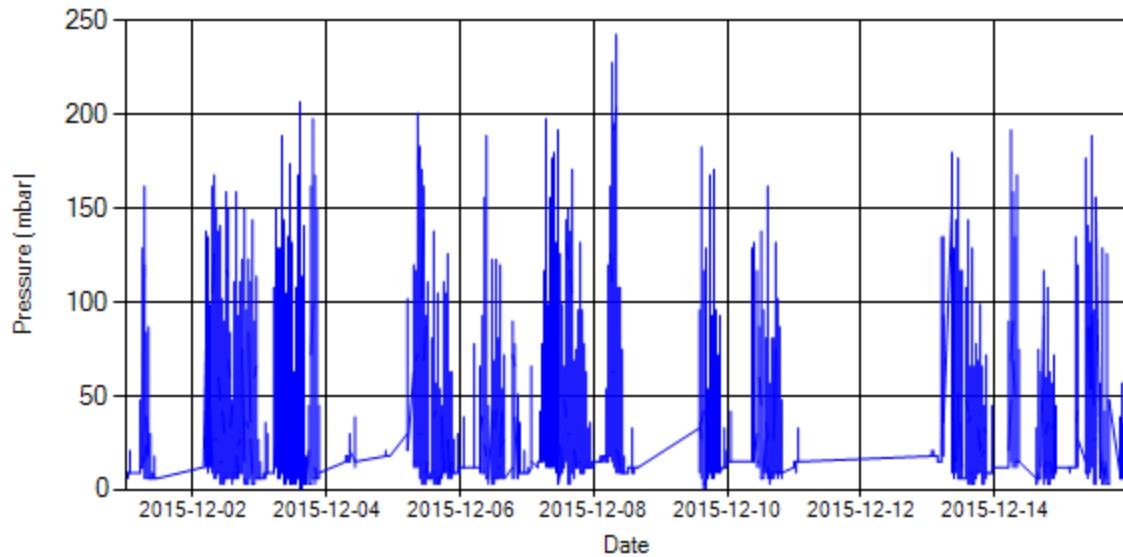


Figure 4- Pressure distribution over the period

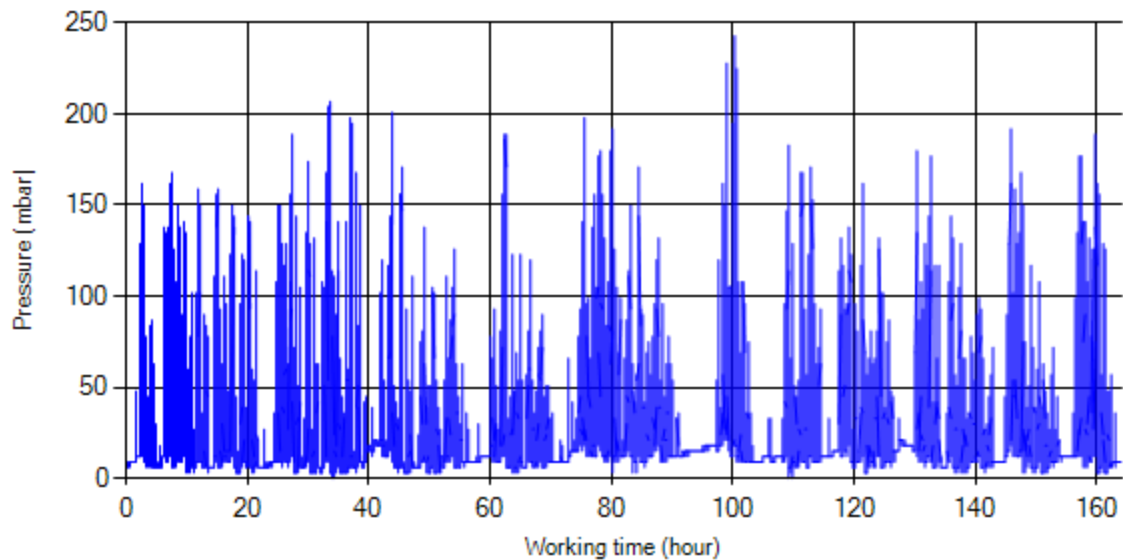


Figure 5- Pressure vs. working hours

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

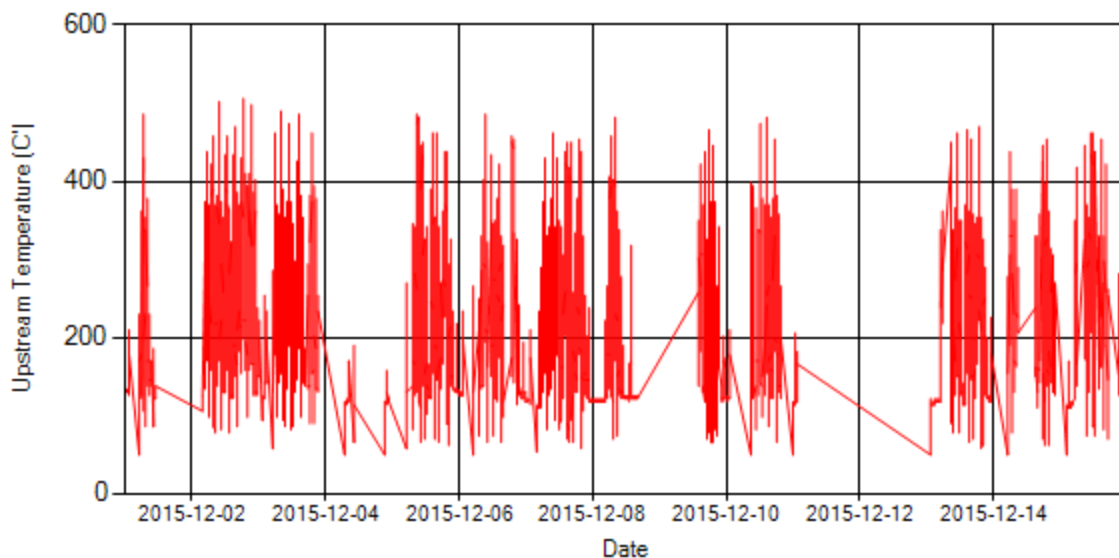


Figure 6- Temperature distribution over the period

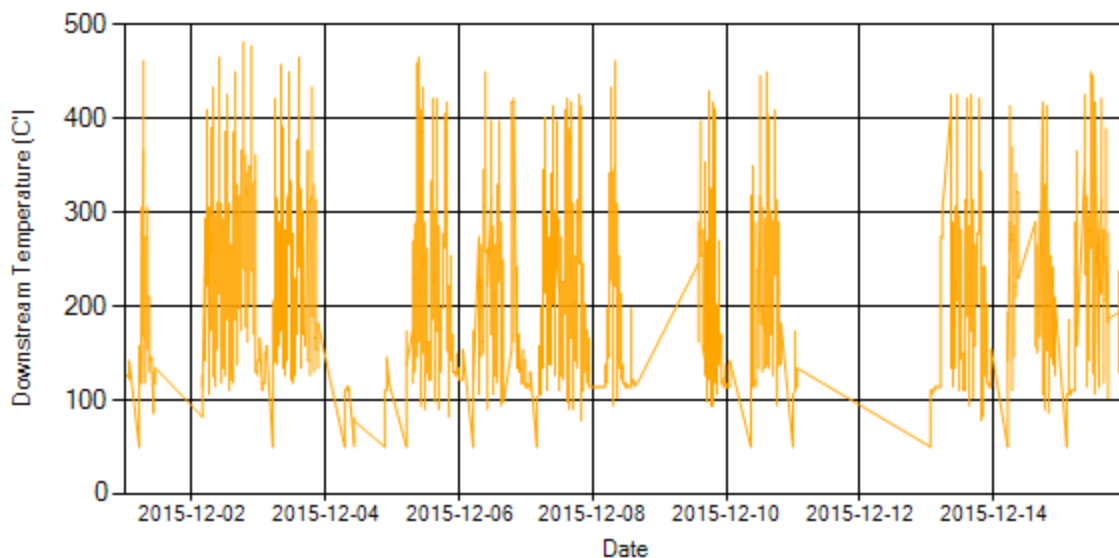
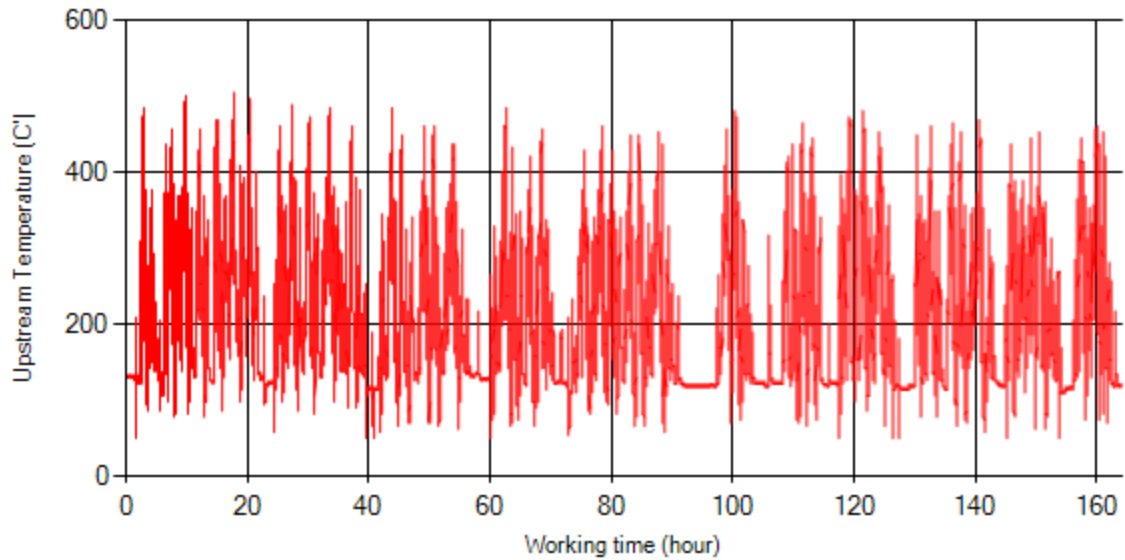
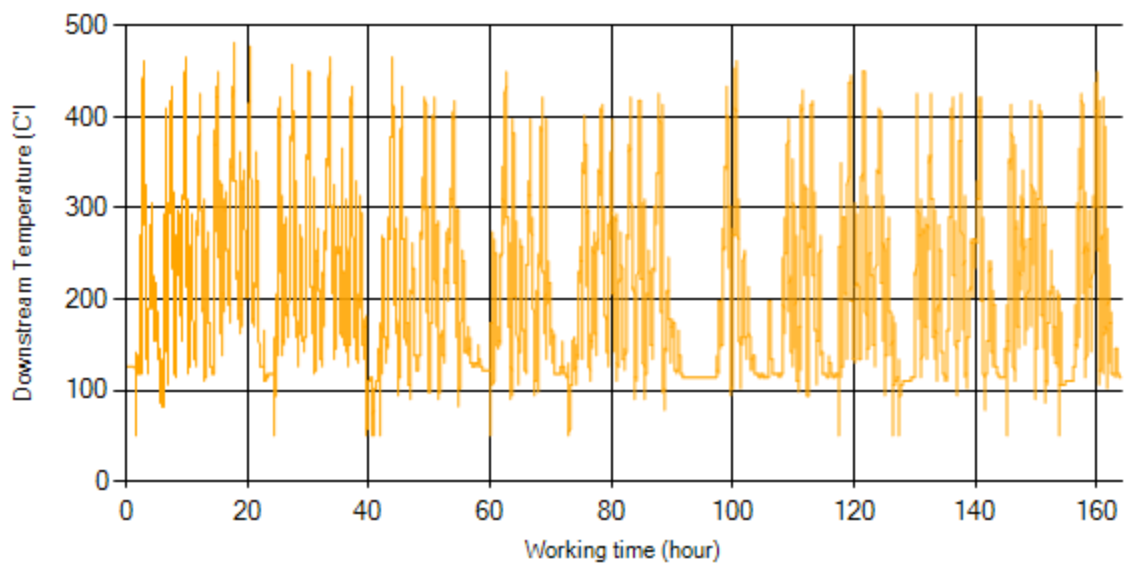


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*



## Engine Speed Diagrams

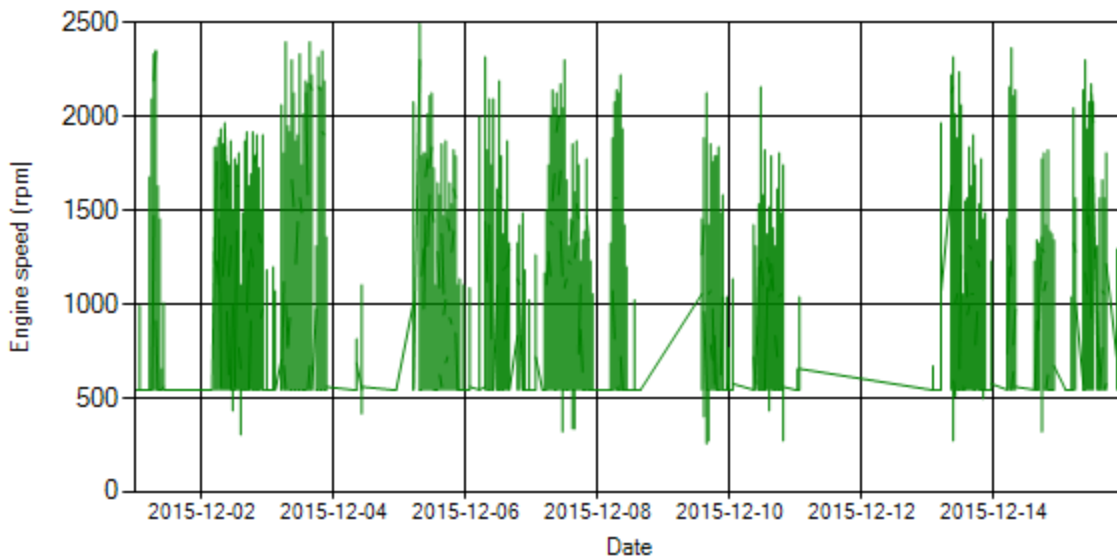


Figure 10- Engine speed distribution over the period

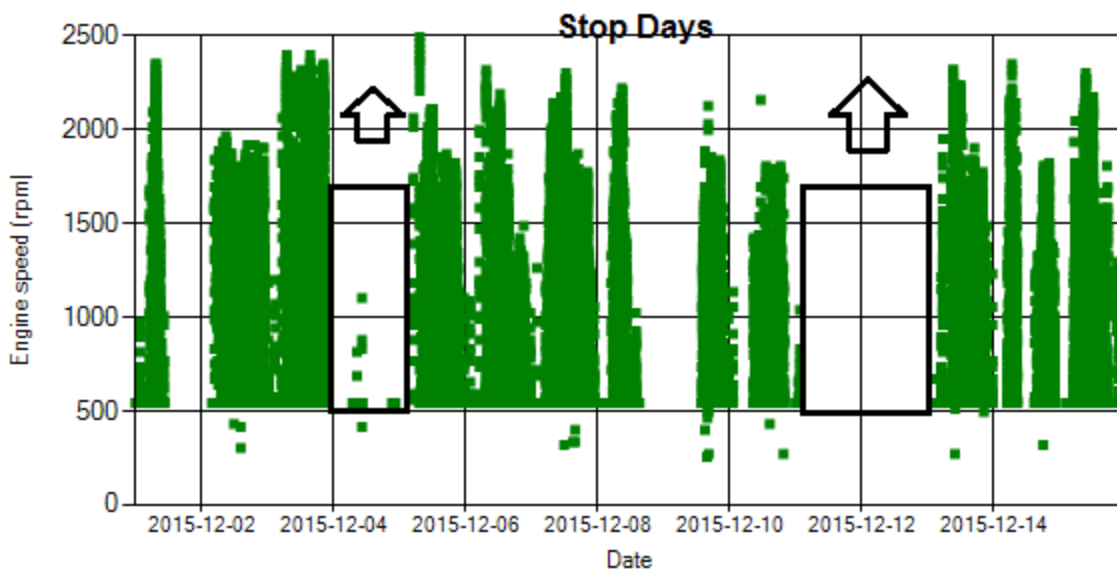


Figure 11- Engine speed diagram for calculating CPK's working days

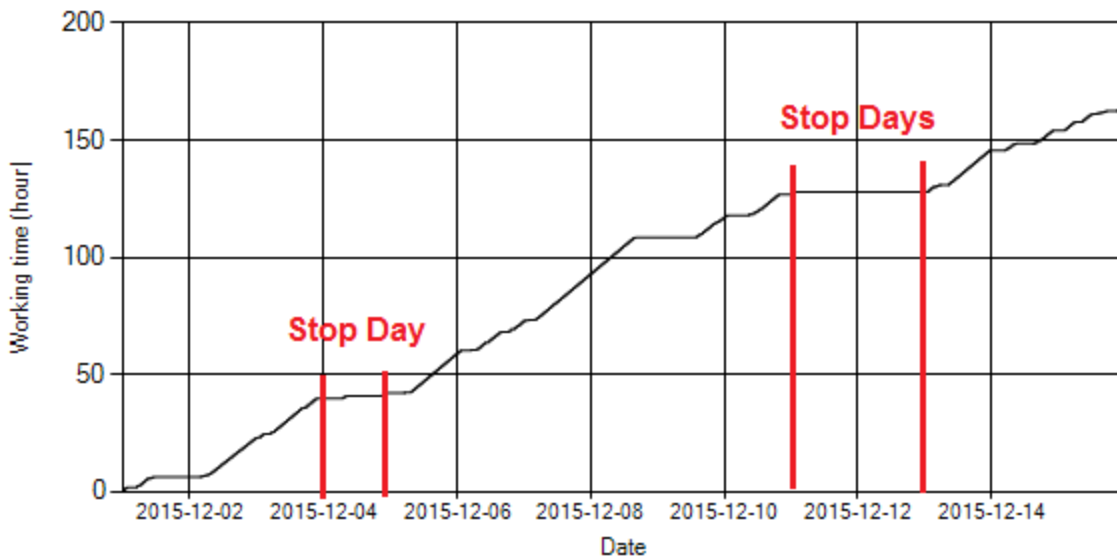


Figure 12- Time diagram for calculating CPK's working days

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

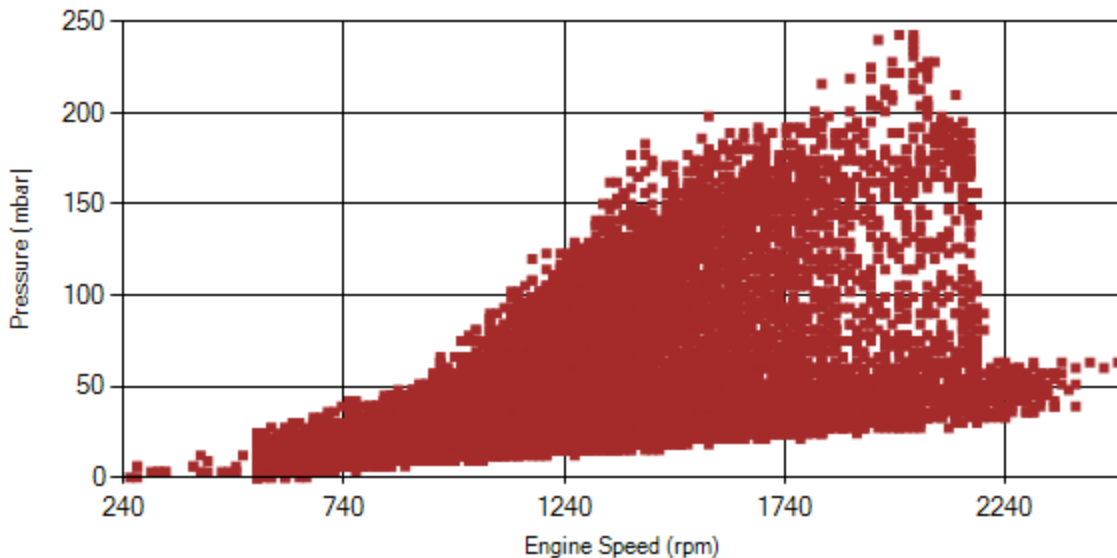


Figure 13- Pressure against engine speed

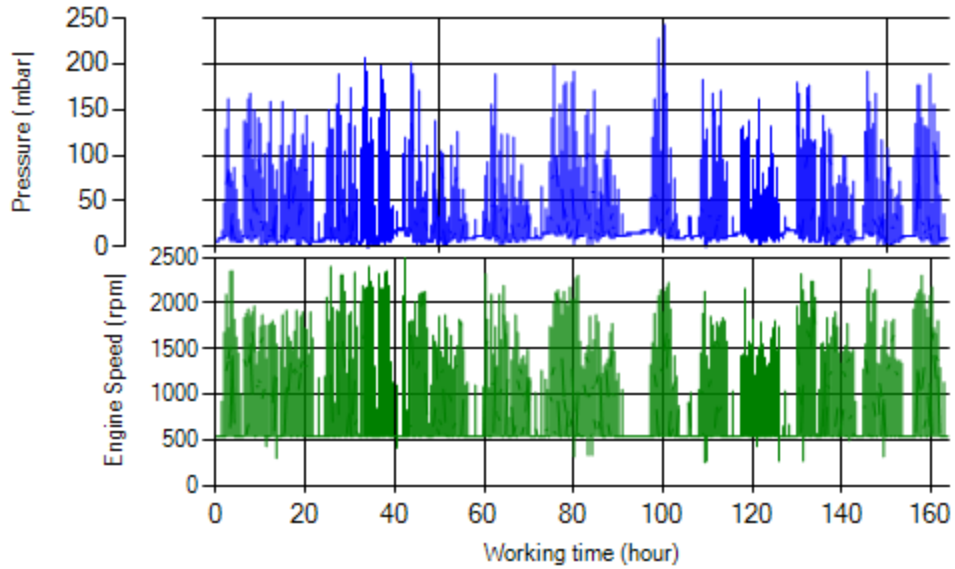


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

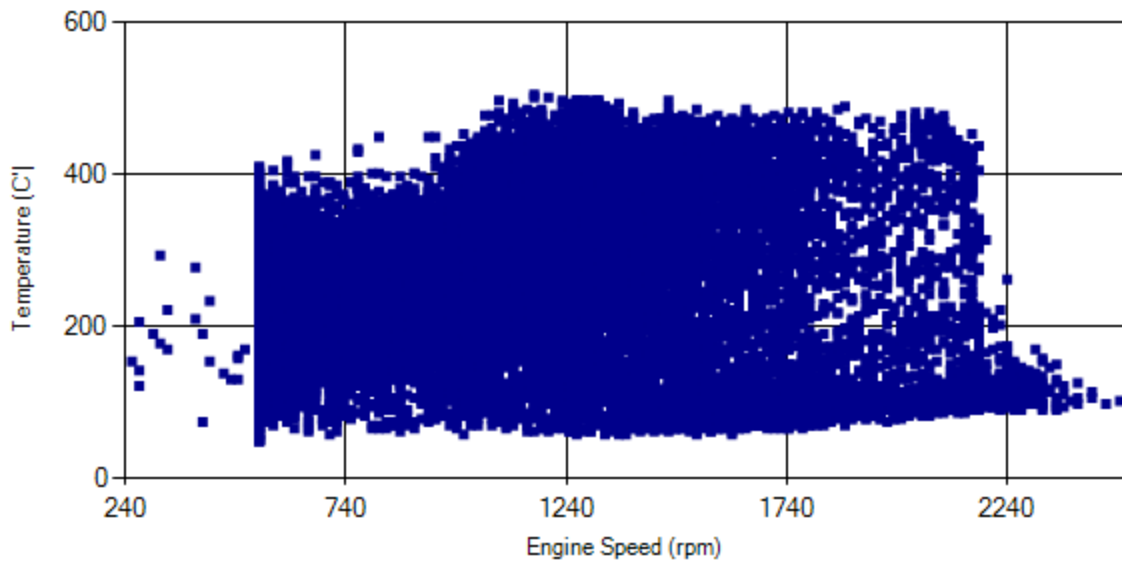


Figure 15- Temperature against engine speed

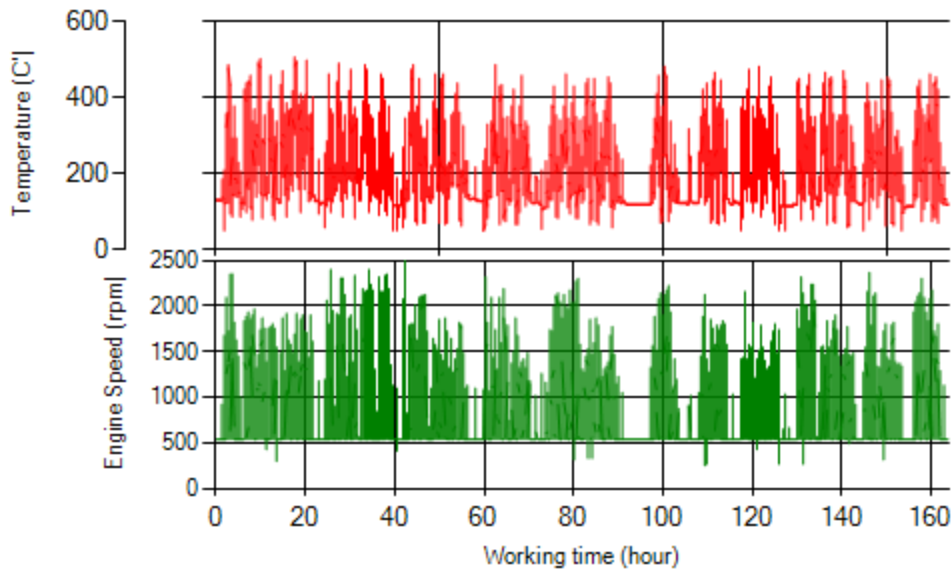


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in Figure 1, only 0.09% of working time, pressure was above 200 mbar and 1.23% above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 5% of total working time temperature is above 400 °C and 10% 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	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/Dec/2015 – 31/Dec/2015 (sixteen days)
K value - DPF upstream	1.9 [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)	76117 km
Bus mileage over the period	3411 km
Working days over the period	15 days
Stop days	1 day
Data logger working days	15 days
Working hours over the period	178 hours 25 minutes
Average working hours per day (including stop days)	11 hours 9 minutes
Bus average speed	19.13 km/hr
idle speed time to all working time ration	53.18 %
Total Bus fuel consumption over the period	2100 lit
Fuel consumption per hour	11.76 lit/hr
Average fuel consumption	0.62 lit/km
Total Bus additive consumption over the period	0.9lit
Average additive consumption	263 cc/km
Additive consumption to fuel ration	429 cc/1000lit

### Temperature, Pressure and Engine Speed Overview

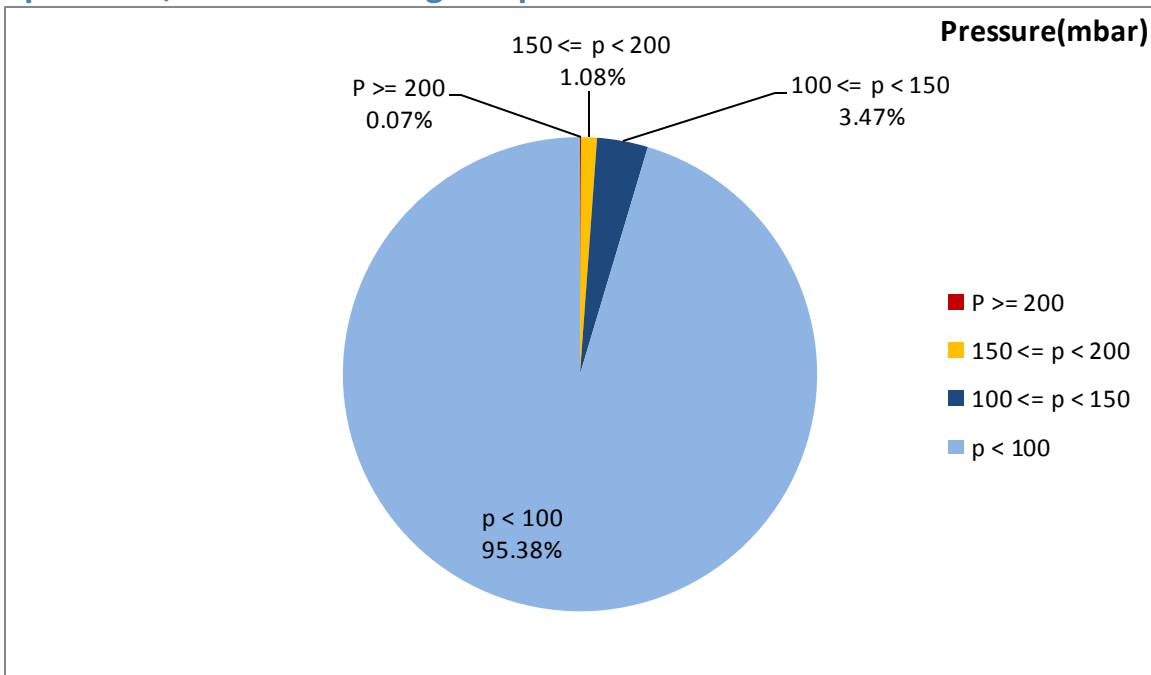


Figure 1- Pressure distribution over the working hours

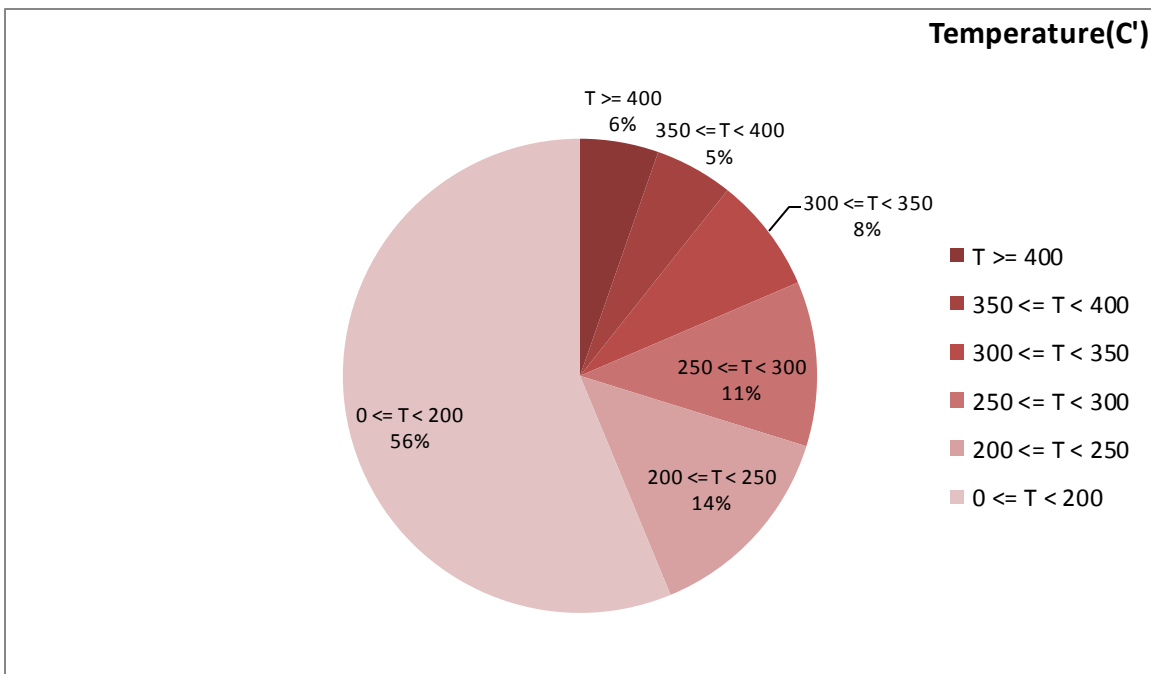


Figure 2-Temperature distribution over the working hours

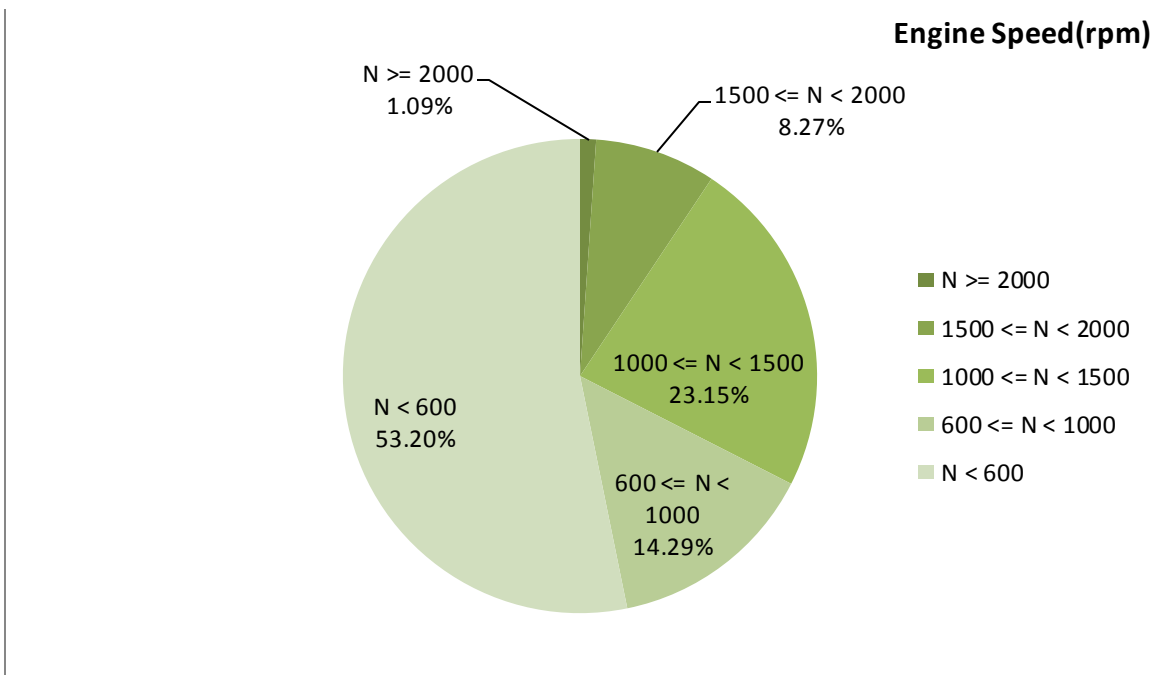


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
210.08	24.1	848

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
264.81	43.19	1192

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
494-50	234-0	2640-288

## Detailed Pressure Analysis

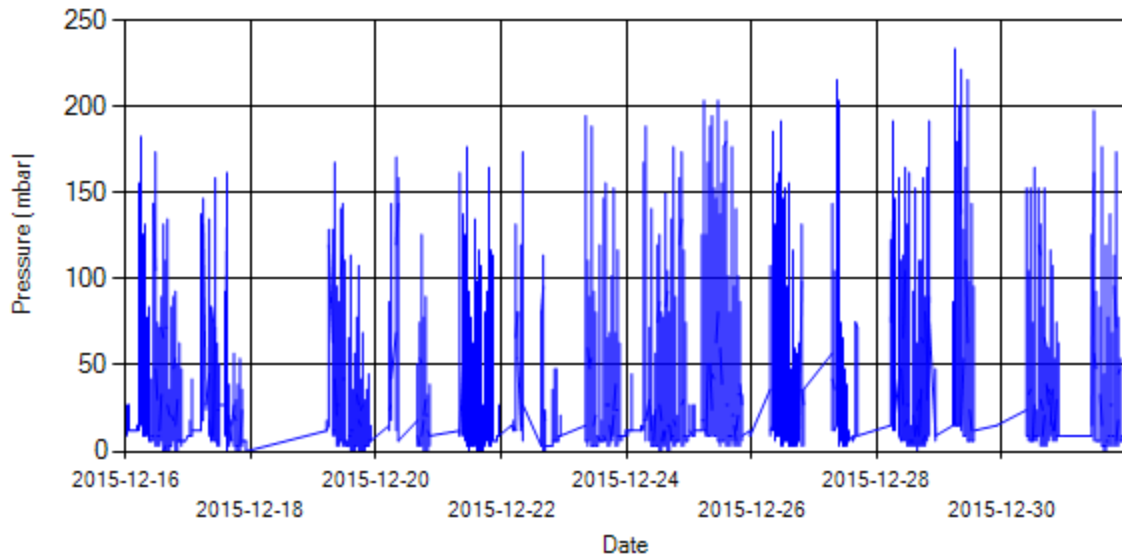


Figure 4- Pressure distribution over the period

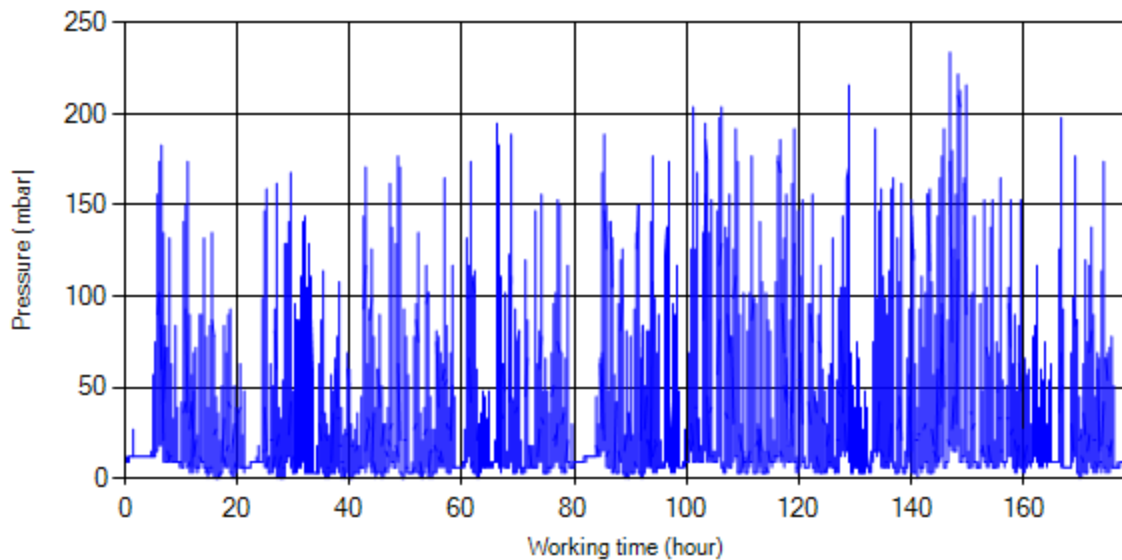


Figure 5- Pressure vs. working hours

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

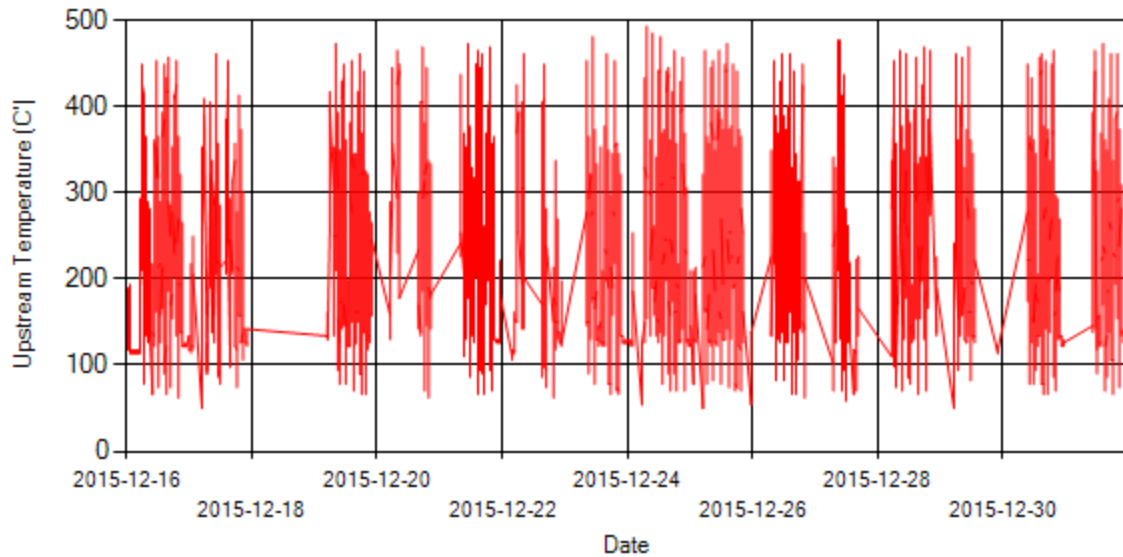


Figure 6- Temperature distribution over the period

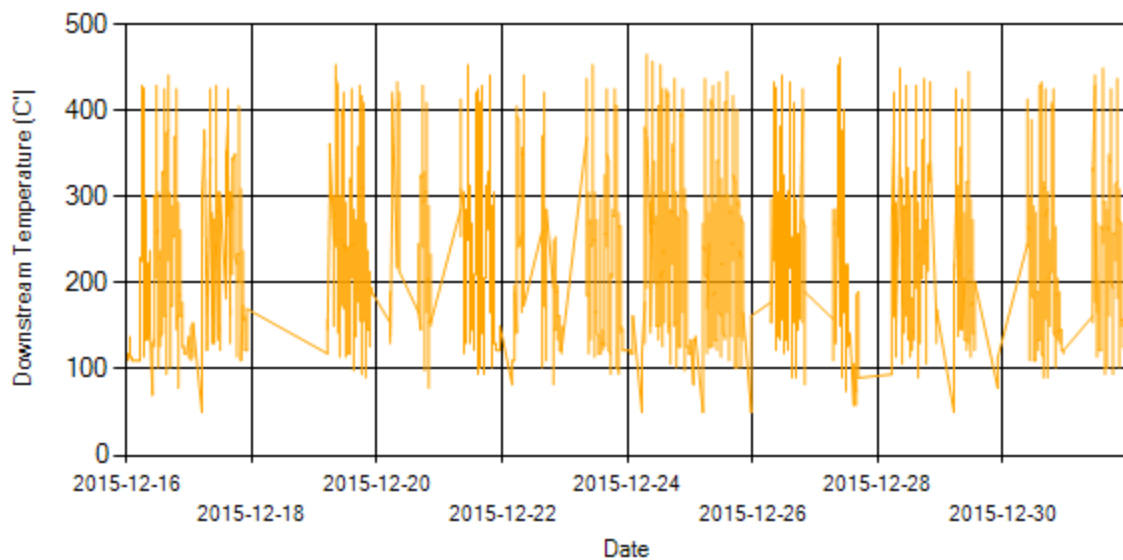
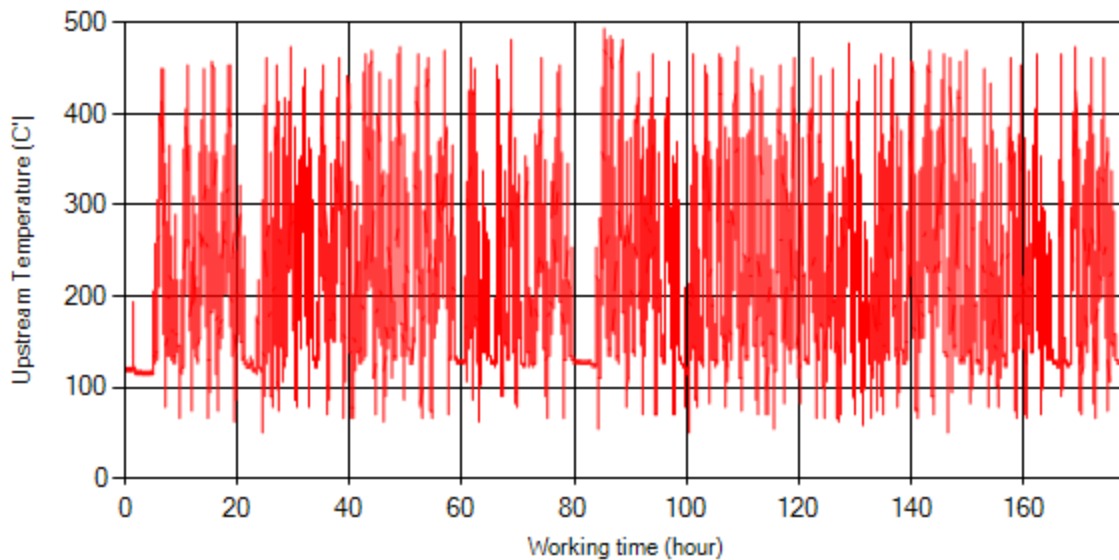
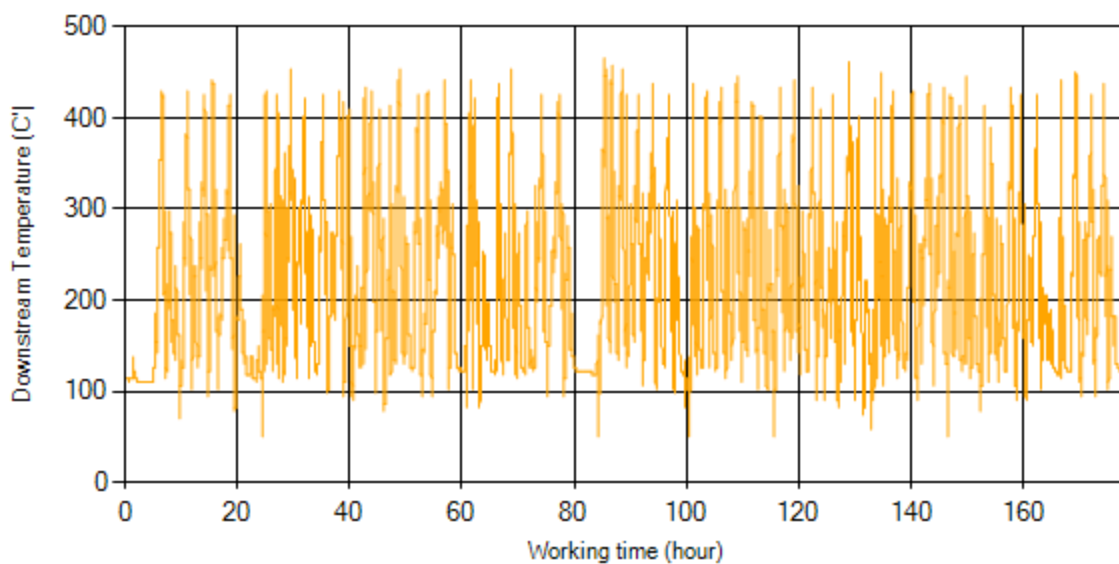


Figure 7- Temperature distribution over the period





*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

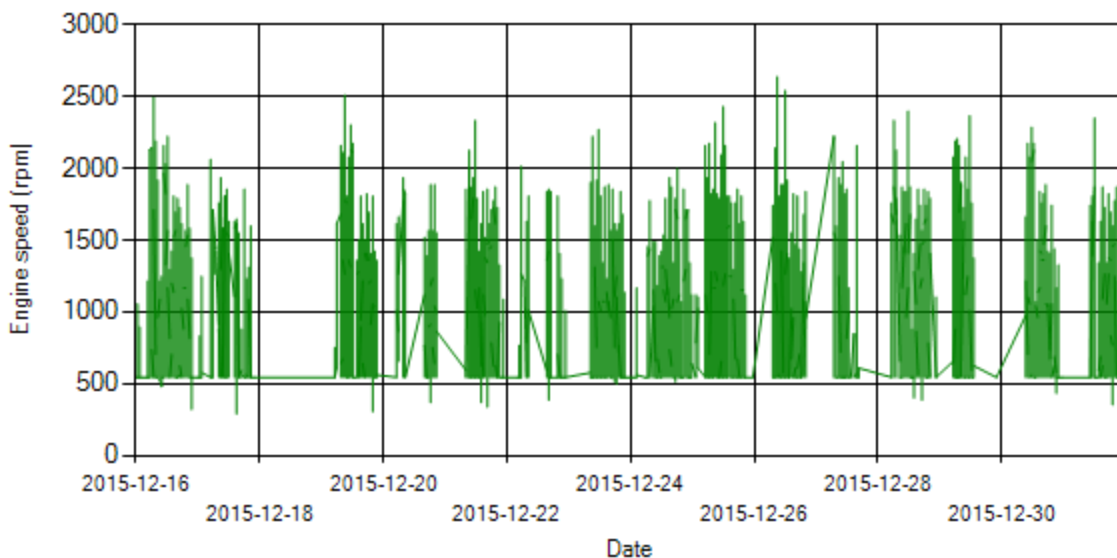


Figure 10- Engine speed distribution over the period

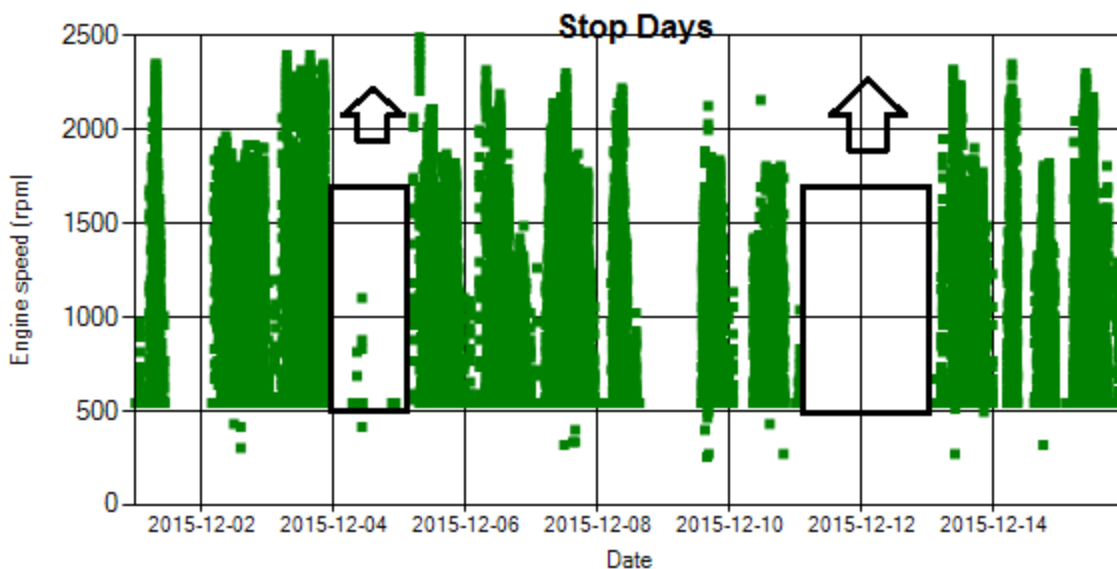


Figure 11- Engine speed diagram for calculating CPK's working days

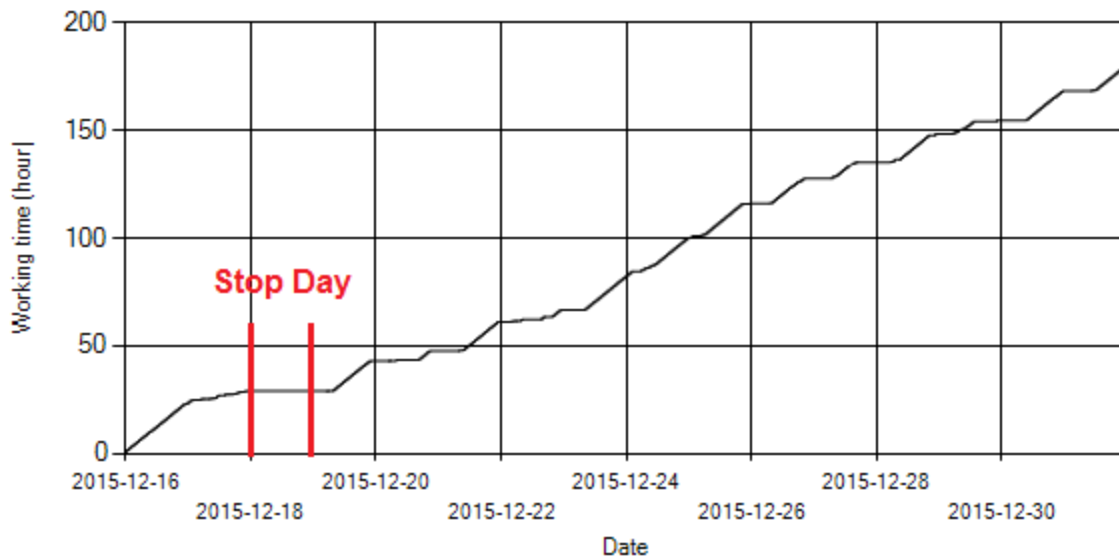


Figure 12- Time diagram for calculating CPK's working days

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 on Dec 18<sup>th</sup>.

### Pressure-Engine Speed diagrams

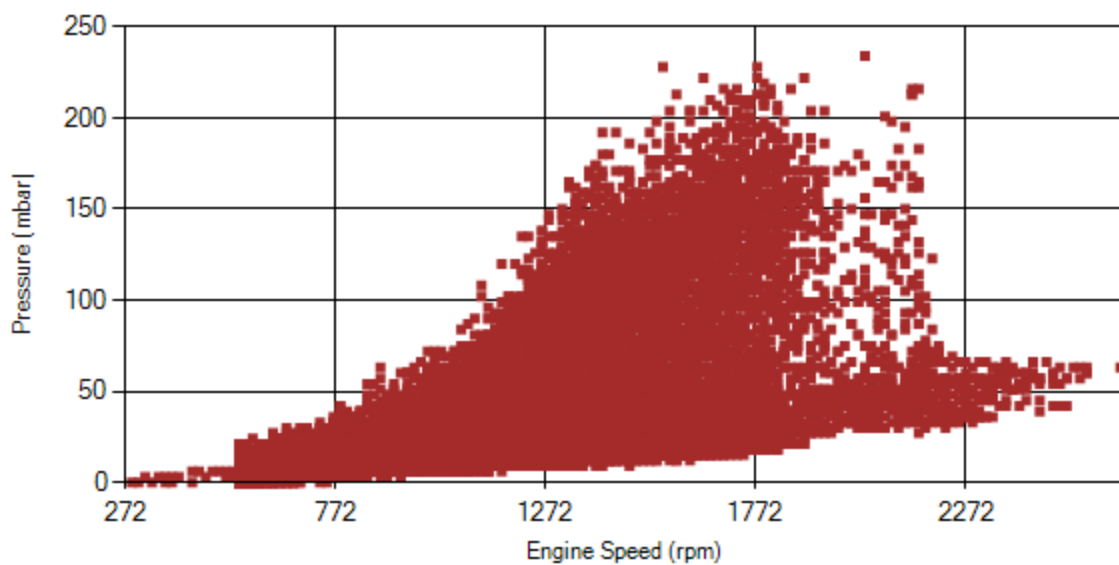


Figure 13- Pressure against engine speed

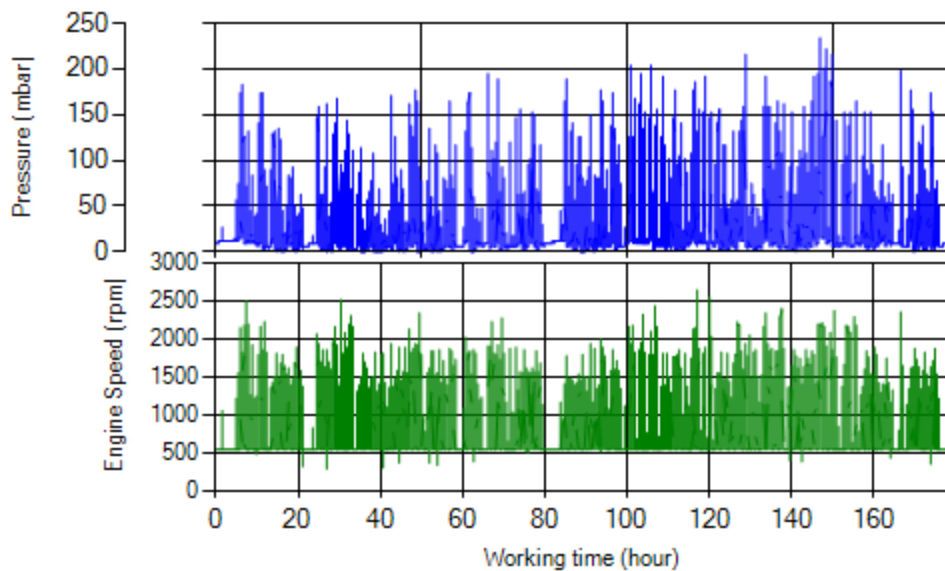


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

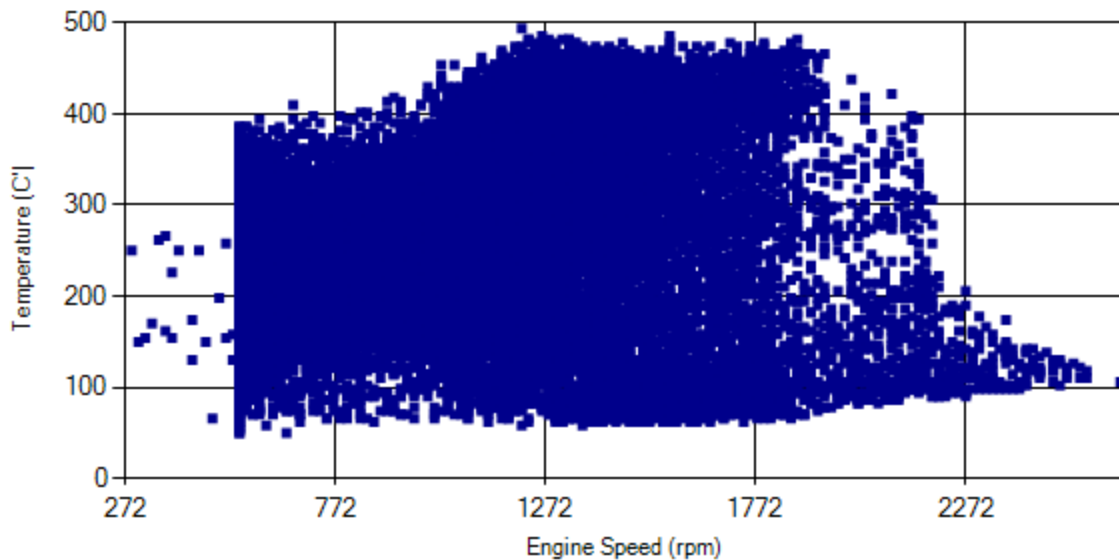


Figure 15- Temperature against engine speed

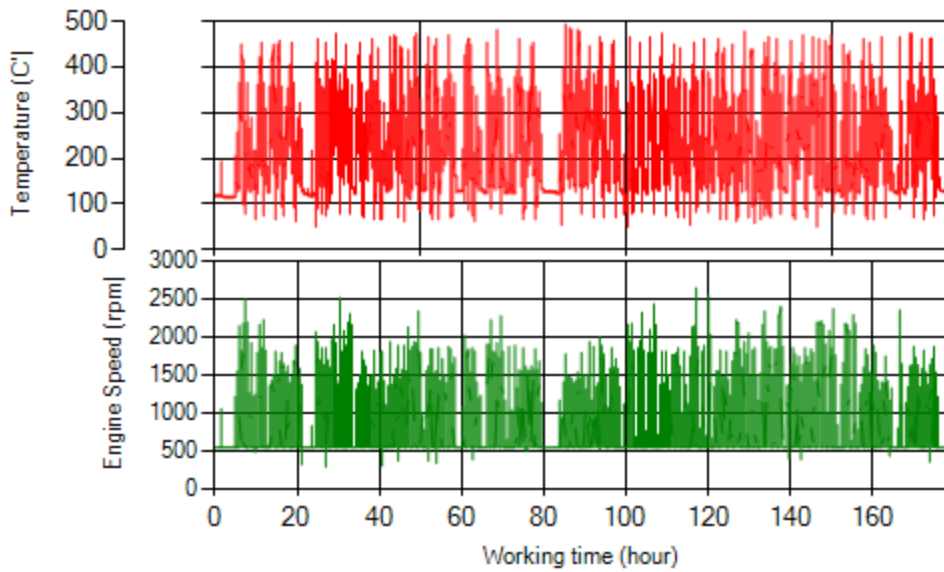


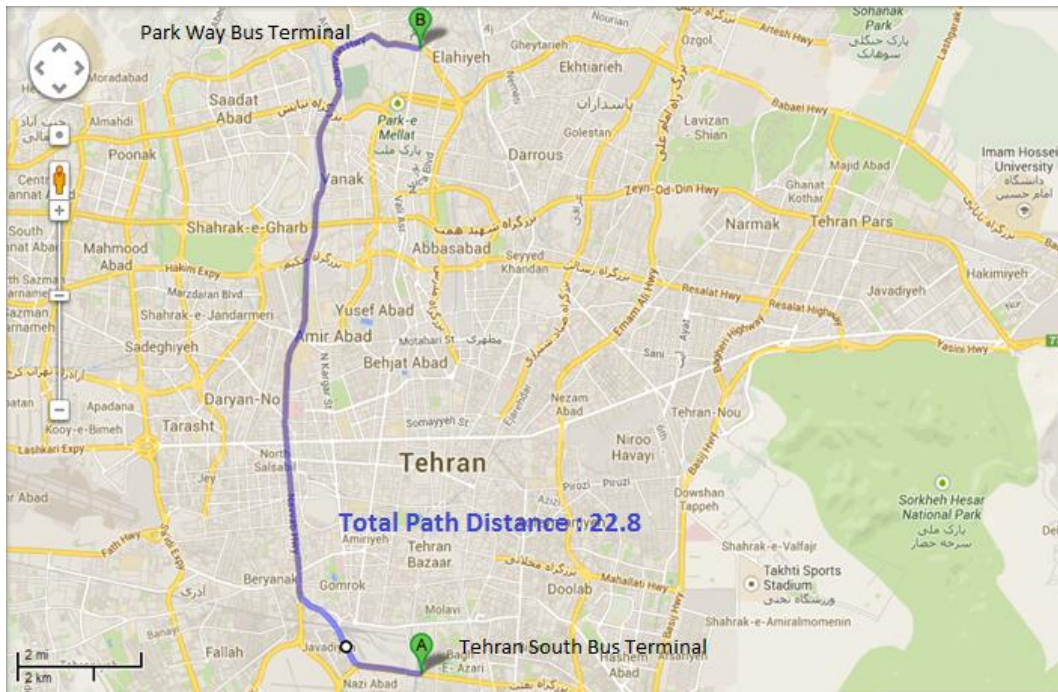
Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in Figure 1, only 0.07% of working time, pressure was above 200 mbar and 1.15% 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 11% 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)



All right reserved by ASA company – confidential no passing to third parties.

## 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/Dec/2015 – 31/Dec/2015 (thirty one days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

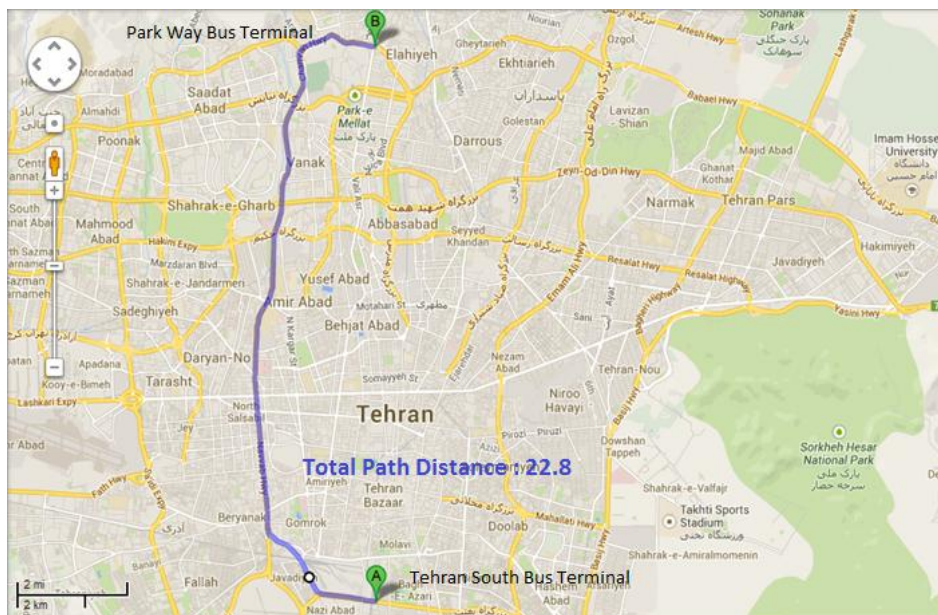
*Table 2- DPF Maintenance History*

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 December's report.**



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



All right reserved by ASA company – confidential no passing to third parties.



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

## 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/Dec/2015 – 15/Dec/2015 (fifteen days)
K value – DPF upstream	1.70 [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)	45899 km
Bus mileage over the period	2134 km
Working days over the period	8 days
Stop days	7 days
Data logger working days	7 days
Working hours over the period	145 hours 7 minutes
Average working hours per day (including stop days)	9 hours 40 minutes
Bus average speed	14.71 km/hr
idle speed time to all working time ration	57.38 %
Total Bus fuel consumption over the period	1280 lit
Fuel consumption per hour	8.83 lit/hr
Average fuel consumption	0.60 lit/km
Total Bus additive consumption over the period	- lit
Average additive consumption	- cc/km
Additive consumption to fuel ration	- cc/1000lit

### Temperature, Pressure and Engine Speed Overview

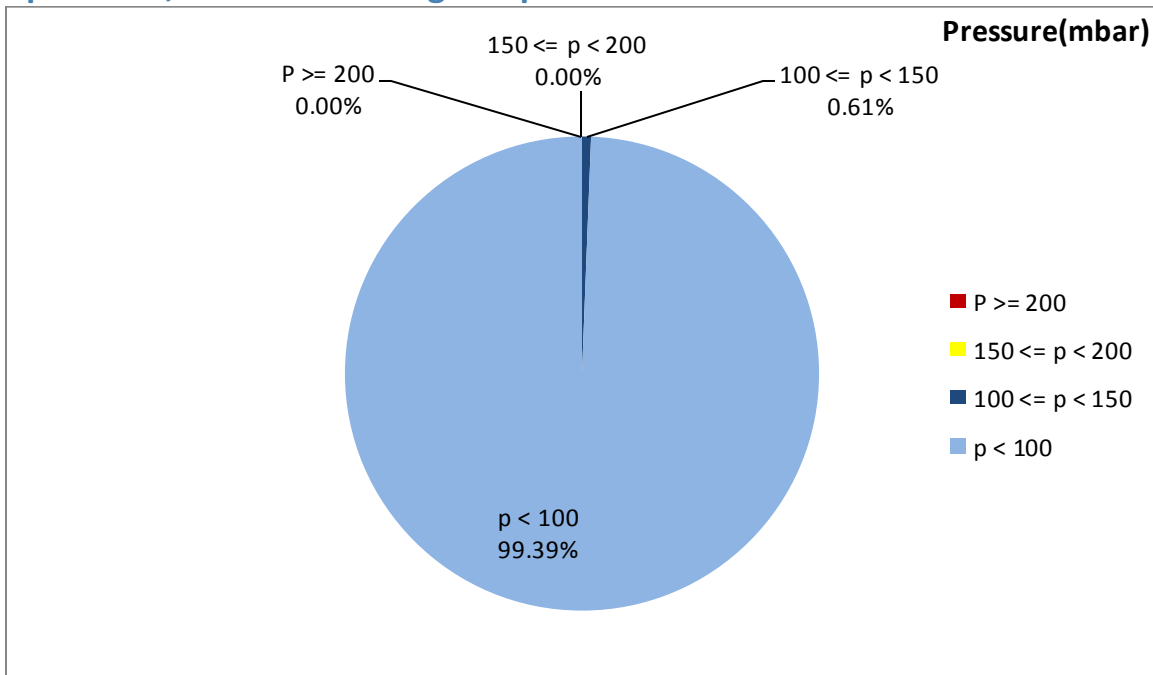


Figure 1- Pressure distribution over the working hours

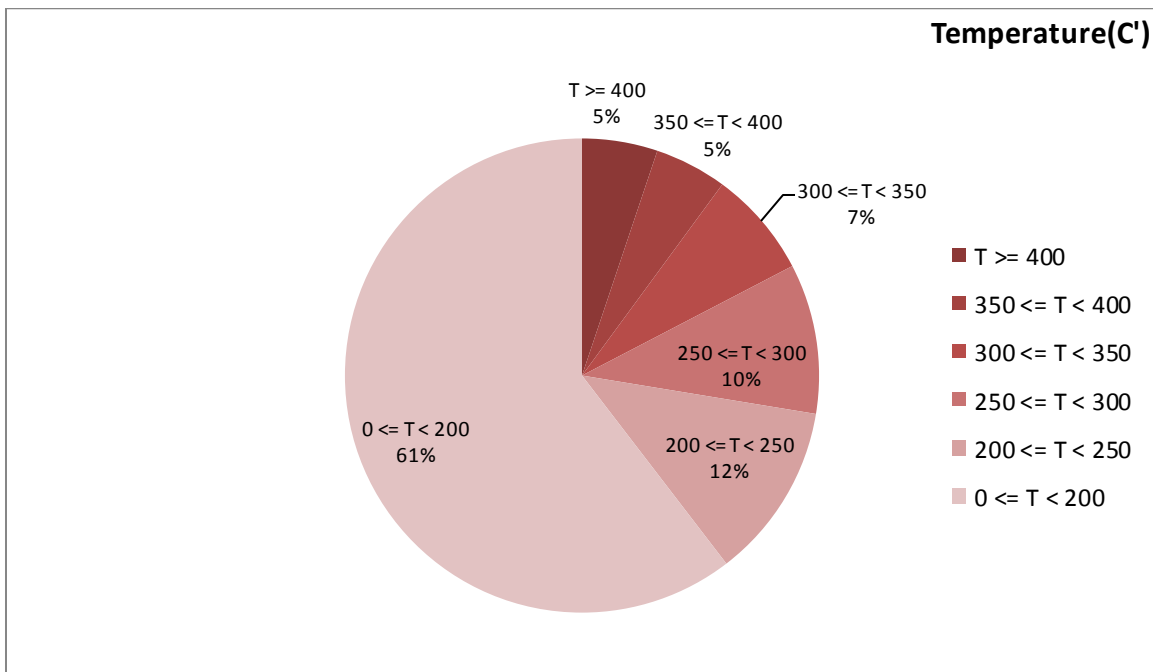


Figure 2-Temperature distribution over the working hours

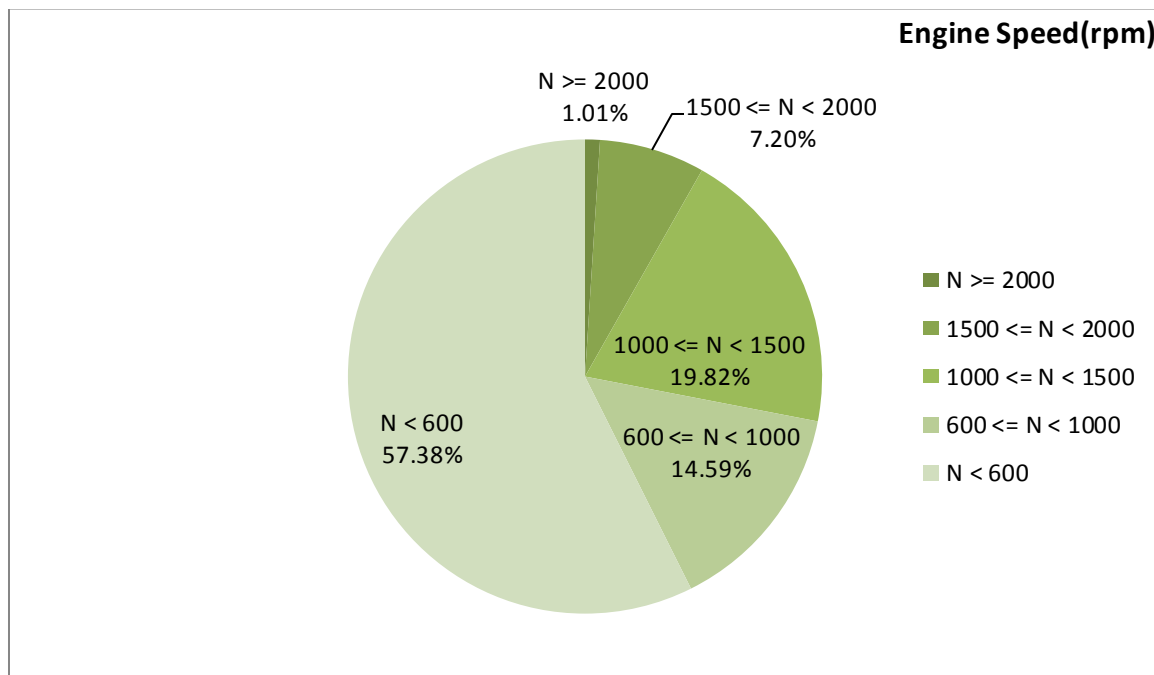


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
202.03	7.14	811

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
270.07	13.84	1168

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
522-50	159-0	2224-288

## Detailed Pressure Analysis

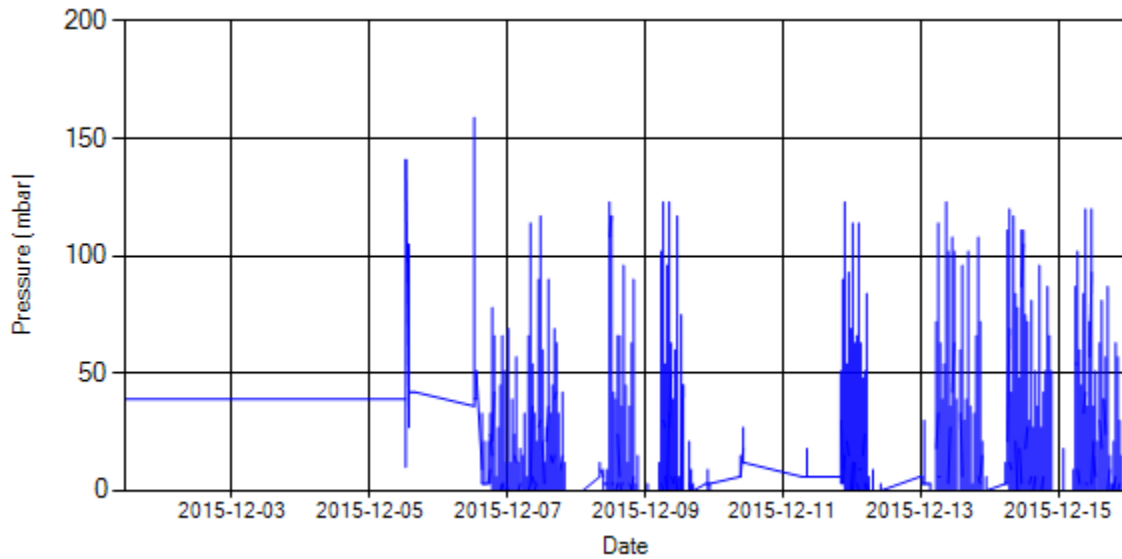


Figure 4- Pressure distribution over the period

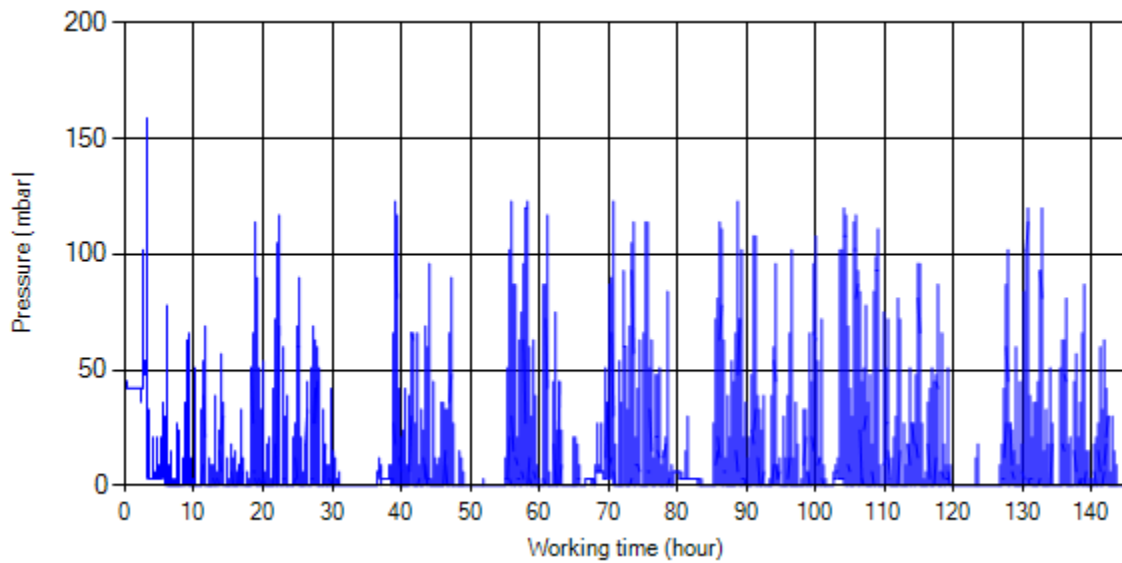


Figure 5- Pressure vs. working hours

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

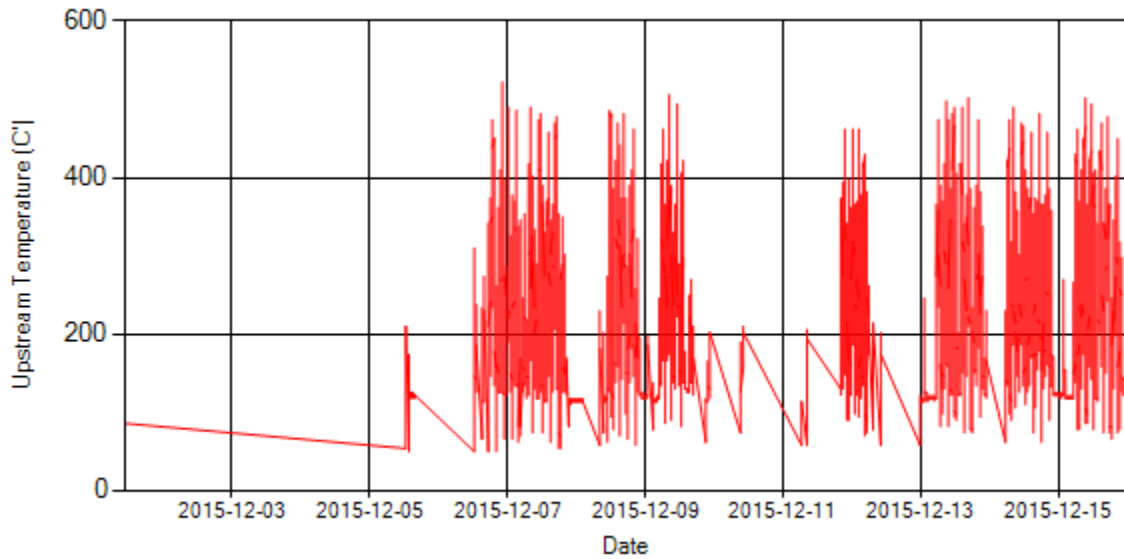


Figure 6- Temperature distribution over the period

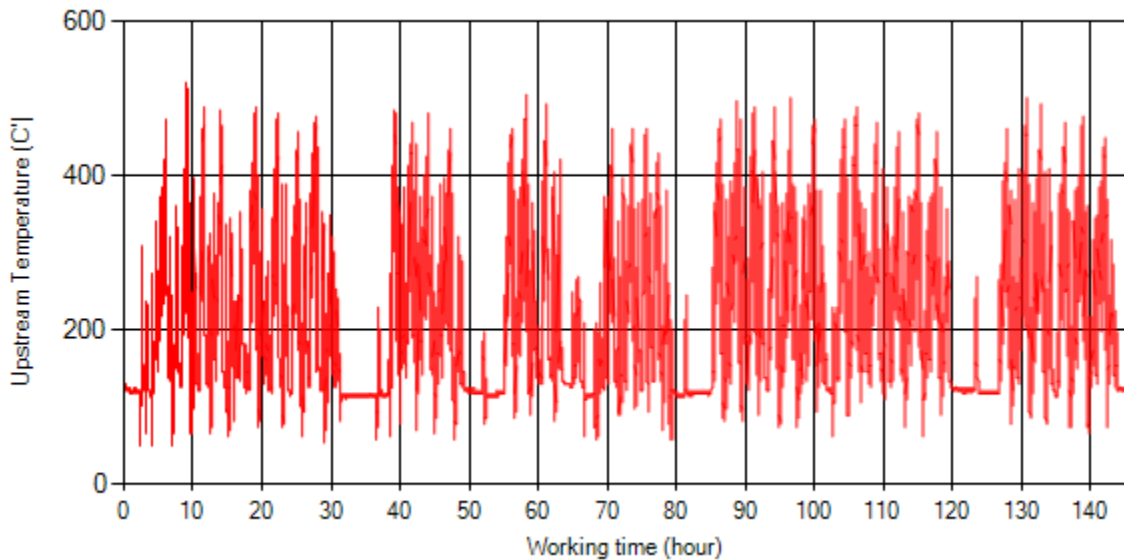


Figure 7- Temperature vs. working hours

## Engine Speed Diagrams

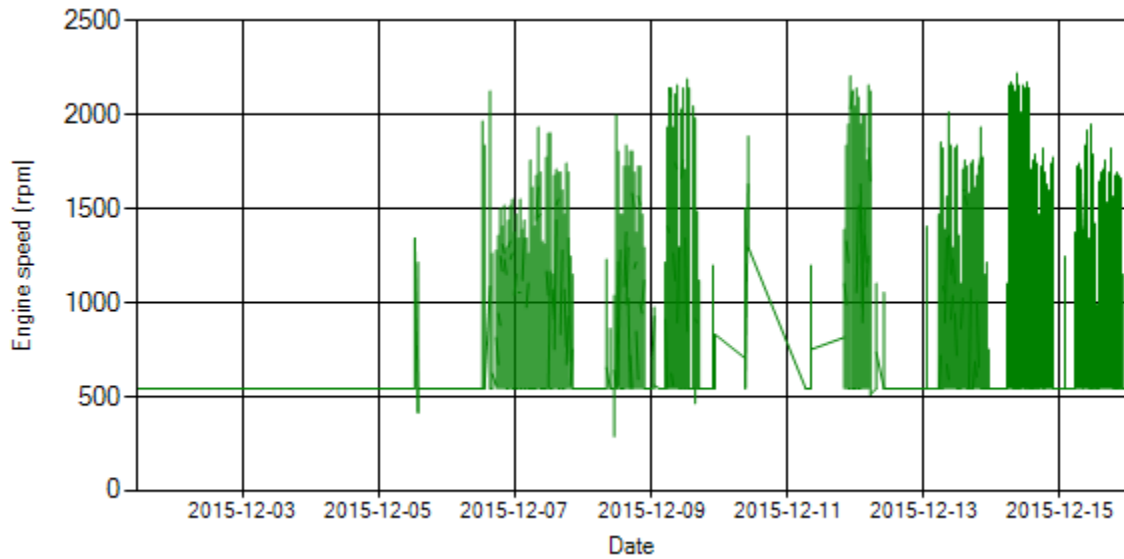


Figure 8- Engine speed distribution over the period

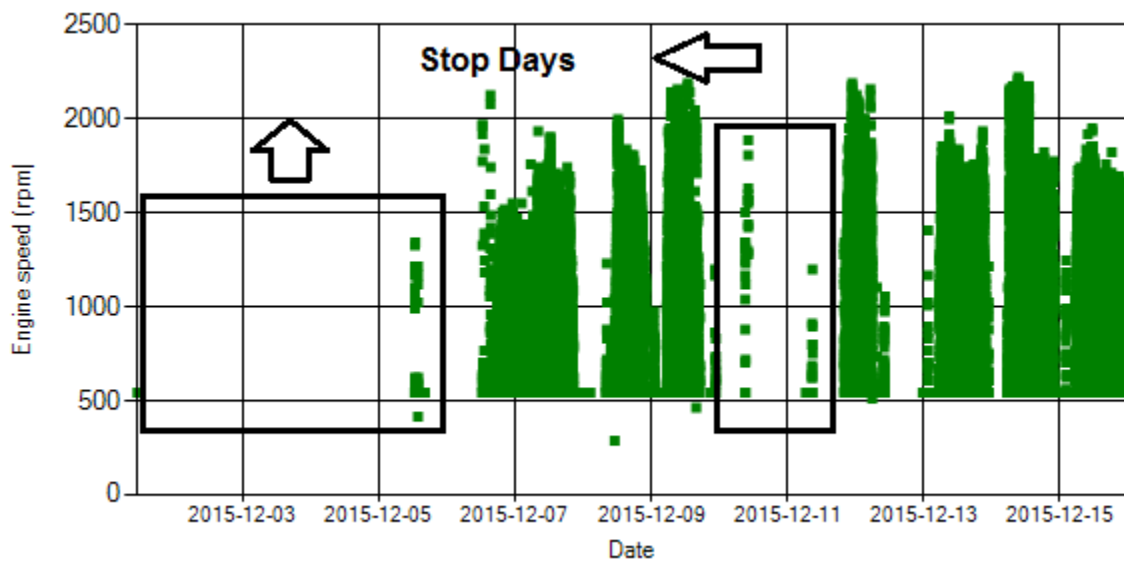


Figure 9- Engine speed diagram for calculating CPK's working days

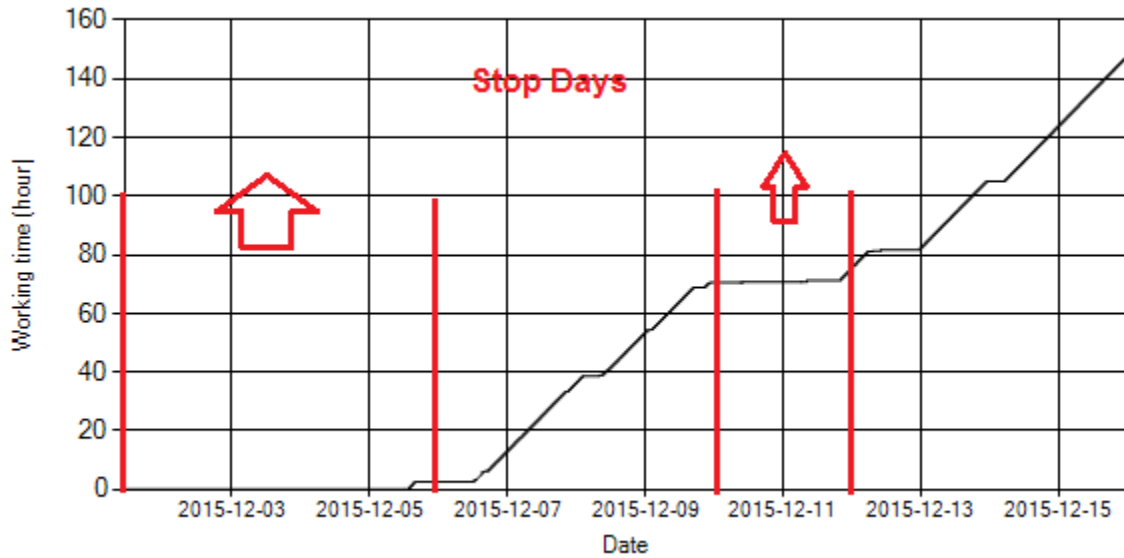


Figure 10- Time diagram for calculating CPK's working days

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

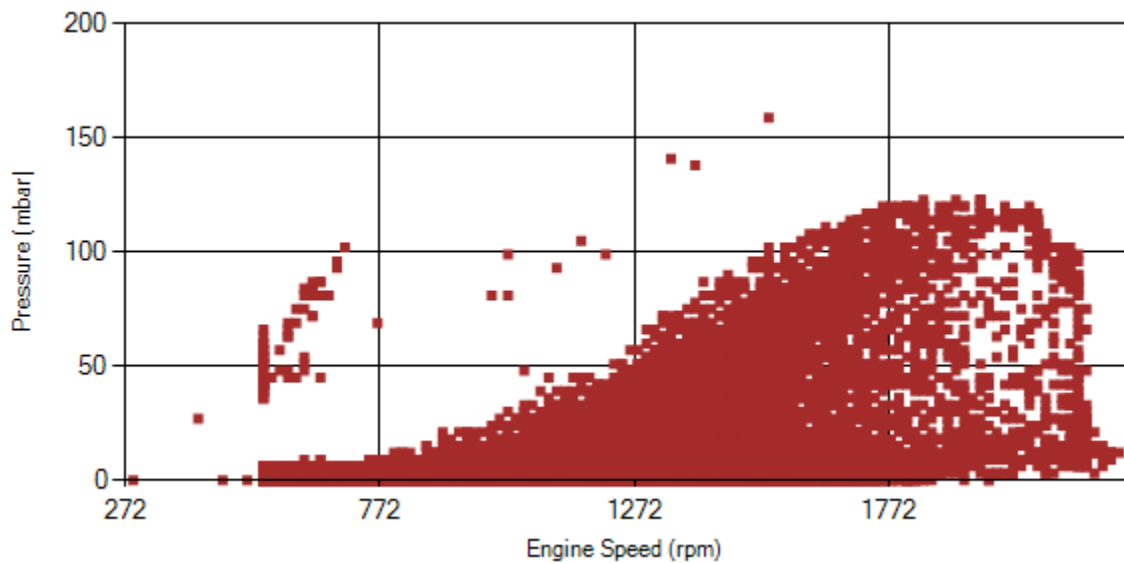


Figure 11- Pressure against engine speed



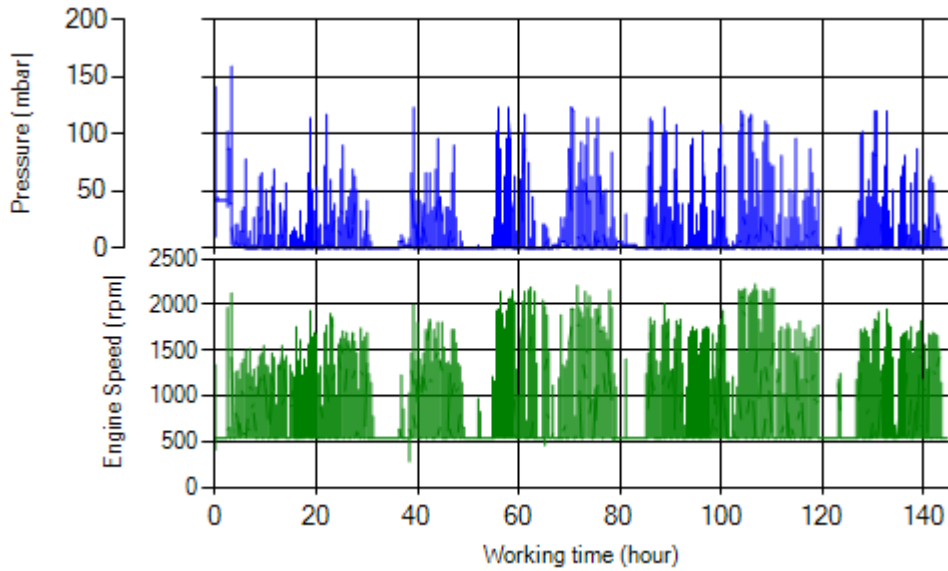


Figure 12- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

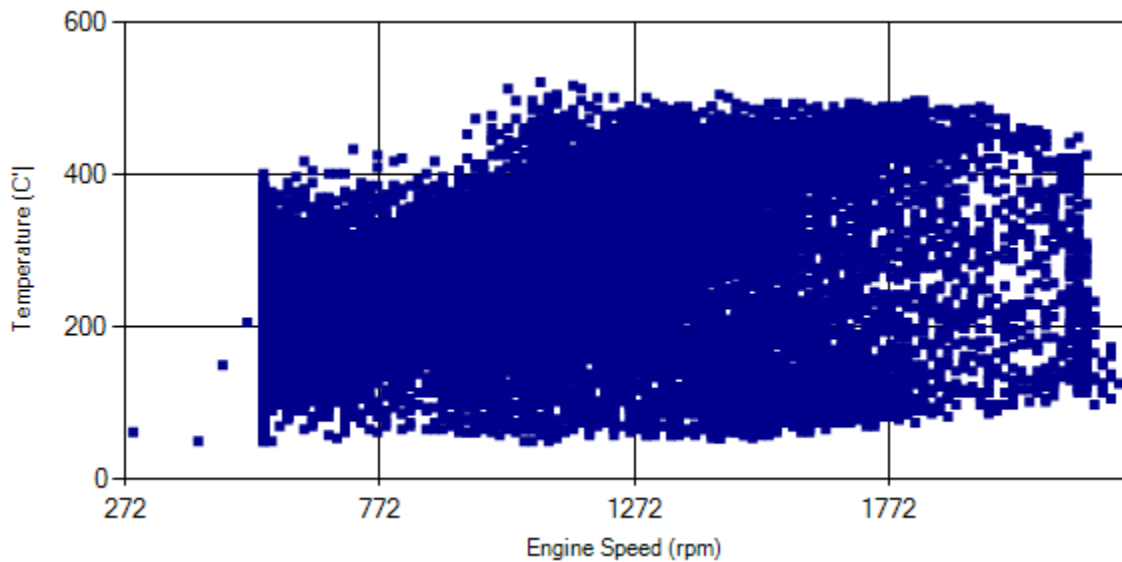
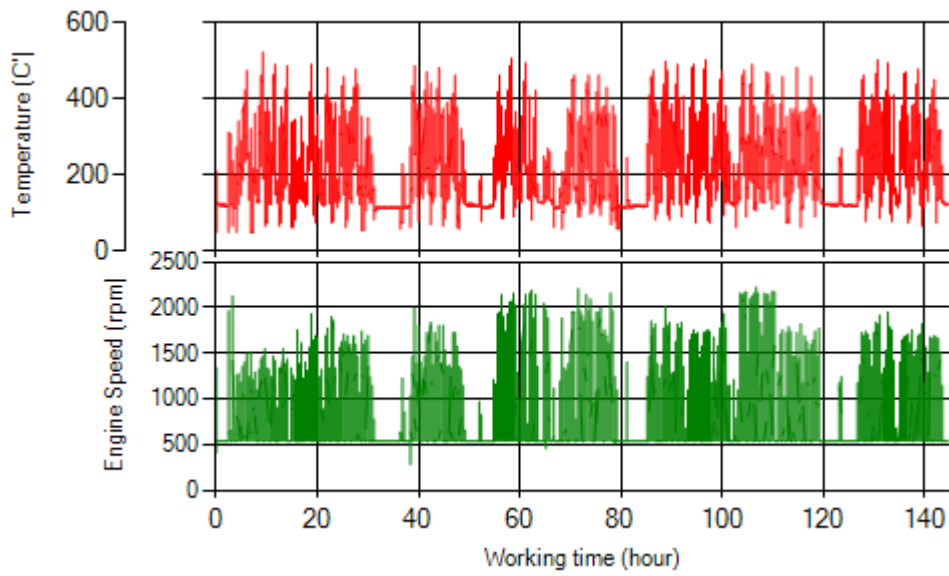


Figure 13- Temperature against engine speed



*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	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	16/Dec/2015 – 31/Dec/2015 (sixteen days)
K value – DPF upstream	1.70 [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)	49044 km
Bus mileage over the period	3145 km
Working days over the period	14 days
Stop days	2 days
Data logger working days	14 days
Working hours over the period	237 hours 13 minutes
Average working hours per day (including stop days)	14 hours 49 minutes
Bus average speed	13.3 km/hr
idle speed time to all working time ration	59.39 %
Total Bus fuel consumption over the period	1950 lit
Fuel consumption per hour	8.22 lit/hr
Average fuel consumption	0.62 lit/km
Total Bus additive consumption over the period	- lit
Average additive consumption	- cc/km
Additive consumption to fuel ration	- cc/1000lit

### Temperature, Pressure and Engine Speed Overview

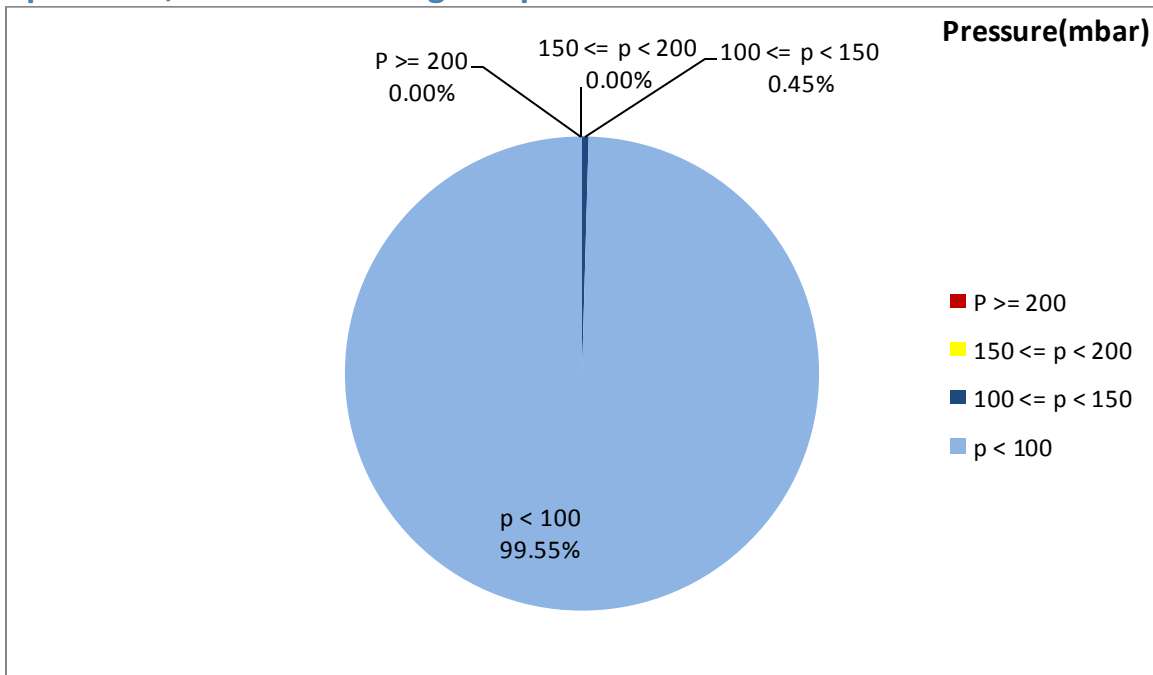


Figure 1- Pressure distribution over the working hours

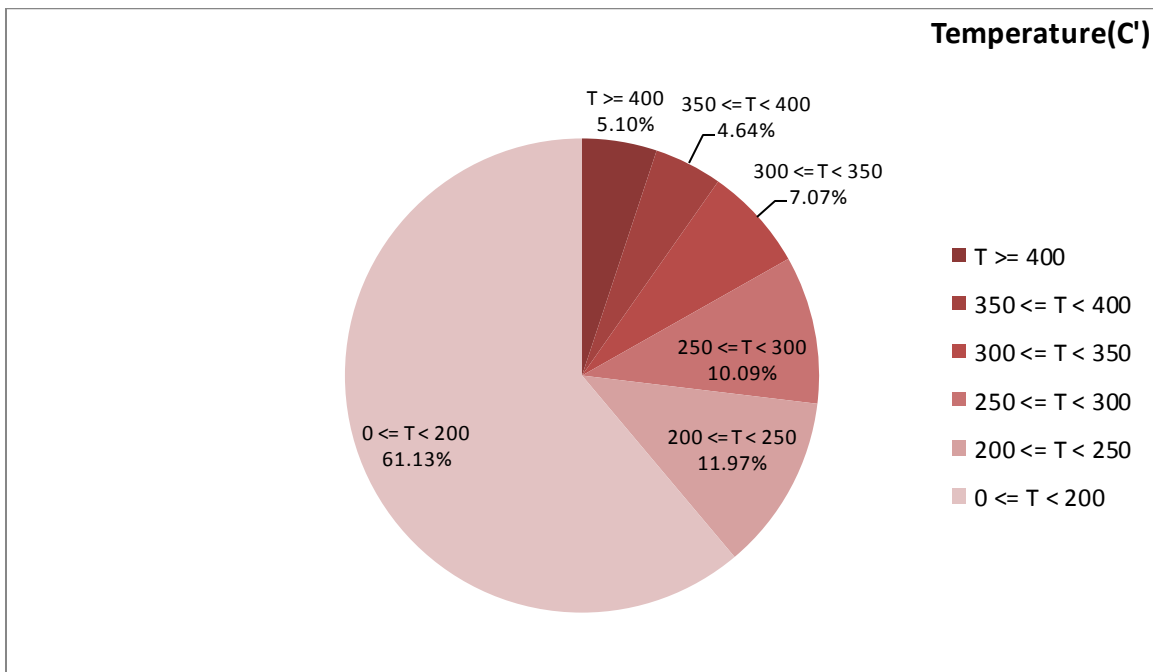


Figure 2-Temperature distribution over the working hours

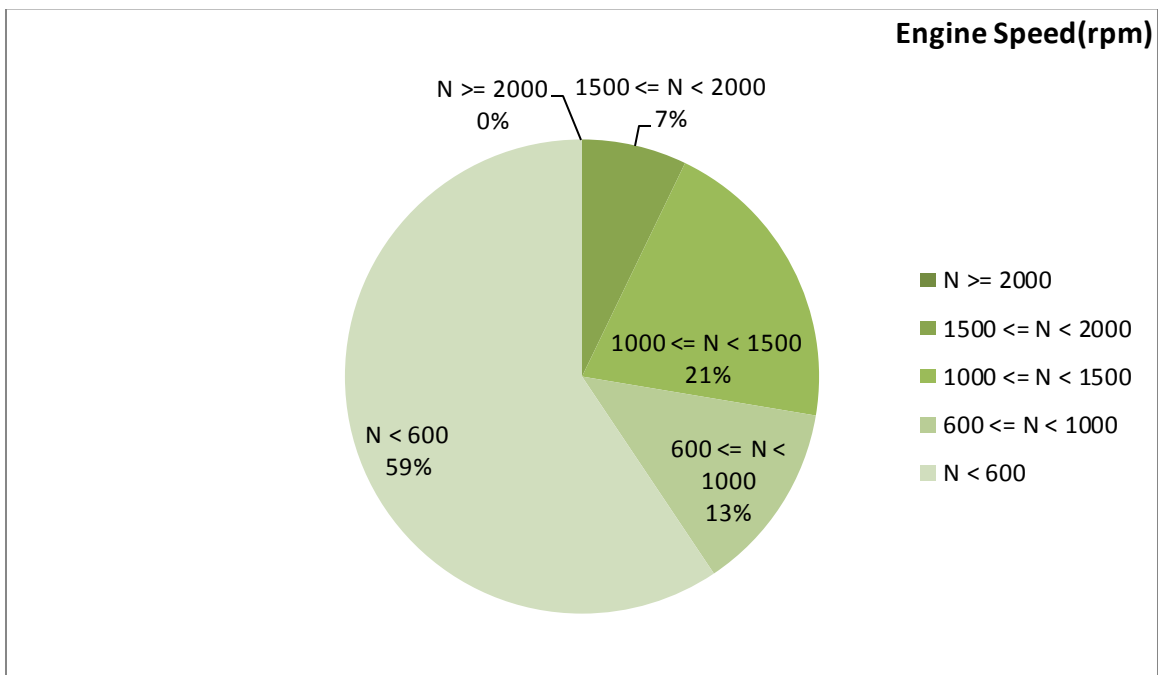


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
200.43	5.29	793

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
273.92	12.82	1156

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
526-50	129-0	2032-272

## Detailed Pressure Analysis

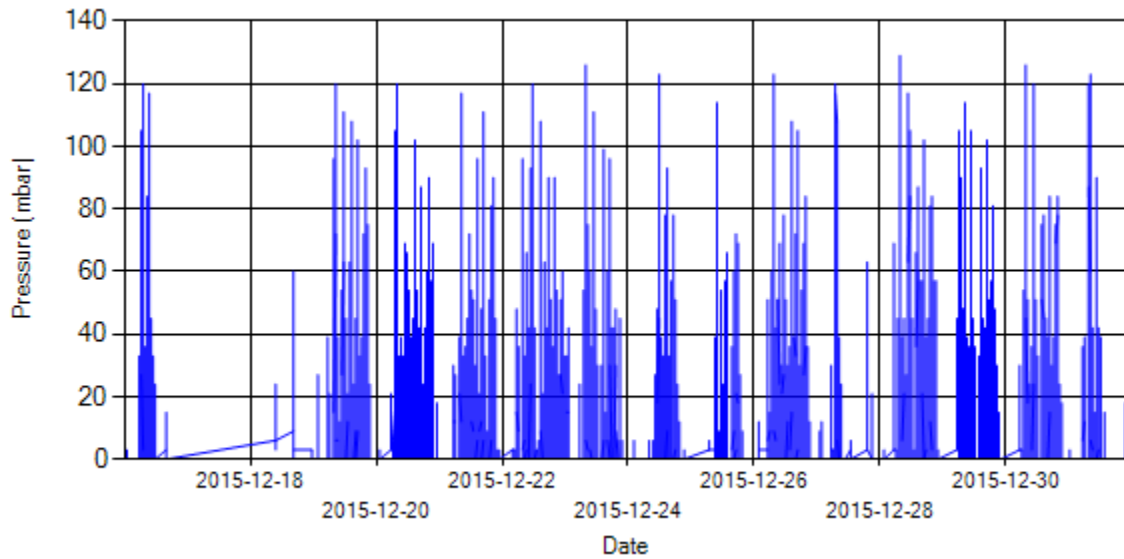


Figure 4- Pressure distribution over the period

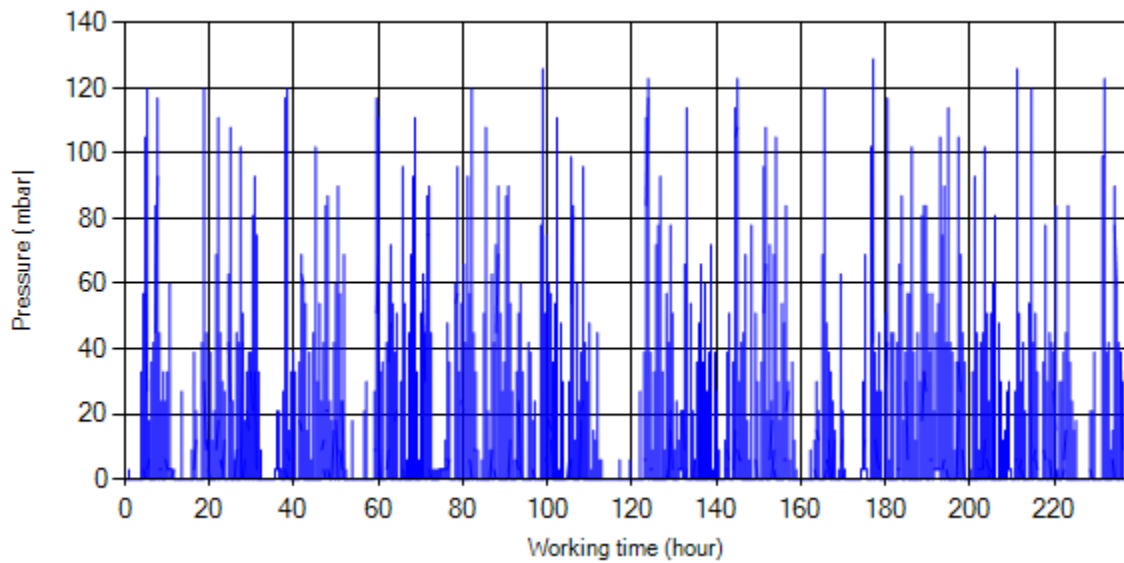


Figure 5- Pressure vs. working hours

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

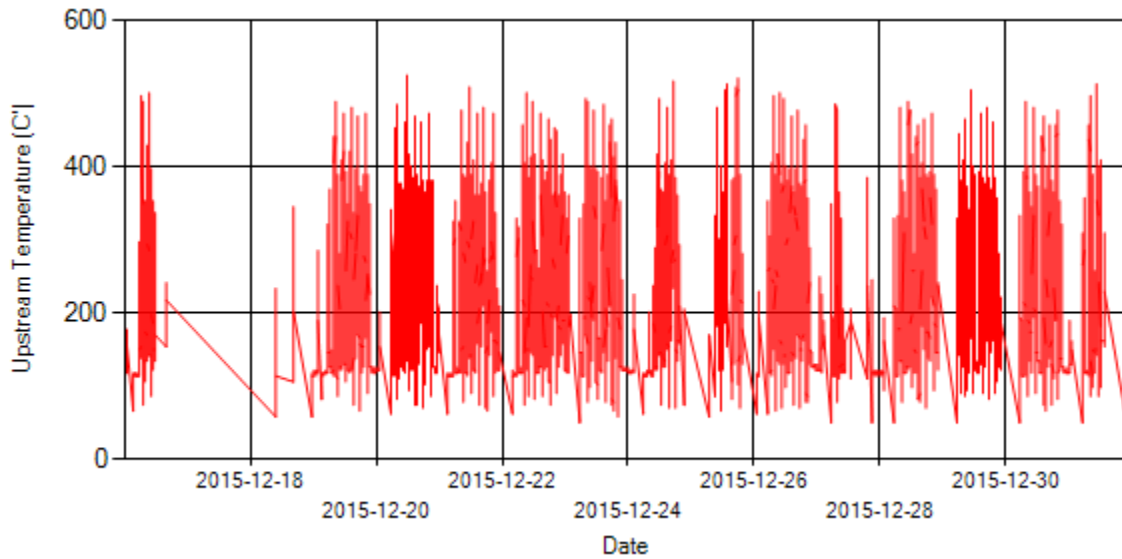


Figure 6- Temperature distribution over the period

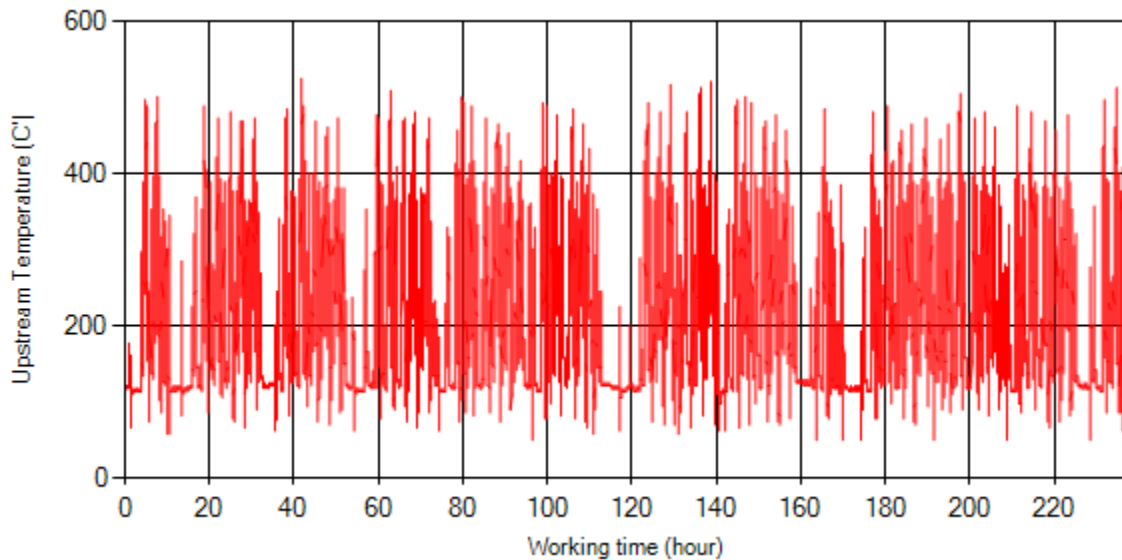


Figure 7- Temperature vs. working hours



## Engine Speed Diagrams

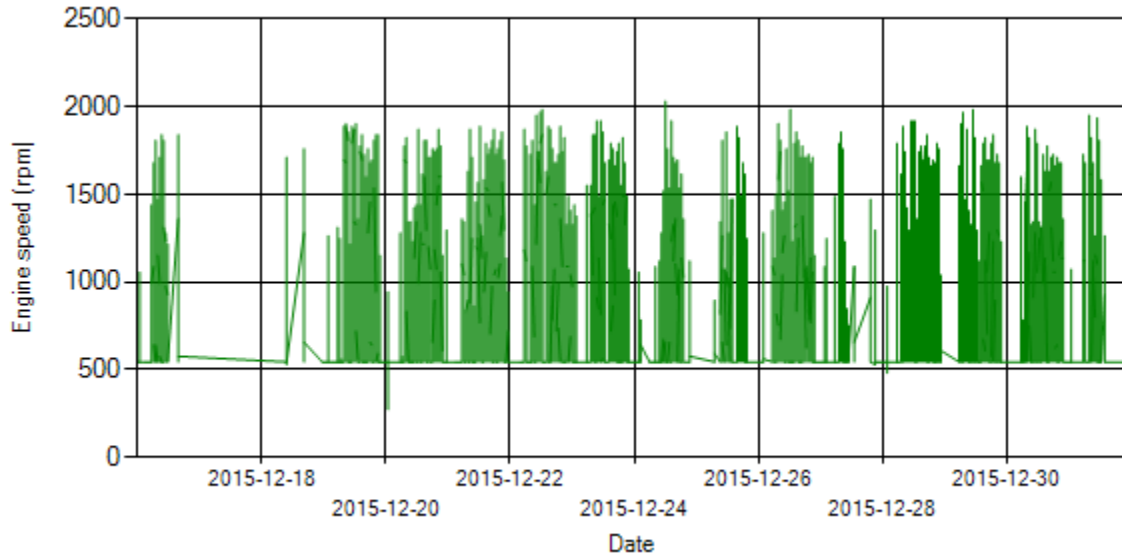


Figure 8- Engine speed distribution over the period

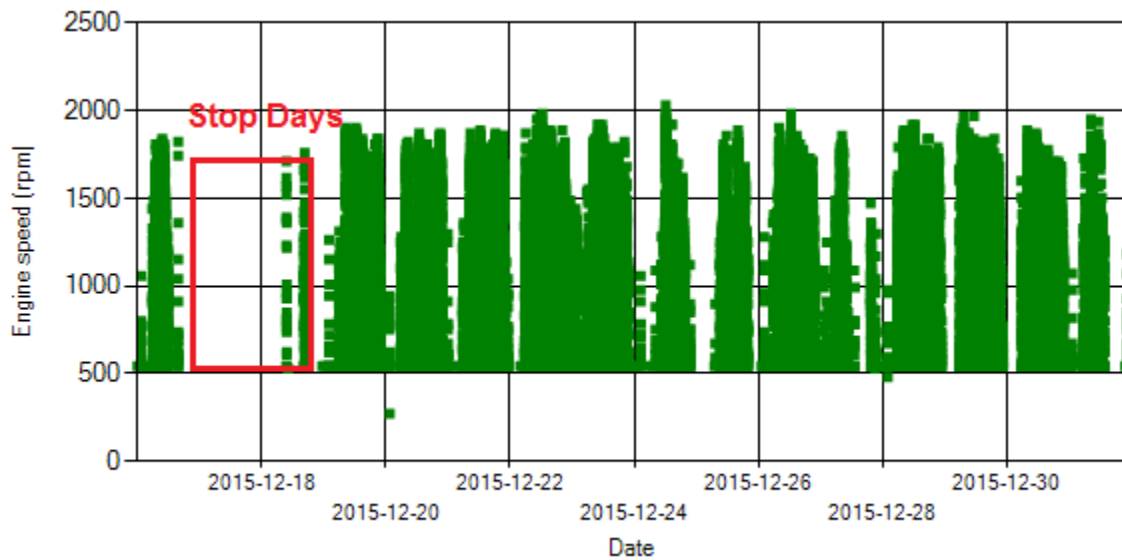


Figure 9- Engine speed diagram for calculating CPK's working days

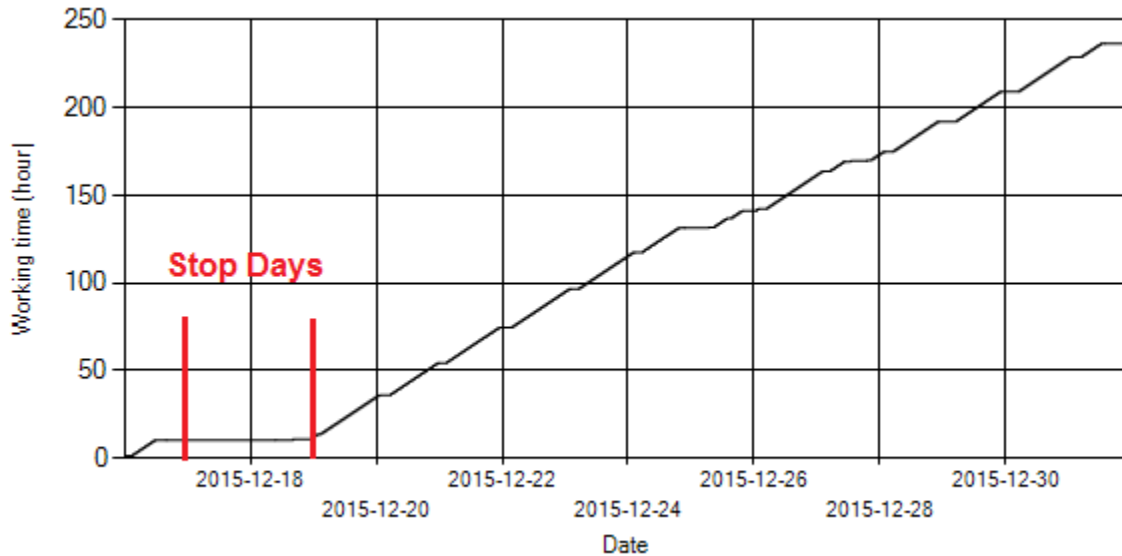


Figure 10- Time diagram for calculating CPK's working days

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 on Dec 17<sup>th</sup> and 18<sup>th</sup>.

### Pressure-Engine Speed diagrams

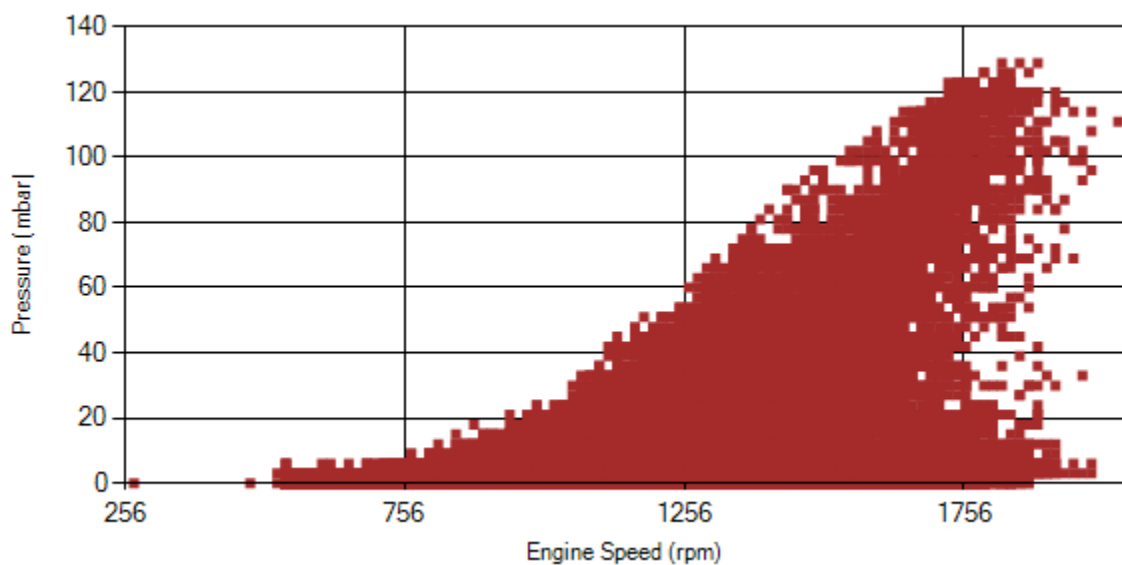


Figure 11- Pressure against engine speed

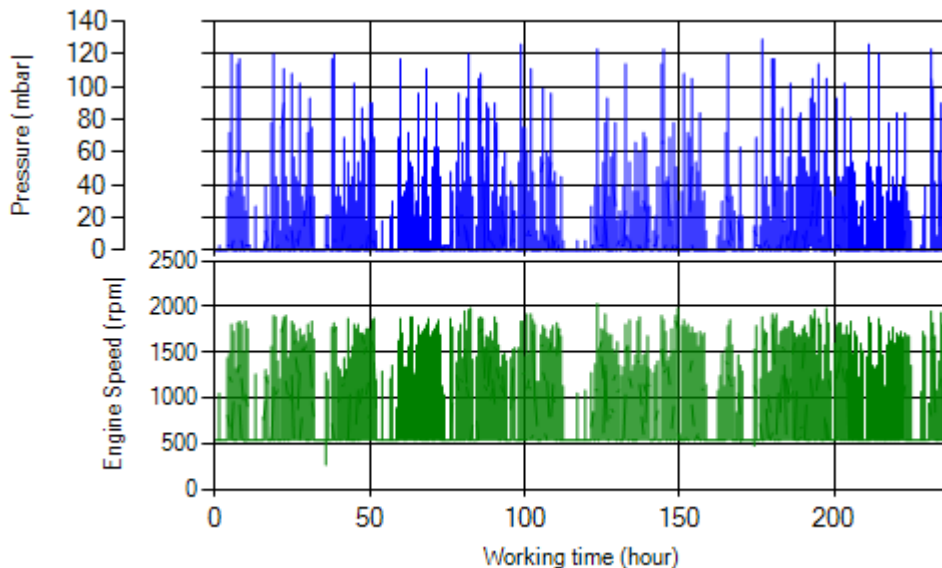


Figure 12- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

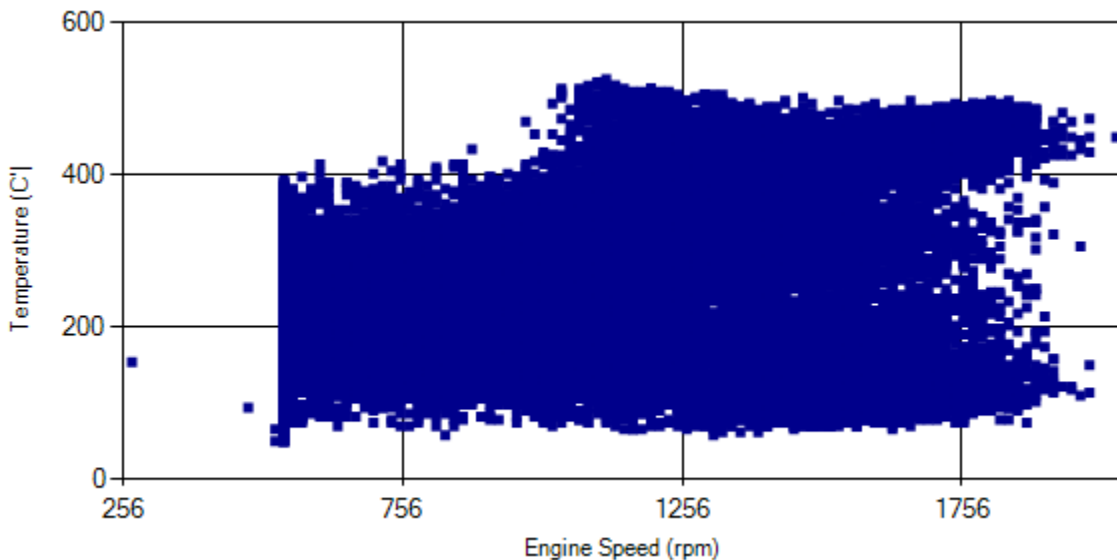
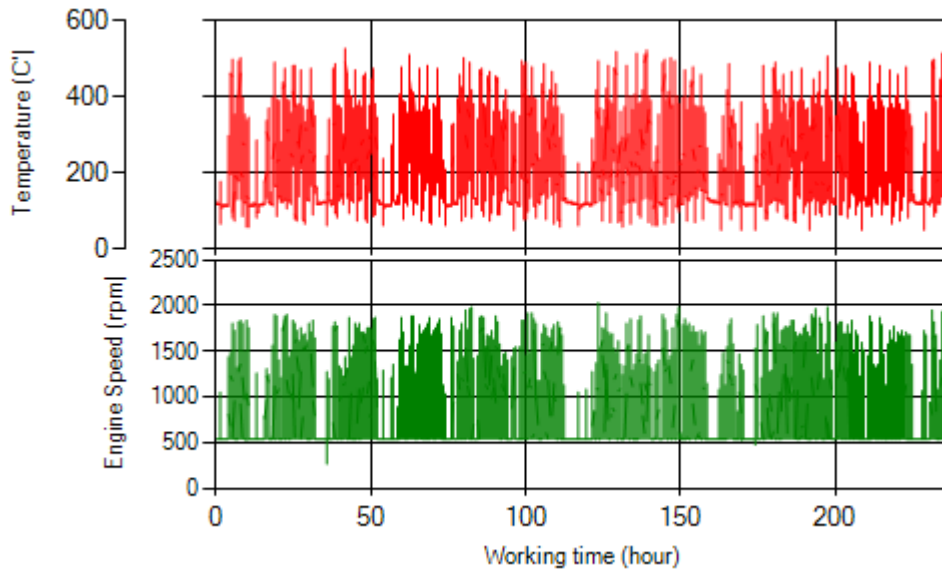


Figure 13- Temperature against engine speed

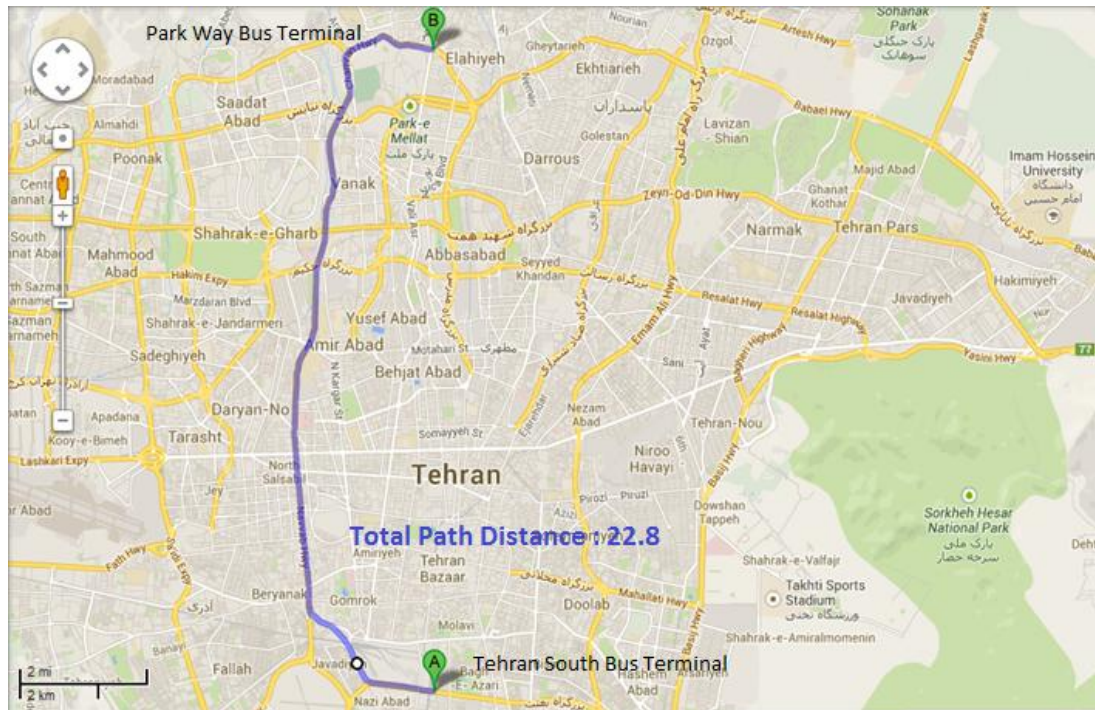


*Figure 14- T, N distribution vs. working hours*

## Filter Operation Analysis

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

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



All right reserved by ASA company – confidential no passing to third parties.

## 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/Dec/2015- 15/Dec/2015 (fifteen days)
K value - DPF upstream	1.85 [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)	50019 km
Bus mileage over the period	2088 km
Working days over the period	14 days
Stop days	1 day
Data logger working days	14 days
Working hours over the period	198 hours 56 minutes
Average working hours per day (including stop days)	13 hours 15 minutes
Bus average speed	10.50 km/hr
idle speed time to all working time ration	59.31 %
Total Bus fuel consumption over the period	1200 lit
Fuel consumption per hour	6.03 lit/hr
Average fuel consumption	0.57 lit/km
Total Bus additive consumption over the period	0.570 lit
Average additive consumption	273 cc/km
Additive consumption to fuel ration	475 cc/1000lit

### Temperature, Pressure and Engine Speed Overview

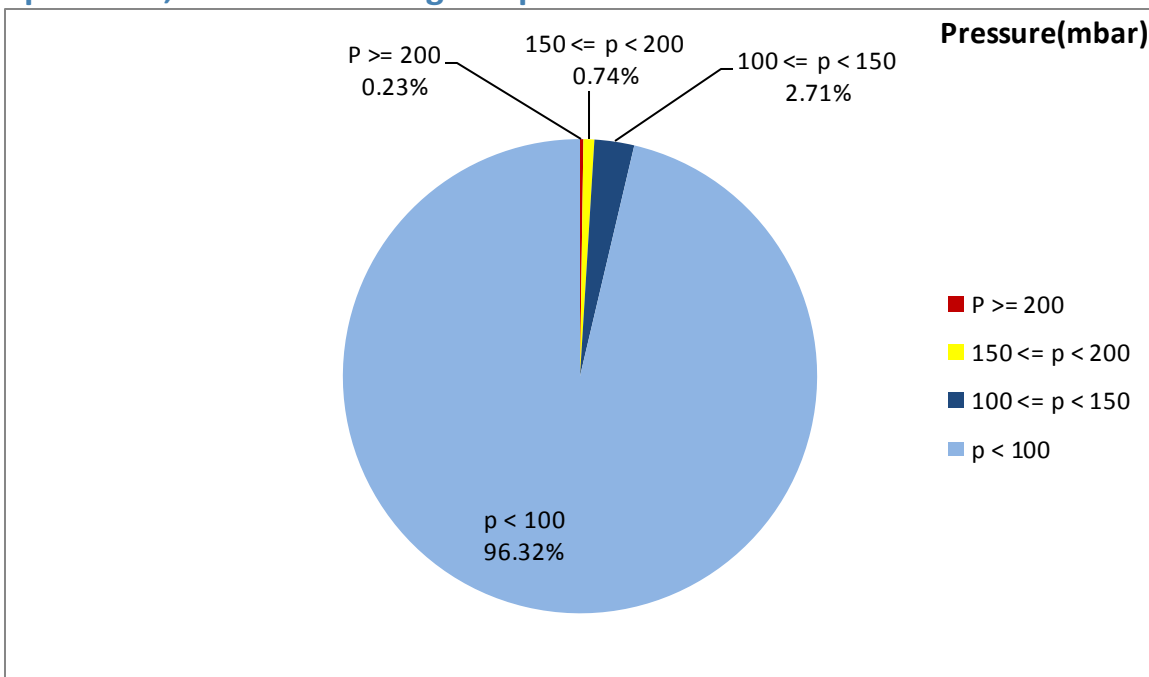


Figure 1- Pressure distribution over the working hours

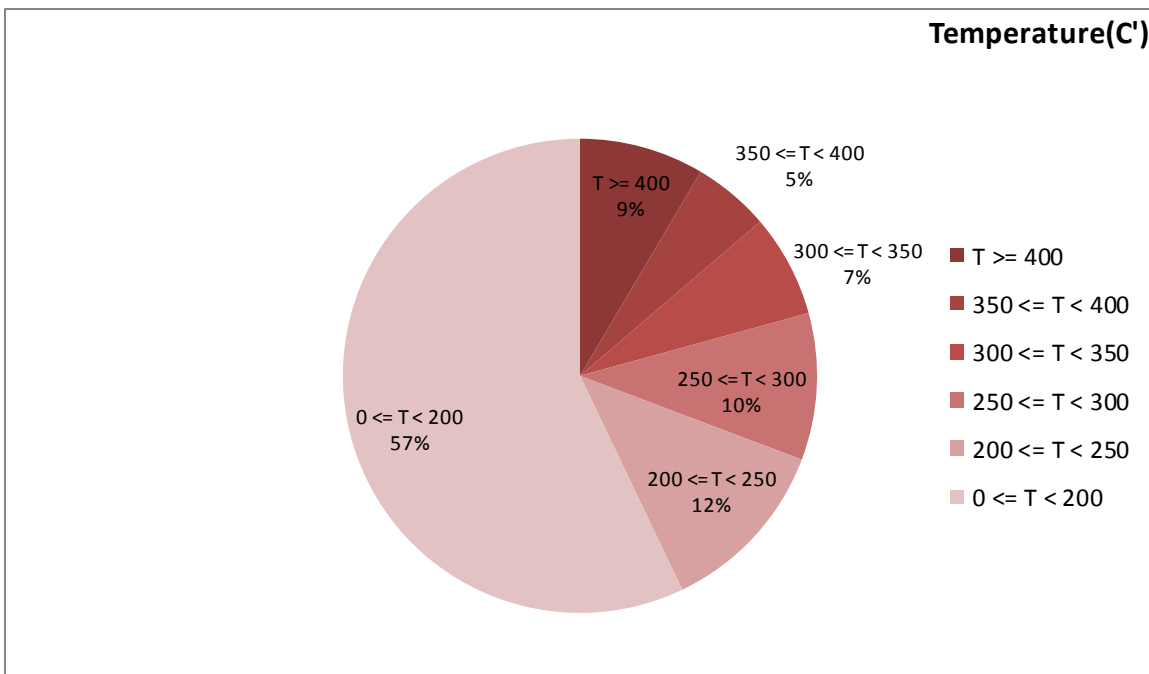


Figure 2-Temperature distribution over the working hours



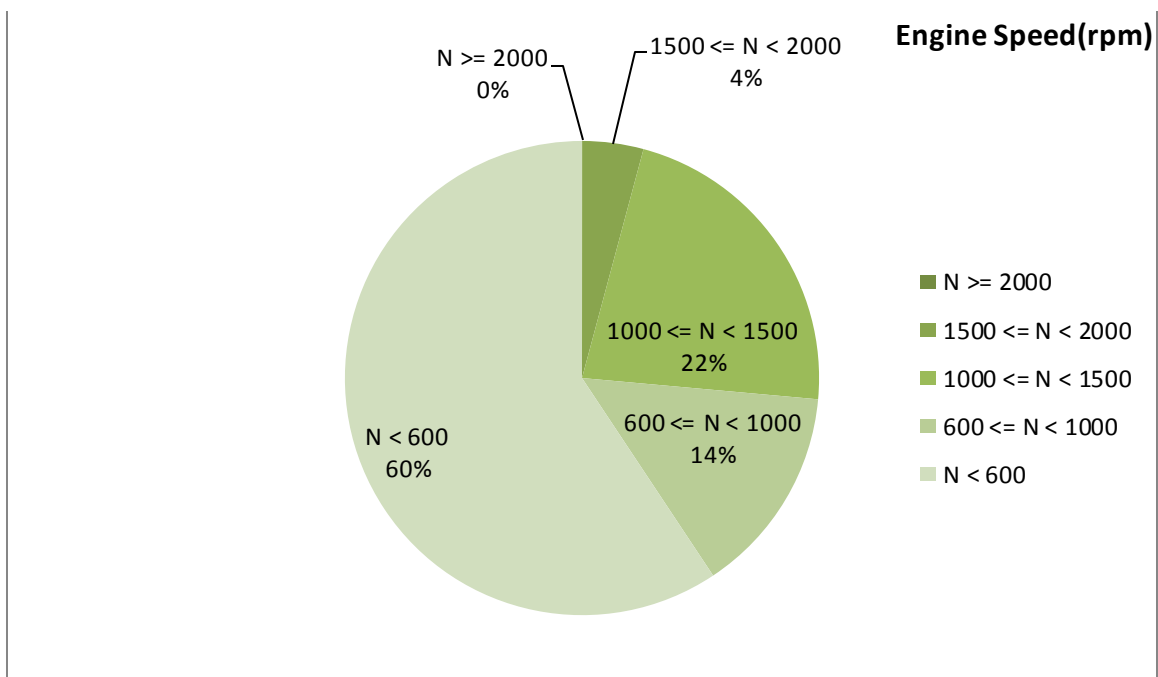


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
215.1	22.82	775

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
299.58	42.83	1110

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
642-50	258-0	2144-256

## Detailed Pressure Analysis

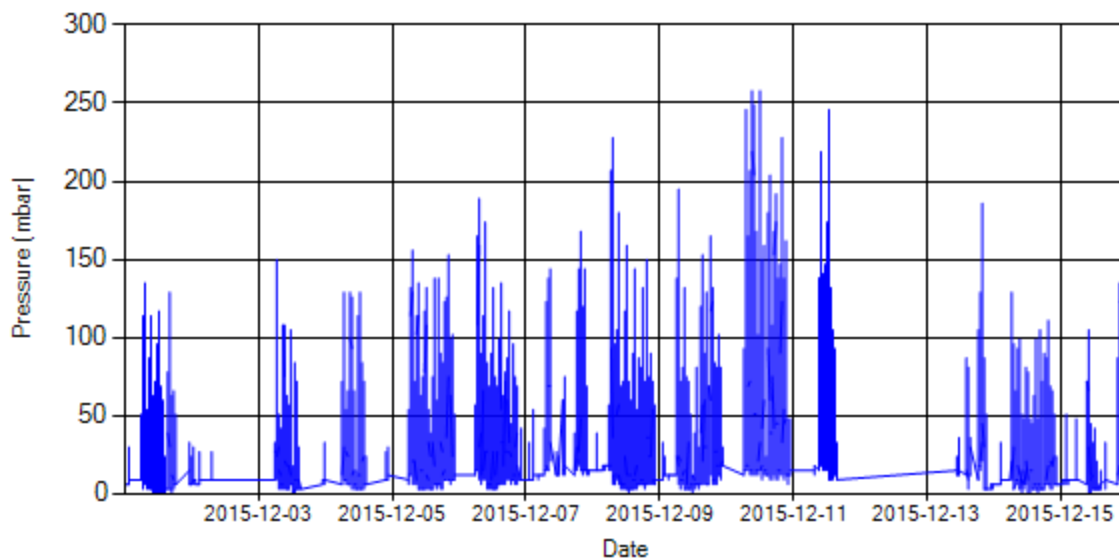


Figure 4- Pressure distribution over the period

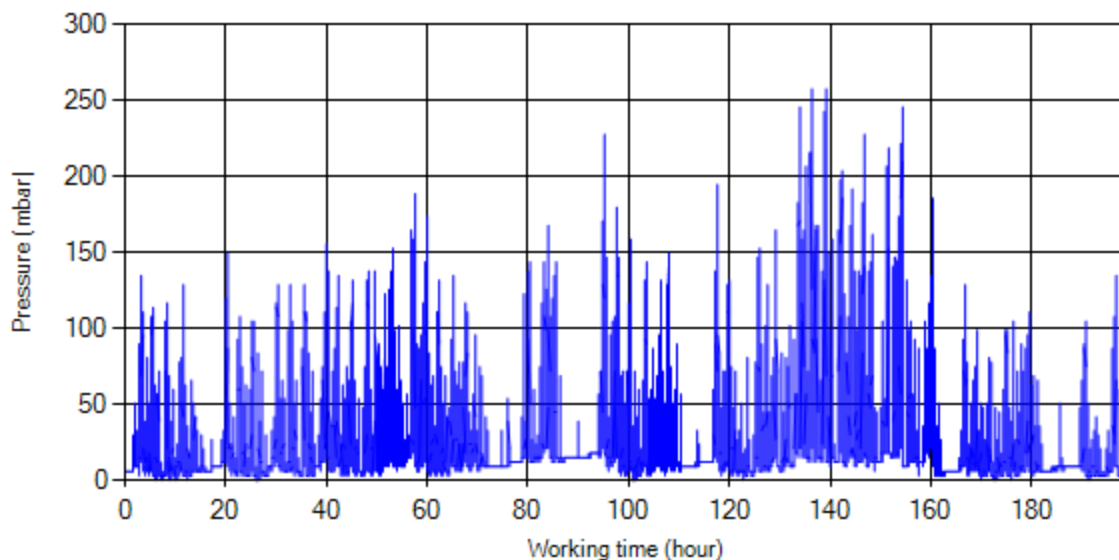


Figure 5- Pressure vs. working hours

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

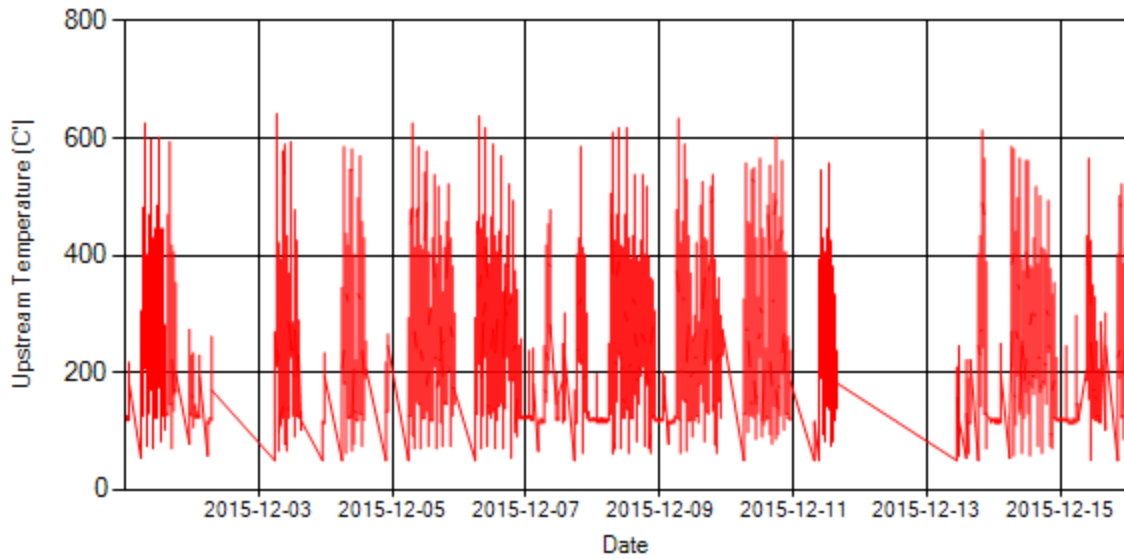


Figure 6- Temperature distribution over the period

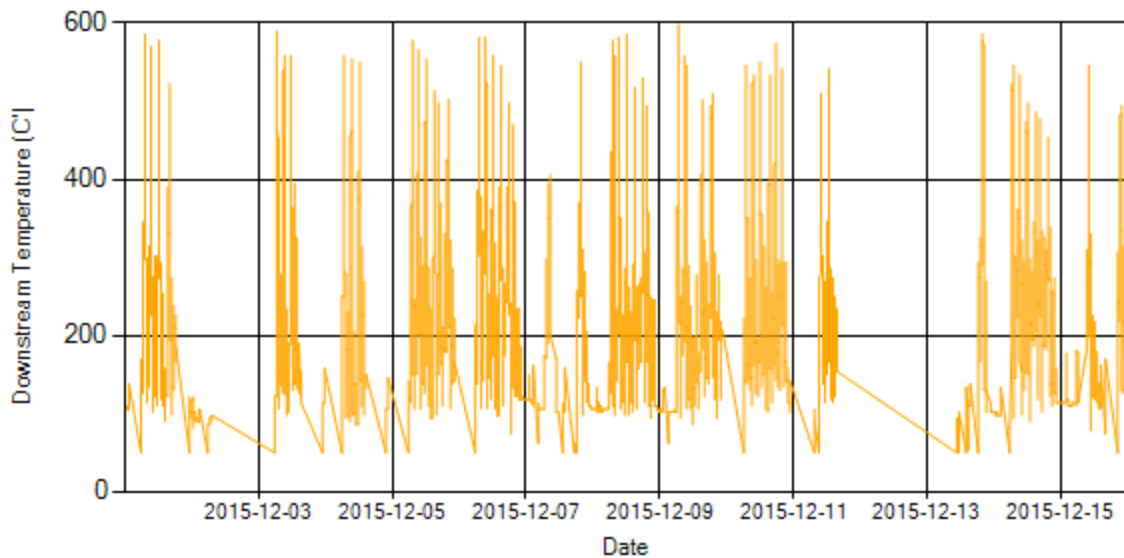
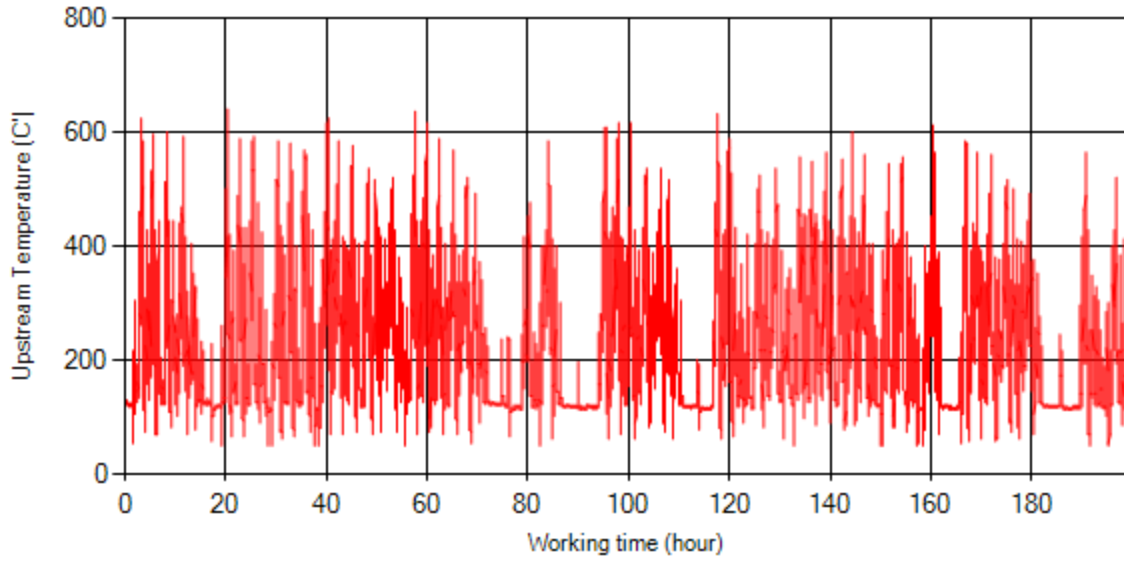
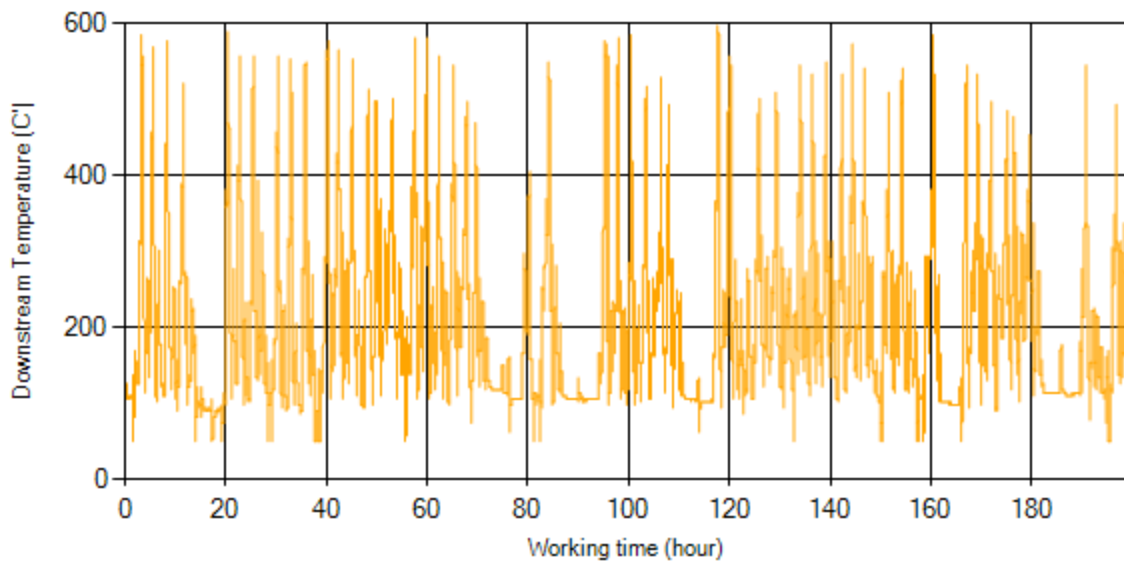


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

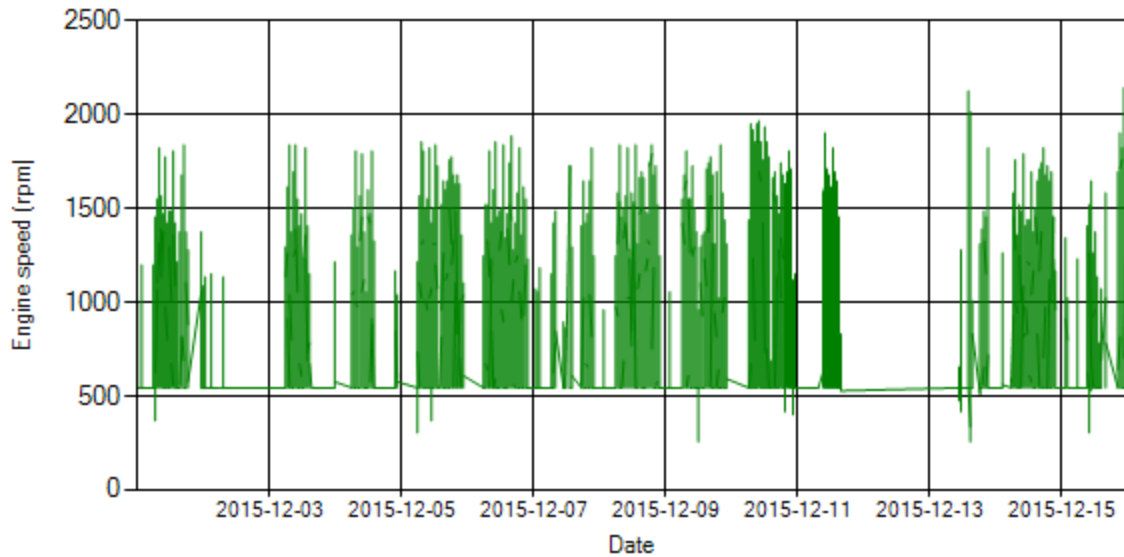


Figure 10- Engine speed distribution over the period

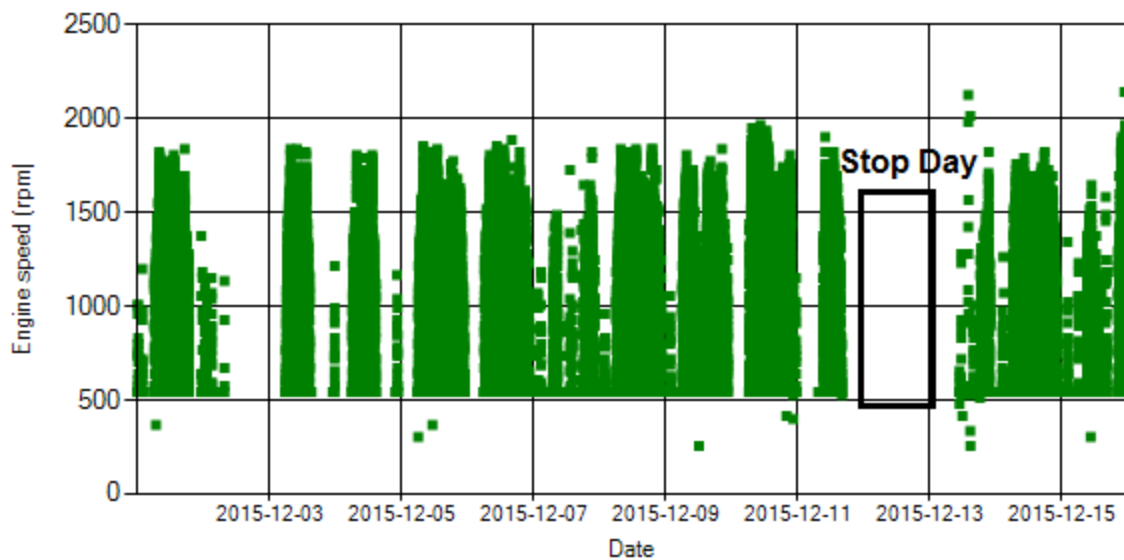


Figure 11- Engine speed diagram for calculating CPK's working days

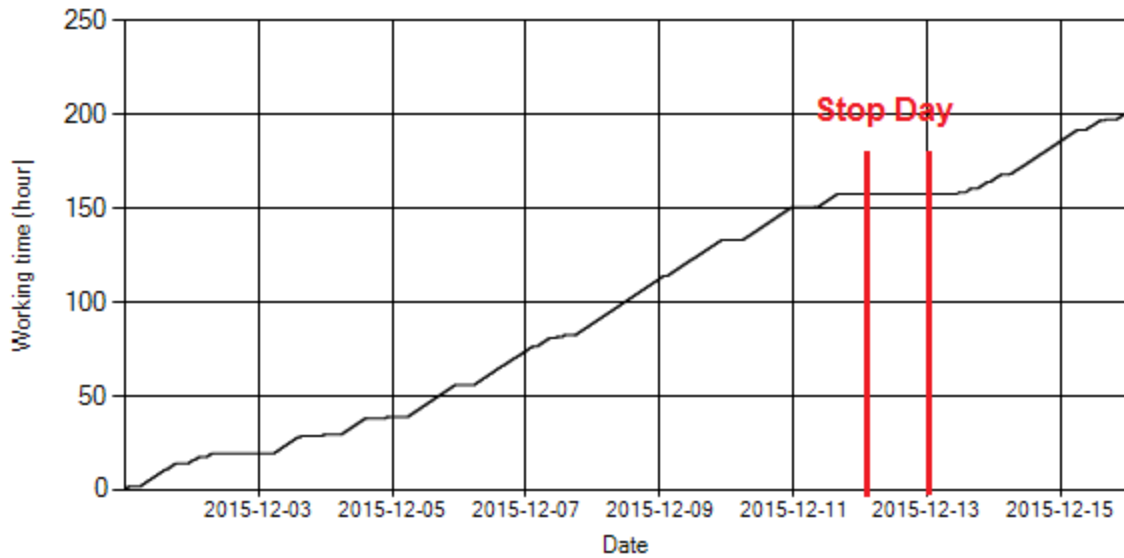


Figure 12- Time diagram for calculating CPK's working days

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

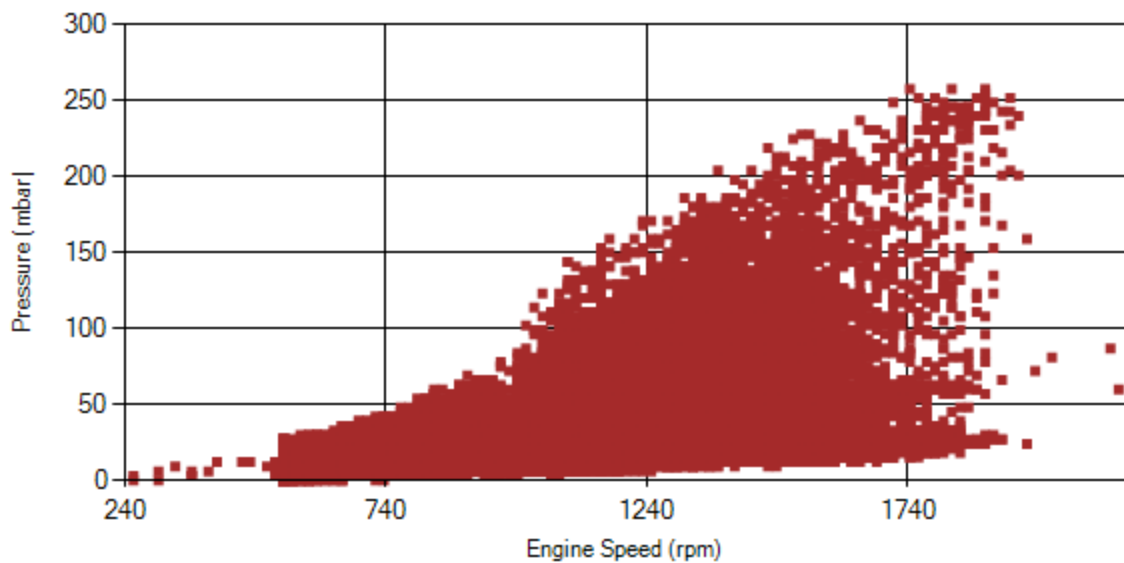


Figure 13- Pressure against engine speed

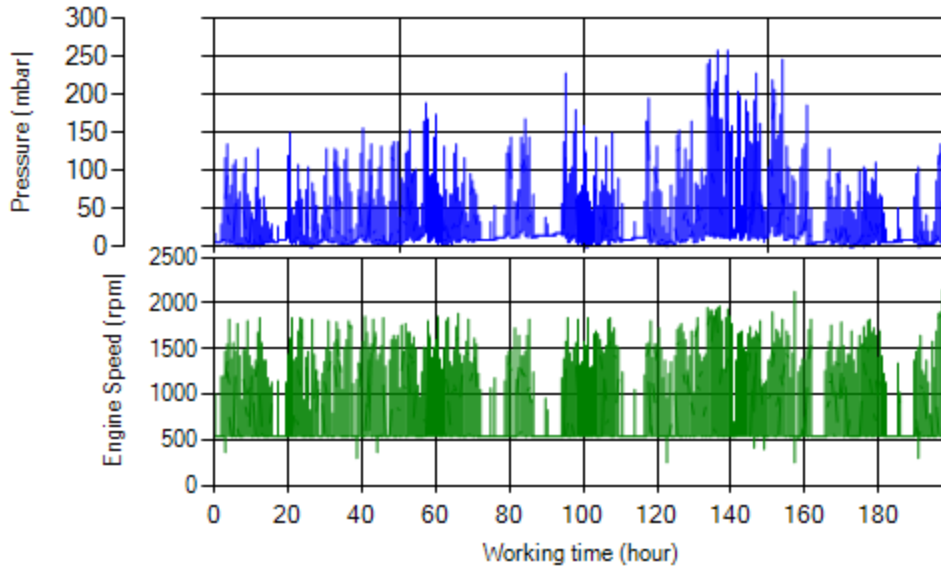


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

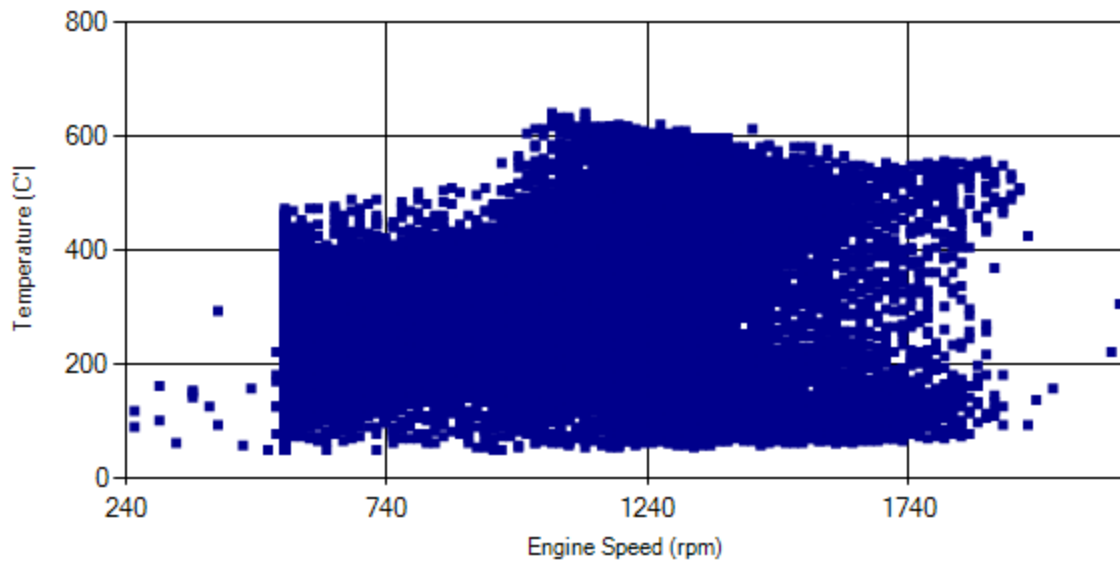


Figure 15- Temperature against engine speed

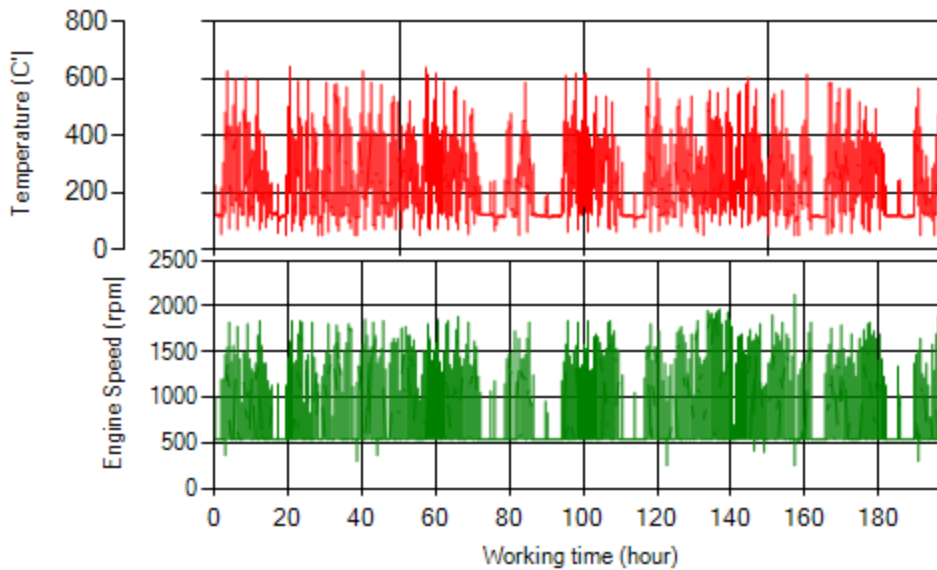


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, 0.23% of time pressure was above 200 mbar and 0.97% 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 14% above 350°C.

Filter operation status	Excellent <input type="checkbox"/> Good <input checked="" 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/Dec/2015- 31/Dec/2015 (sixteen days)
K value - DPF upstream	1.85 [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)	52372 km
Bus mileage over the period	2353 km
Working days over the period	15 days
Stop days	1 day
Data logger working days	6 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	54.63 %
Total Bus fuel consumption over the period	1360 lit
Fuel consumption per hour	- lit/hr
Average fuel consumption	0.58 lit/km
Total Bus additive consumption over the period	0.650 lit
Average additive consumption	276 cc/km
Additive consumption to fuel ration	478 cc/1000lit

Notice: Data logger got problem on Dec 17<sup>th</sup> and was fixed on Dec 26<sup>th</sup>.

### Temperature, Pressure and Engine Speed Overview

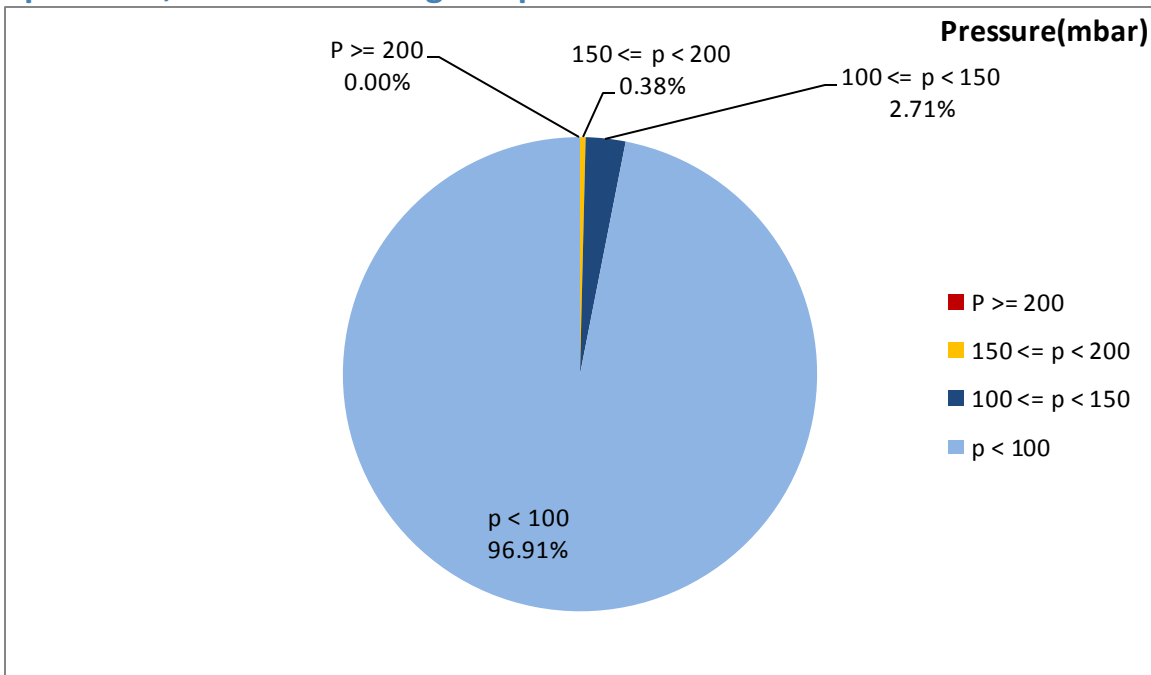


Figure 1- Pressure distribution over the working hours

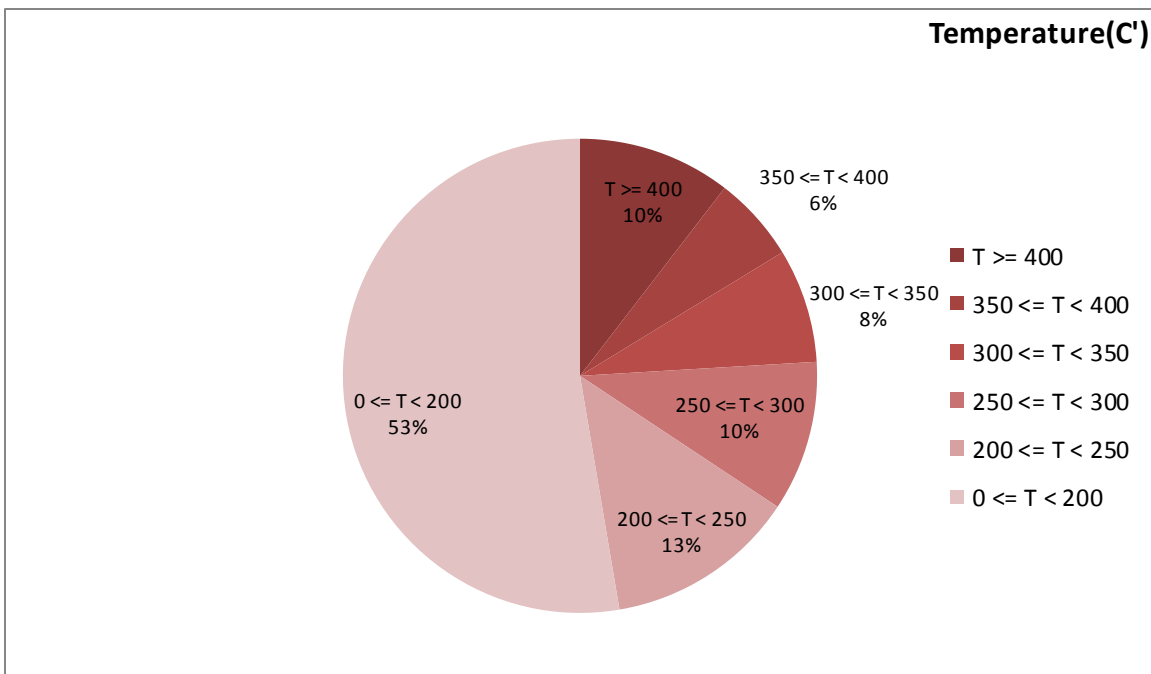


Figure 2-Temperature distribution over the working hours

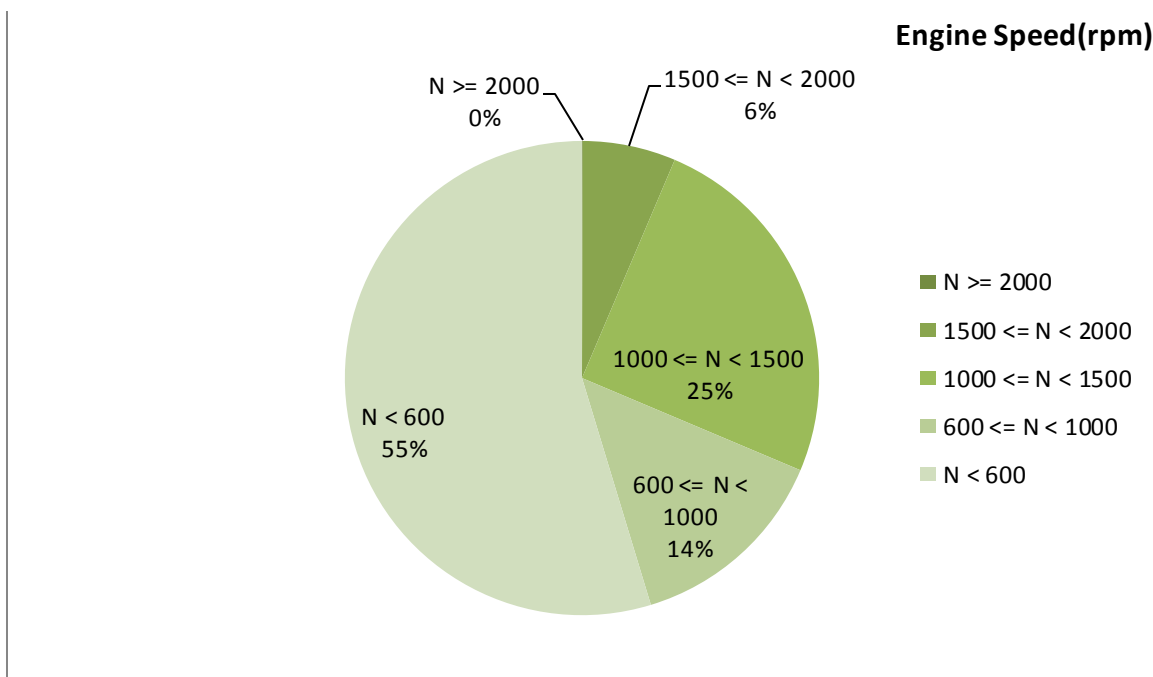


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
226.07	20.76	822

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
303.23	37.77	1156

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
630-50	186-0	2144-256

## Detailed Pressure Analysis

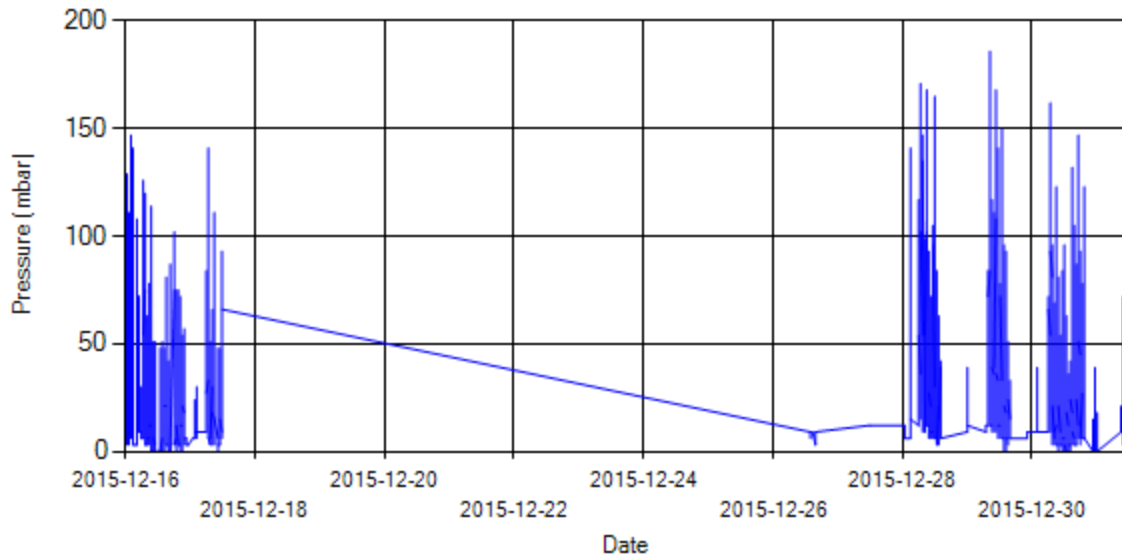


Figure 4- Pressure distribution over the period

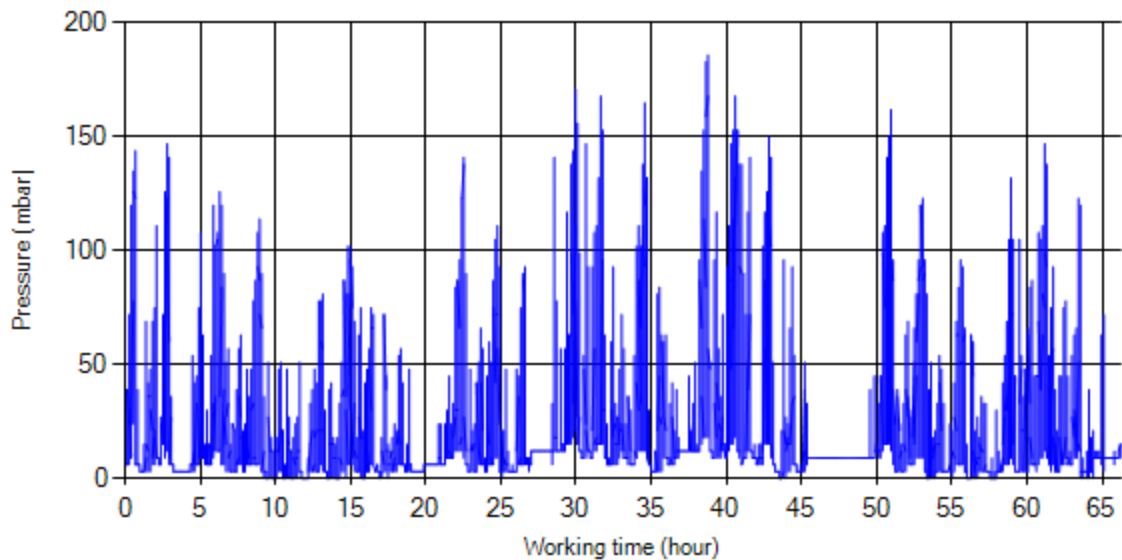


Figure 5- Pressure vs. working hours

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

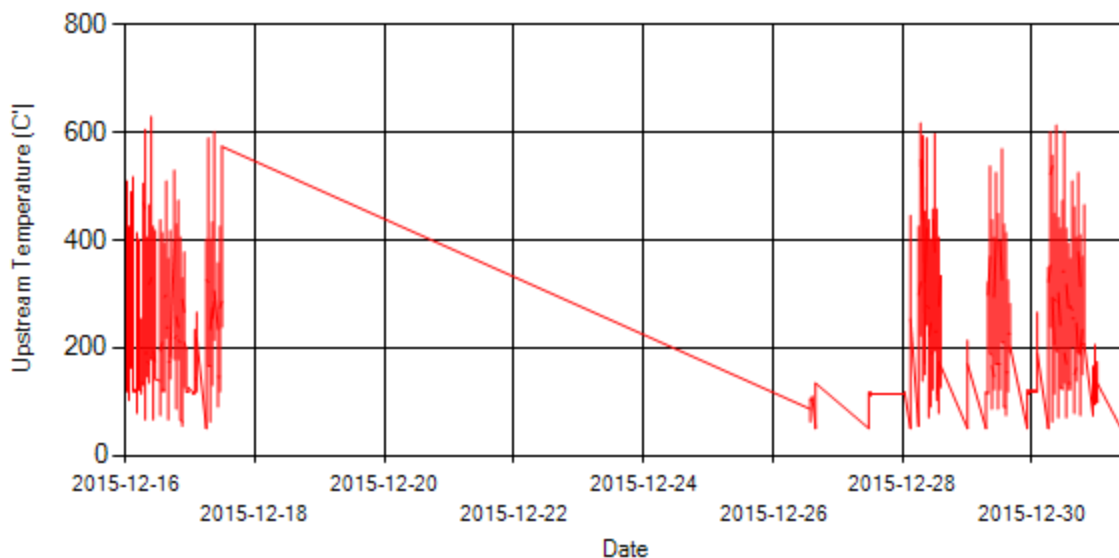


Figure 6- Temperature distribution over the period

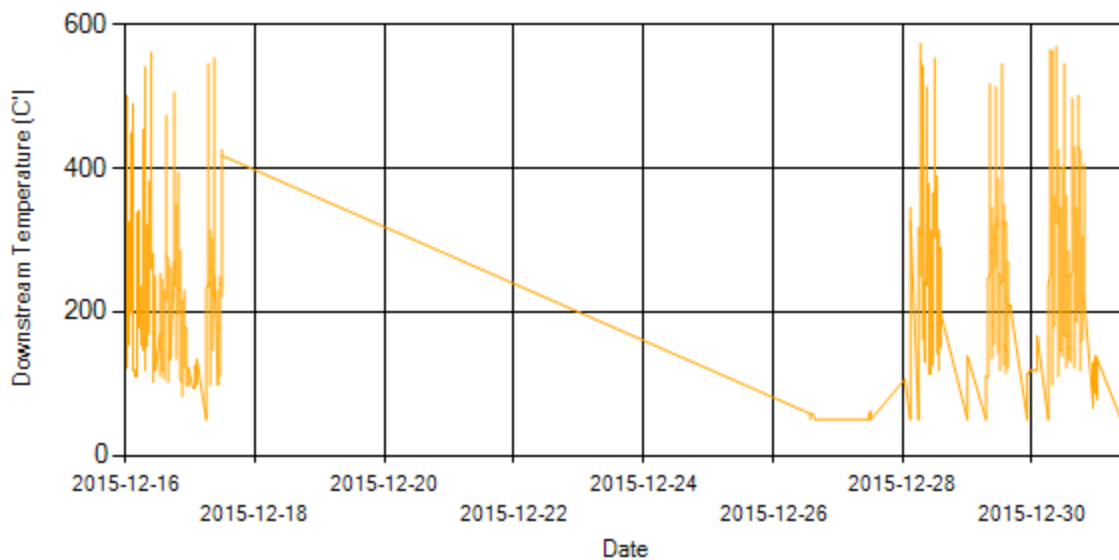
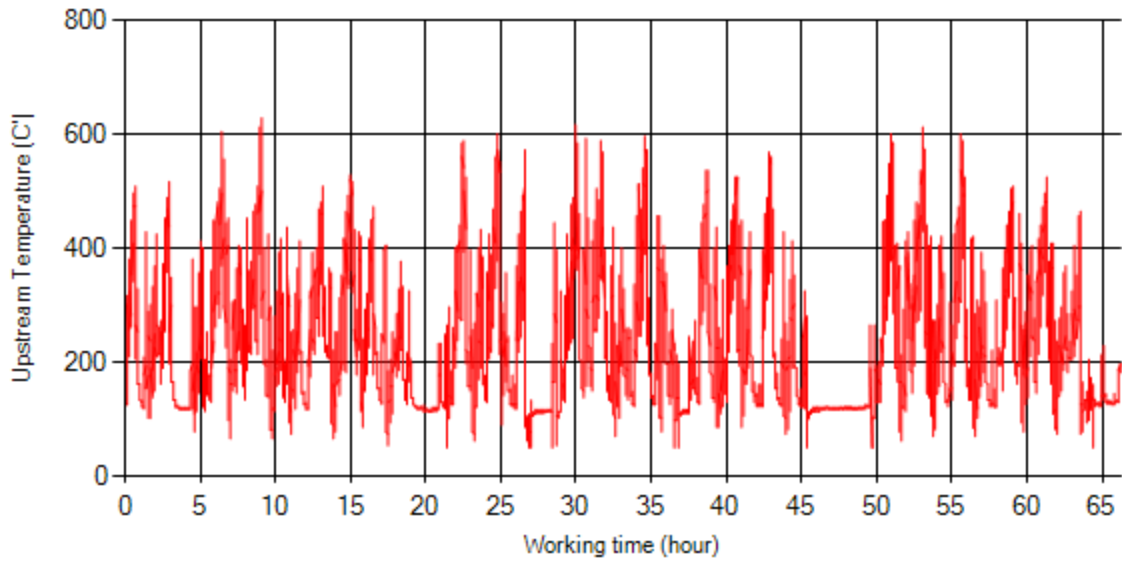
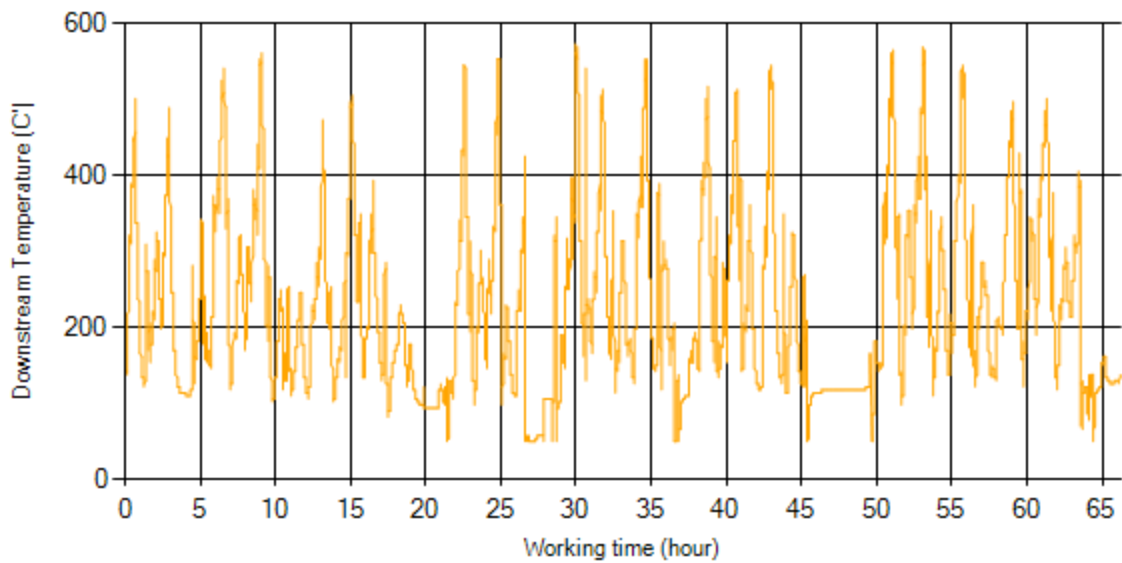


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

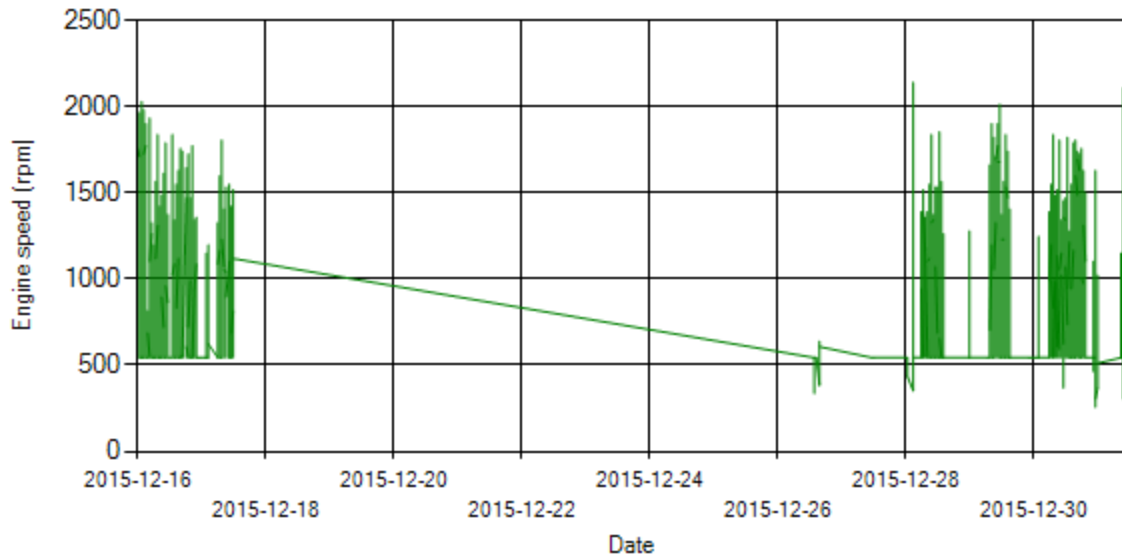


Figure 10- Engine speed distribution over the period

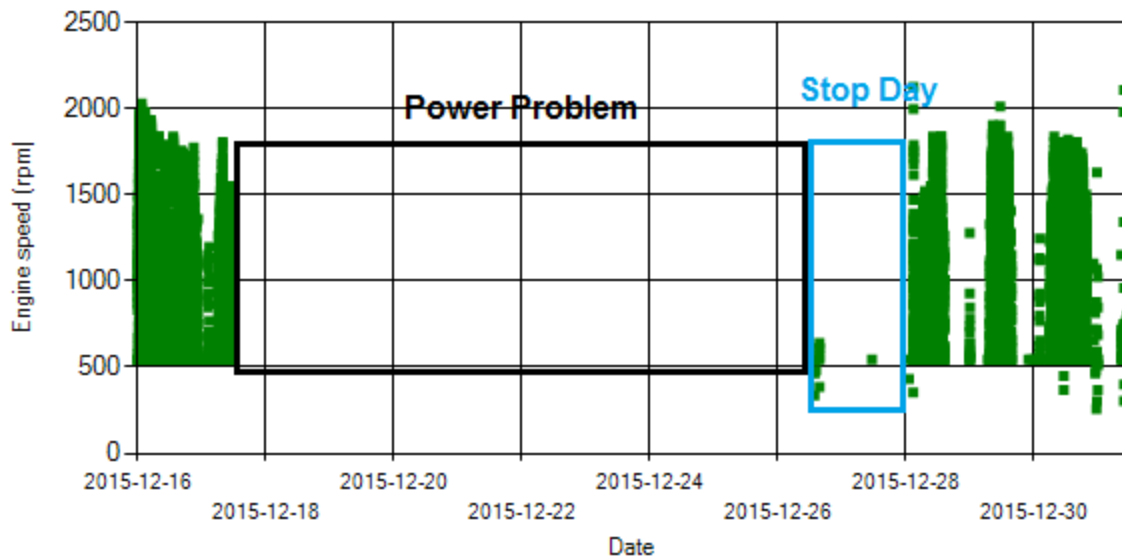


Figure 11- Engine speed diagram for calculating CPK's working days



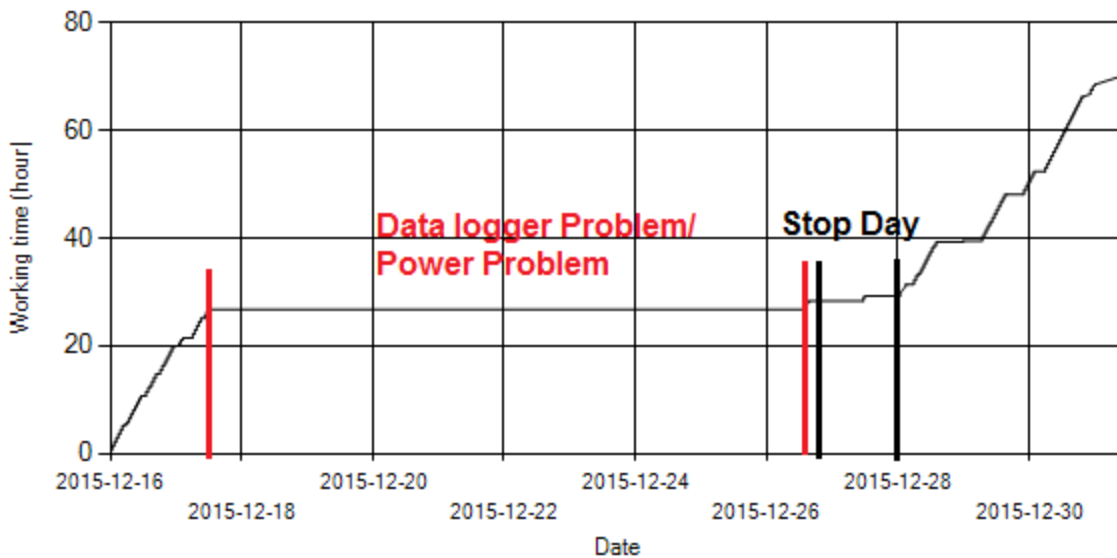


Figure 12- Time diagram for calculating CPK's working days

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

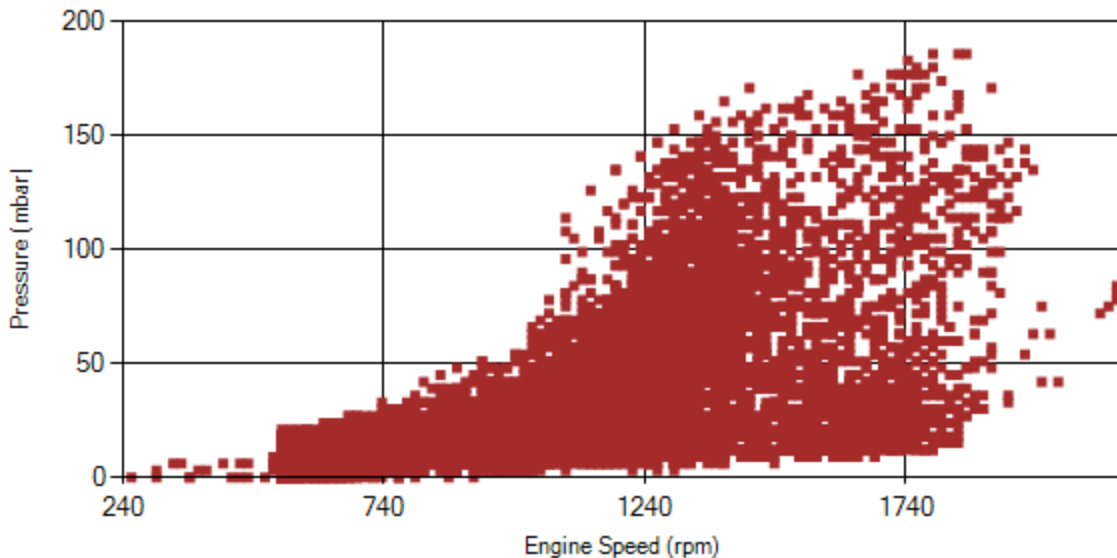


Figure 13- Pressure against engine speed

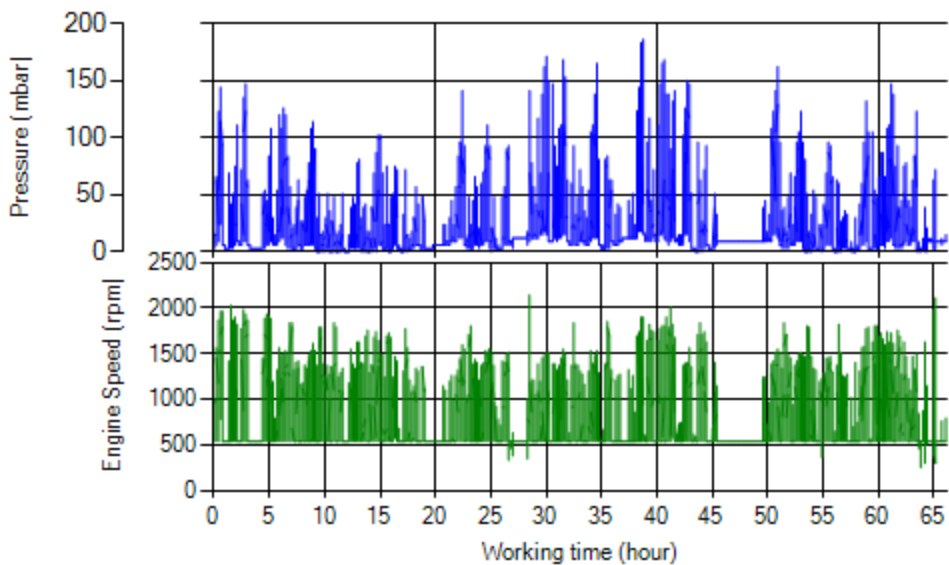


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

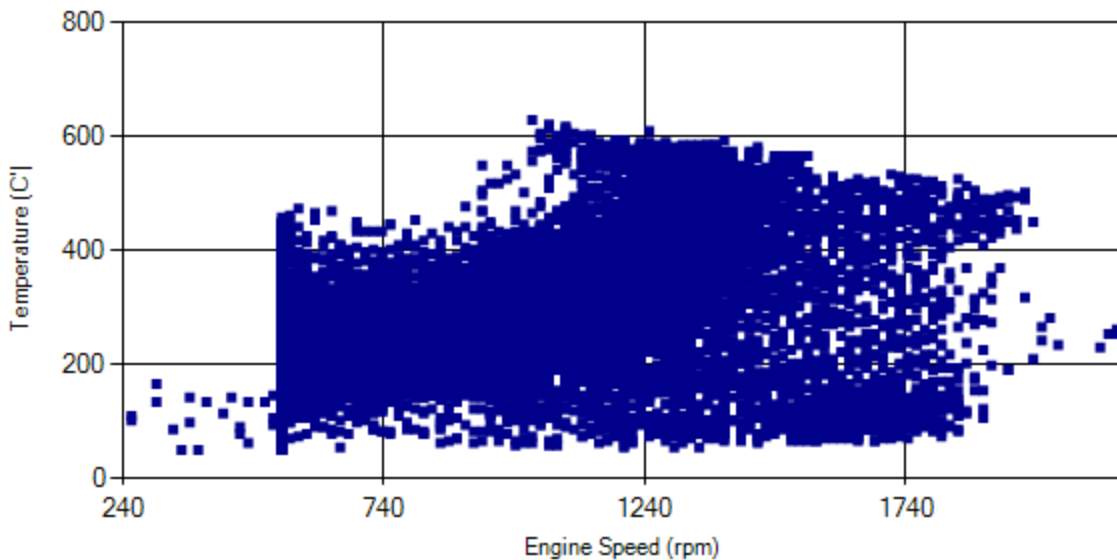


Figure 15- Temperature against engine speed

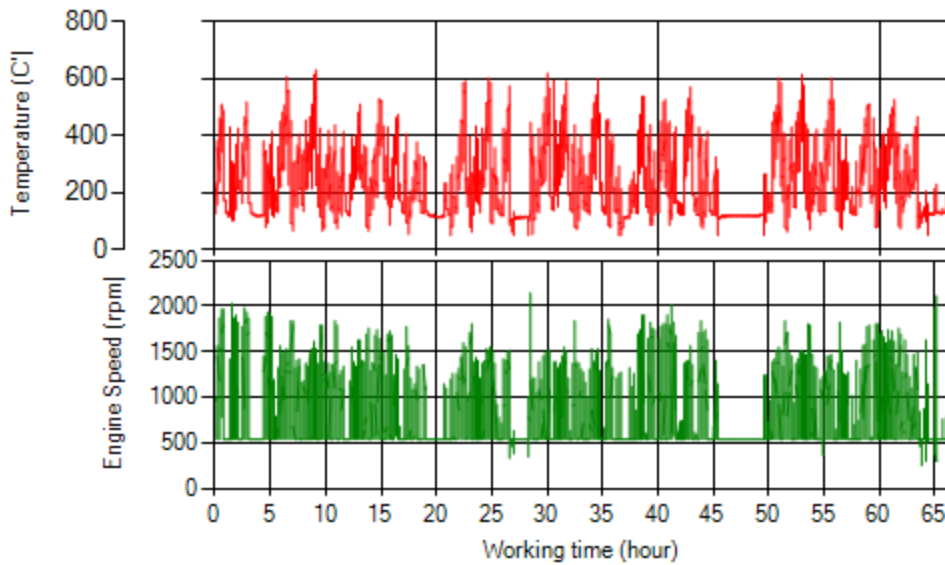


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

Considering data logger working days:

- As depicted in figure 1, only 0.38% of time pressure was above 150 mbar and pressure above 200 mbar was not observed.
- 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"/>

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)



All right reserved by ASA company – confidential no passing to third parties.

## 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/Dec/2015 – 15/Dec/2015 (fifteen days)
K value - DPF upstream	1.85 [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)	39886 km
Bus mileage over the period	907 km
Working days over the period	6 days
Stop days	9 days
Data logger working days	6 days
Working hours over the period	51 hours 28 minutes
Average working hours per day (including stop days)	3 hours 25 minutes
Bus average speed	17.62 km/hr
idle speed time to all working time ration	56.4 %
Total Bus fuel consumption over the period	590 lit
Fuel consumption per hour	11.46 lit/hr
Average fuel consumption	0.65 lit/km
Total Bus additive consumption over the period	0.25 lit
Average additive consumption	276 cc/km
Additive consumption to fuel ration	424 cc/1000lit

## Temperature, Pressure and Engine Speed Overview

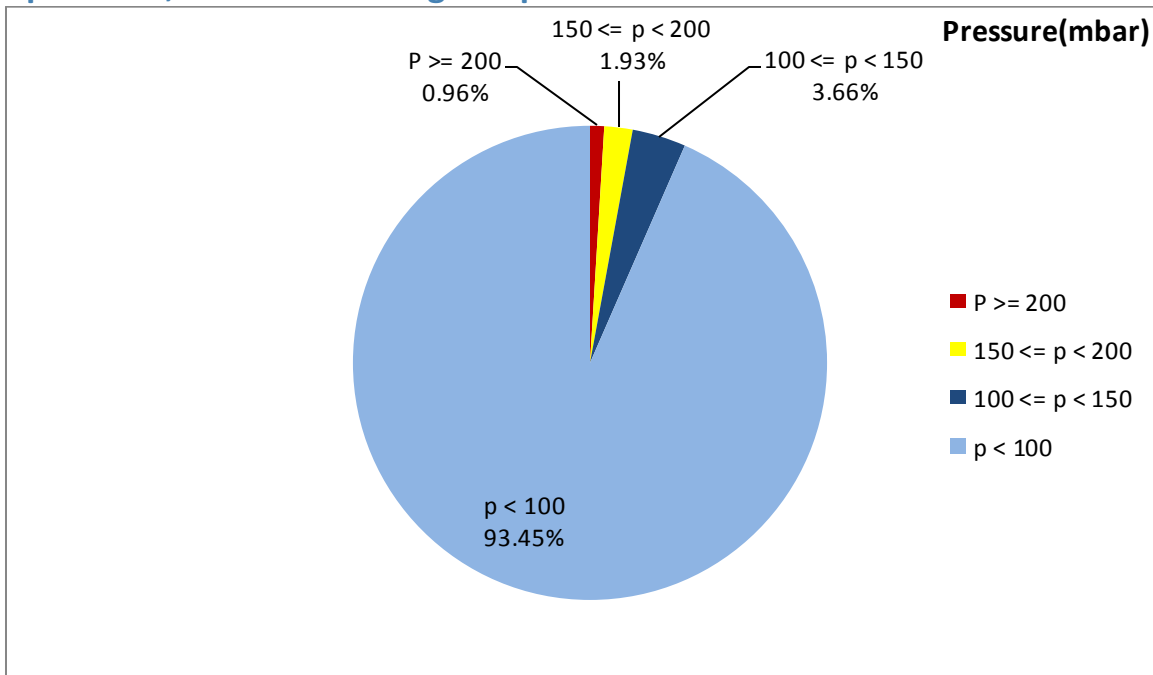


Figure 1- Pressure distribution over the working hours

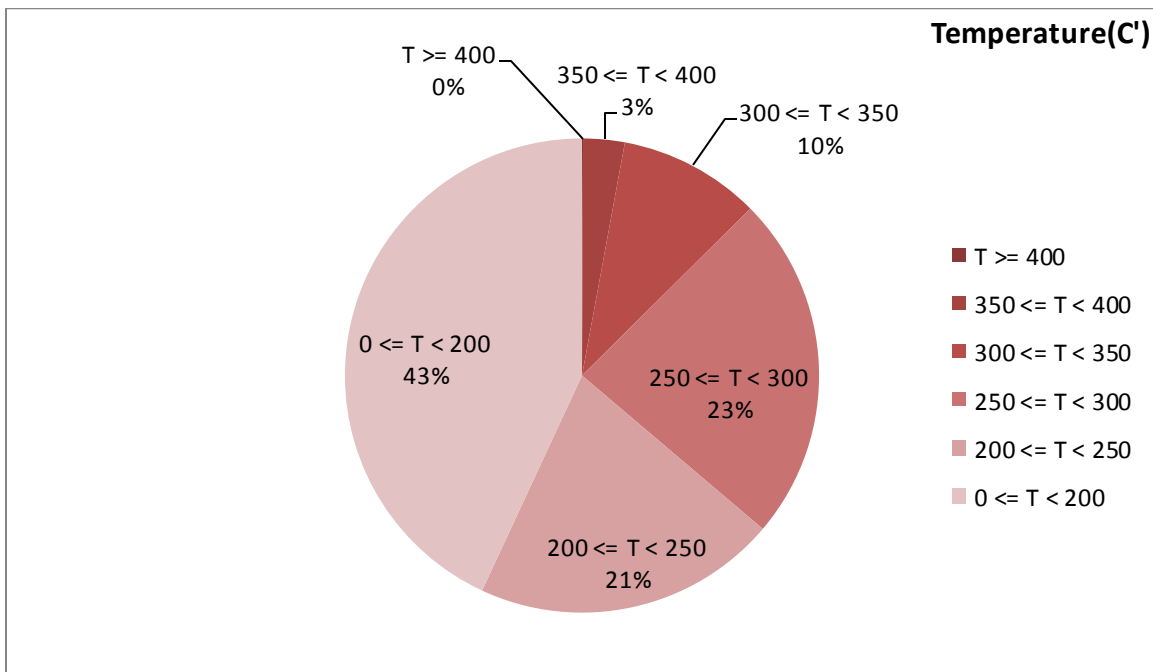


Figure 2-Temperature distribution over the working hours

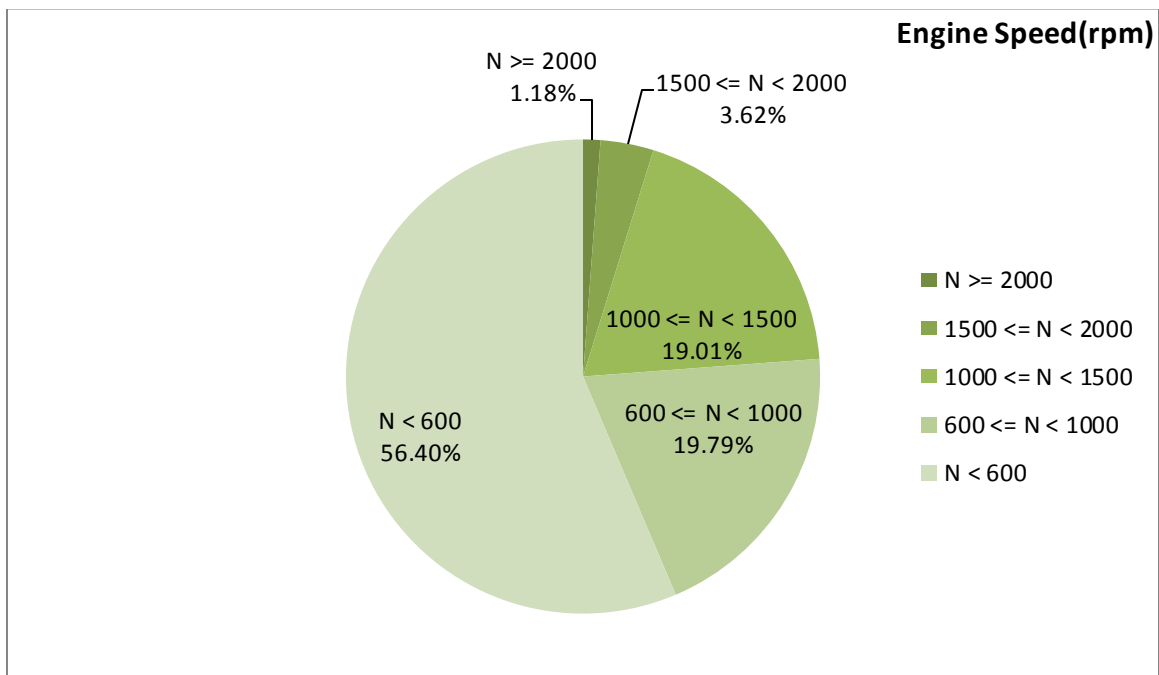


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
218.8	27.93	774

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
274.33	58.08	1069

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
426-62	315-0	2208-528



## Detailed Pressure Analysis

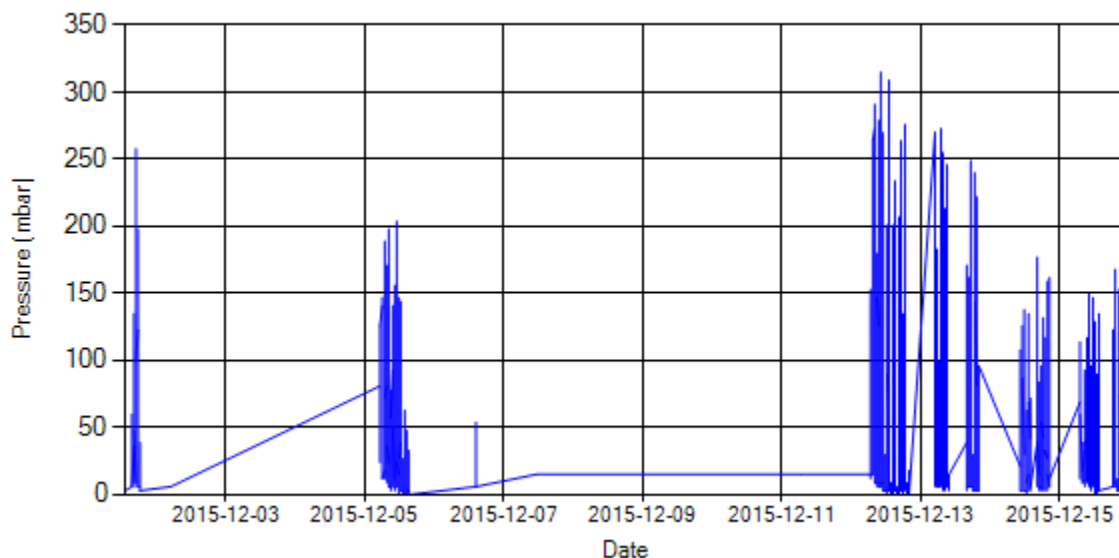


Figure 4- Pressure distribution over the period

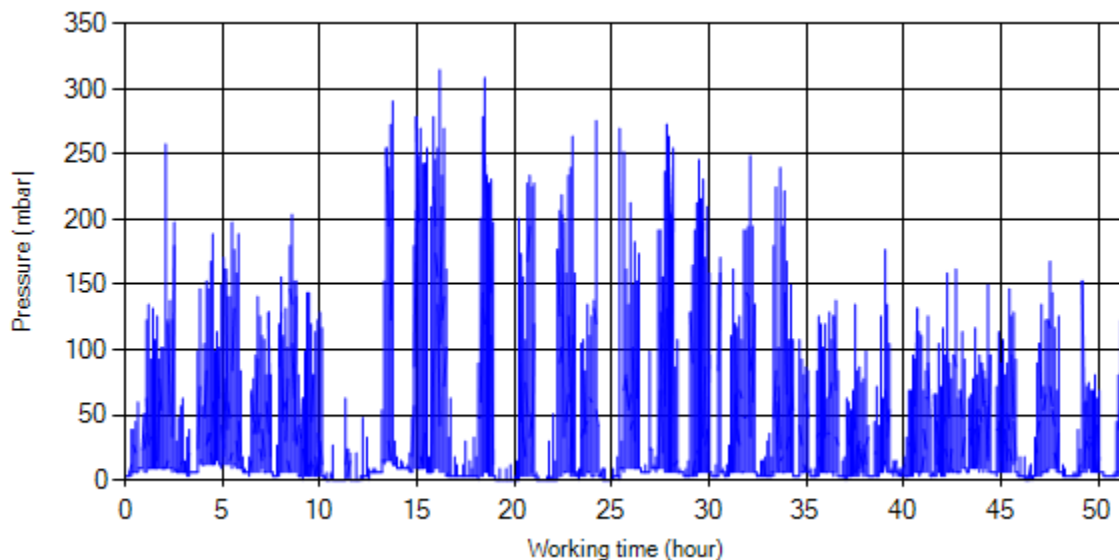


Figure 5- Pressure vs. working hours

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

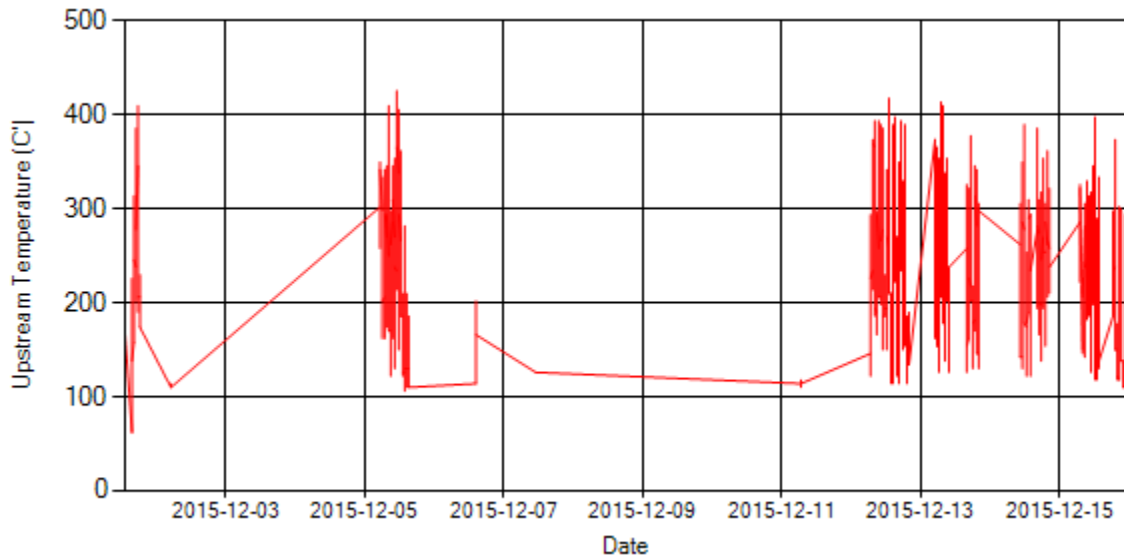


Figure 6- Temperature distribution over the period

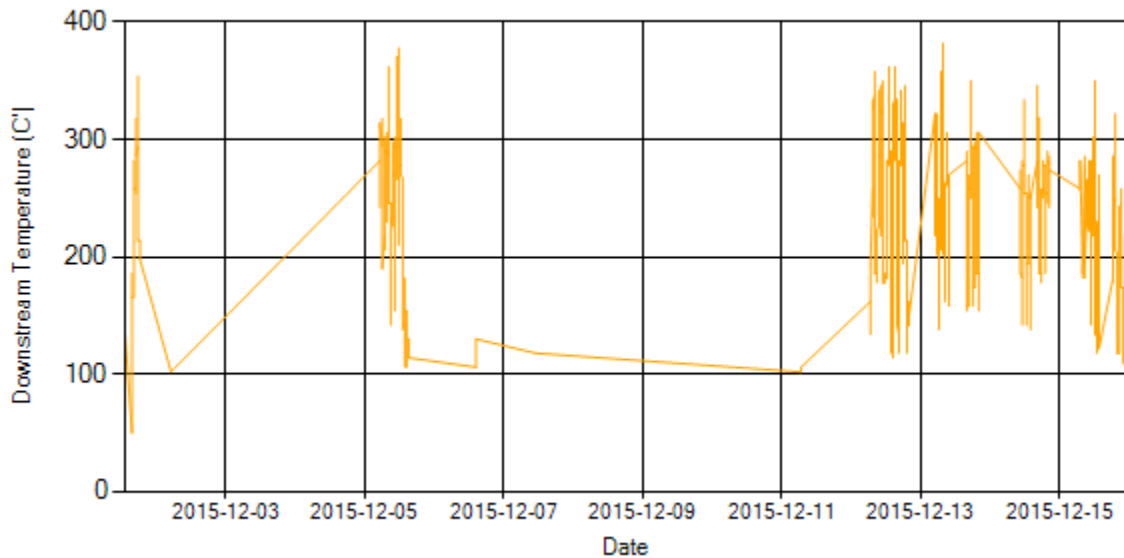
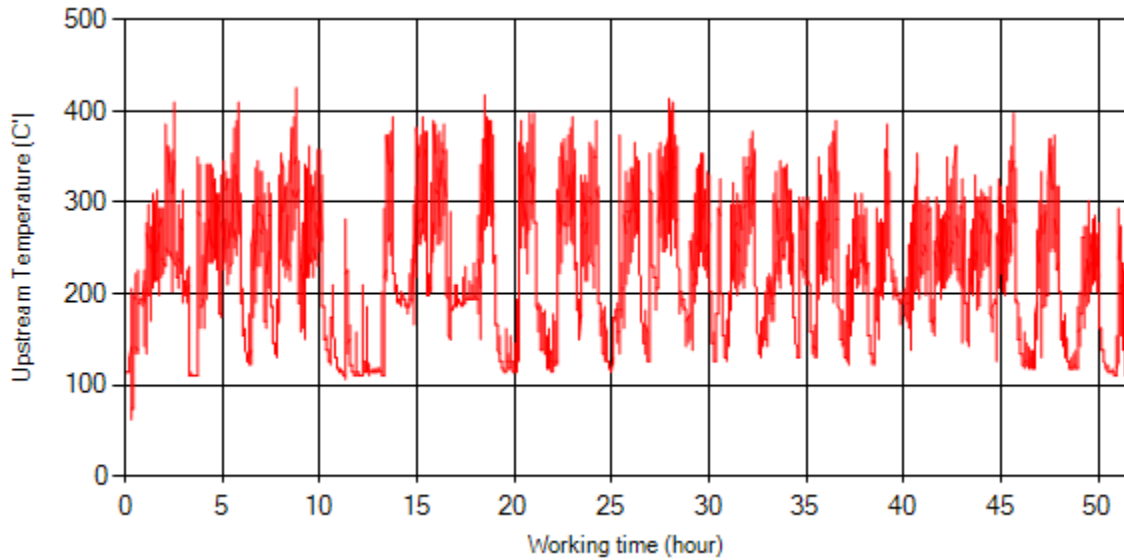
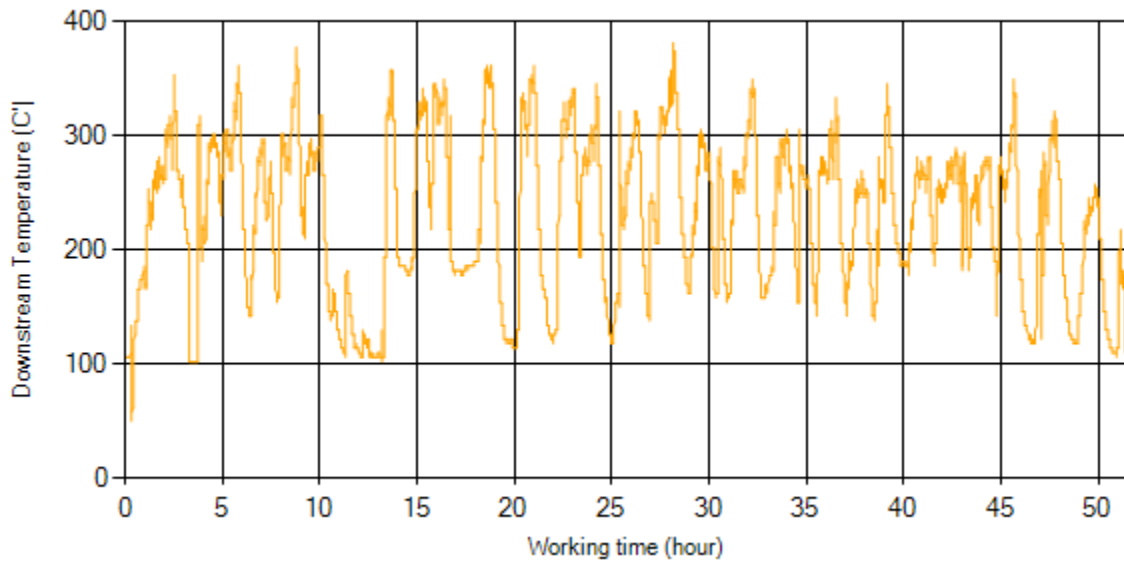


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

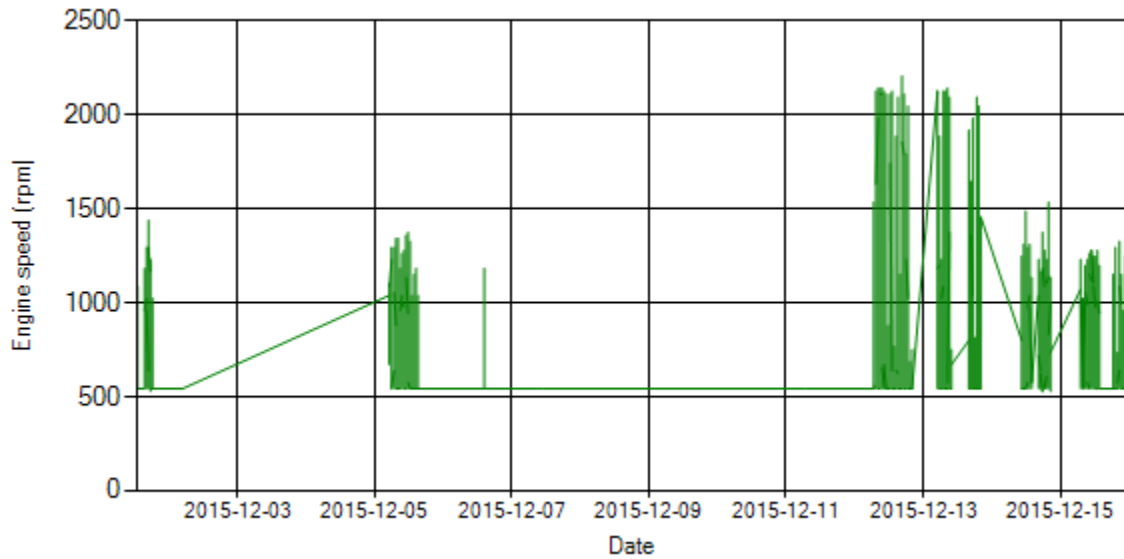


Figure 10- Engine speed distribution over the period

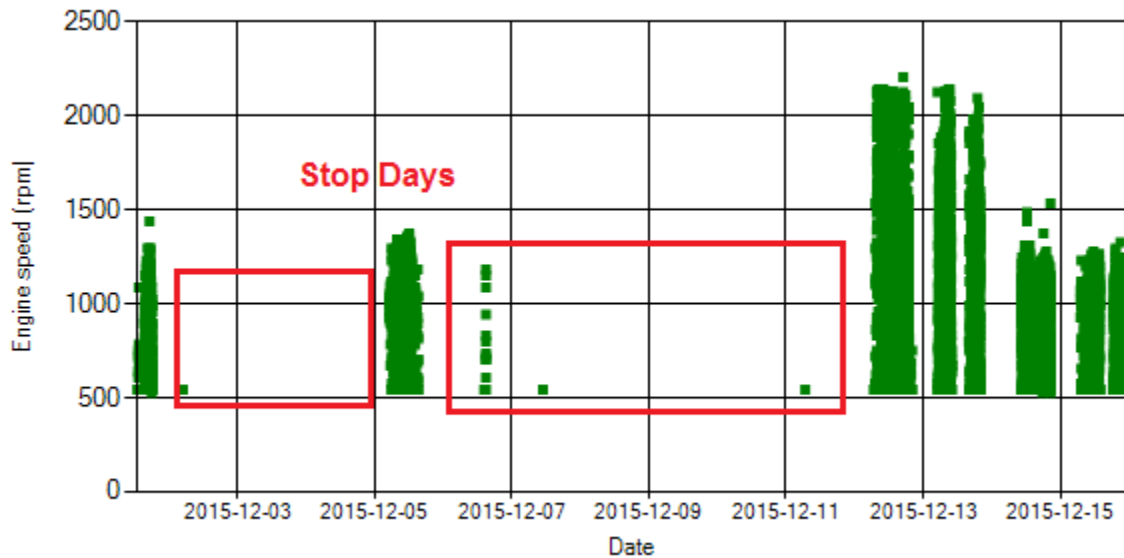


Figure 11- Engine speed diagram for calculating CPK's working days

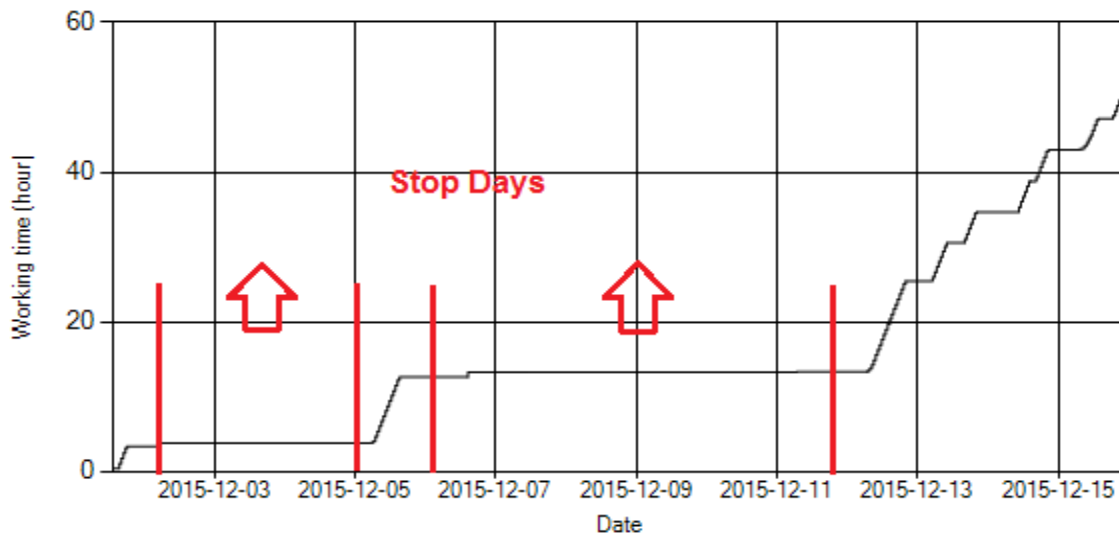


Figure 12- Time diagram for calculating CPK's working days

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 nine days during this period.

### Pressure-Engine Speed diagrams

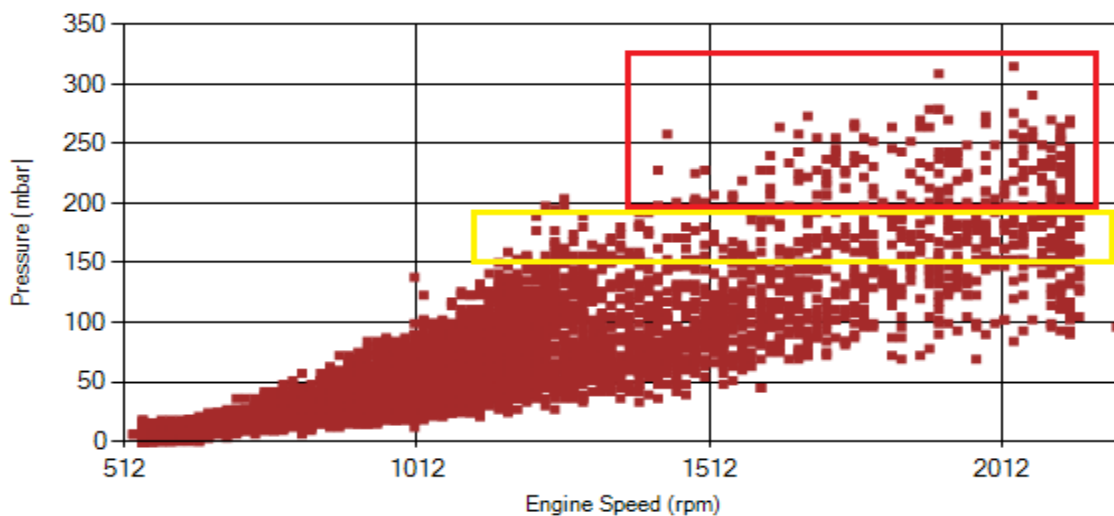


Figure 13- Pressure against engine speed

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

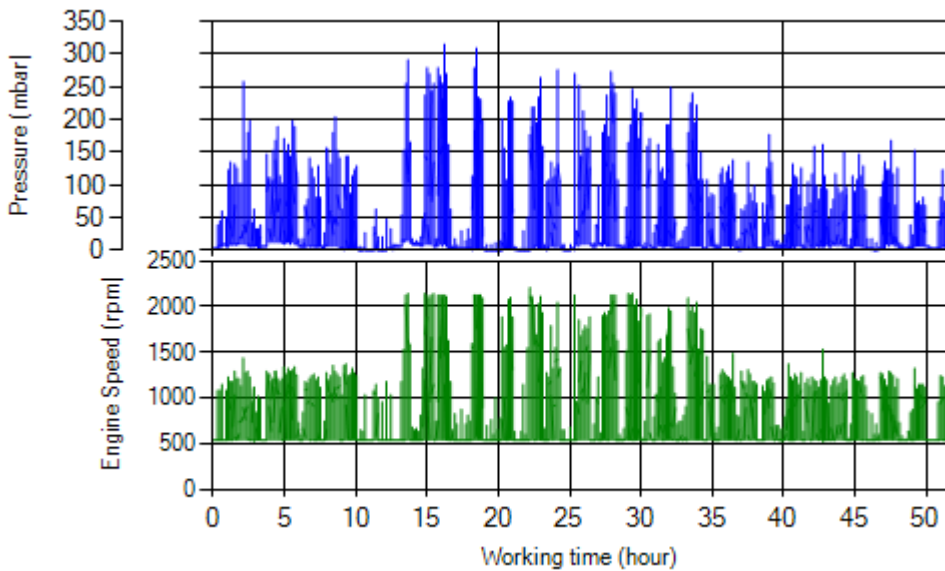


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

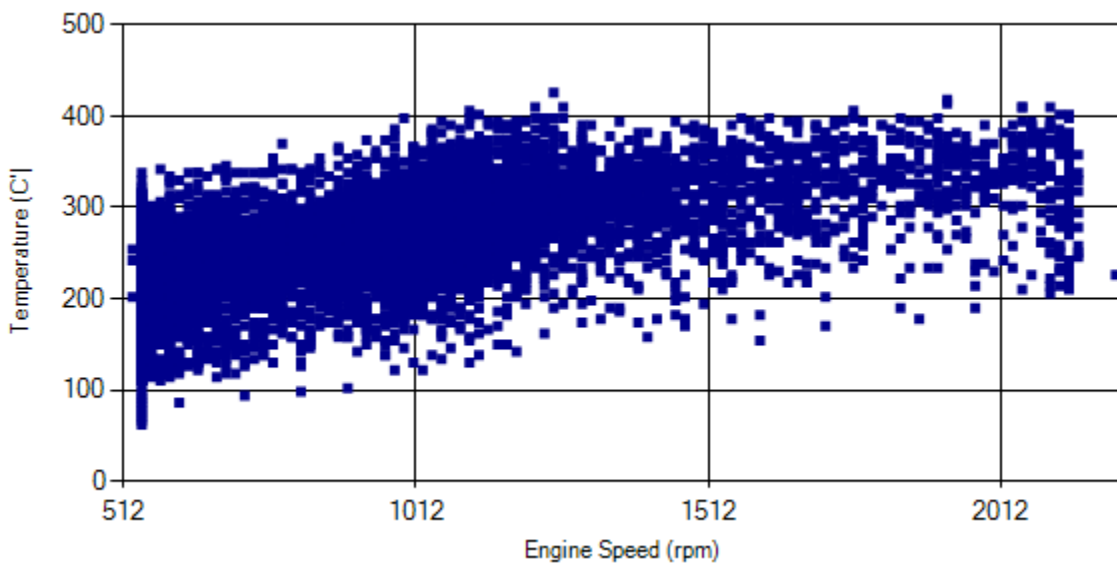


Figure 15- Temperature against engine speed

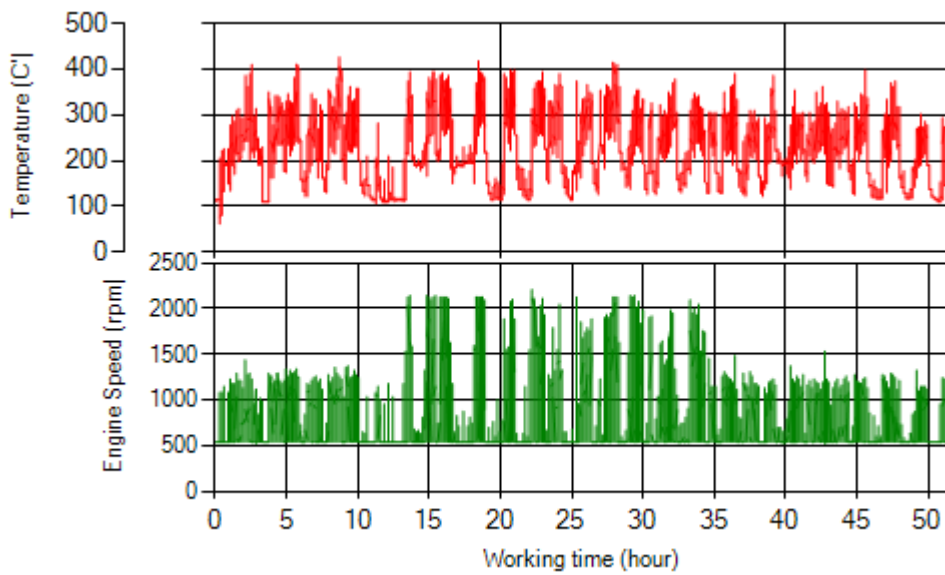


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

- As depicted in figure 1, 0.96% of total working time pressure is above 200 mbar and 2.89% above 150 mbar during this period. This high pressure distribution was because of additive system problem and unusual driving profile for this line.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed 3% of total working time temperature is above 350°C.

Filter operation status	Excellent <input type="checkbox"/>	Good <input checked="" 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/Dec/2015 – 31/Dec/2015 (sixteen days)
K value - DPF upstream	1.85 [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. The second cleaning was done on Dec 19 <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)	42525 km
Bus mileage over the period	2639 km
Working days over the period	16 days
Stop days	0 day
Data logger working days	6 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	49.57 %
Total Bus fuel consumption over the period	1650 lit
Fuel consumption per hour	- lit/hr
Average fuel consumption	0.63 lit/km
Total Bus additive consumption over the period	0.75 lit
Average additive consumption	284 cc/km
Additive consumption to fuel ration	454 cc/1000lit

Notice: Data logger got problem on Dec 21<sup>st</sup> and was fixed on Dec 31<sup>st</sup>.

## Temperature, Pressure and Engine Speed Overview

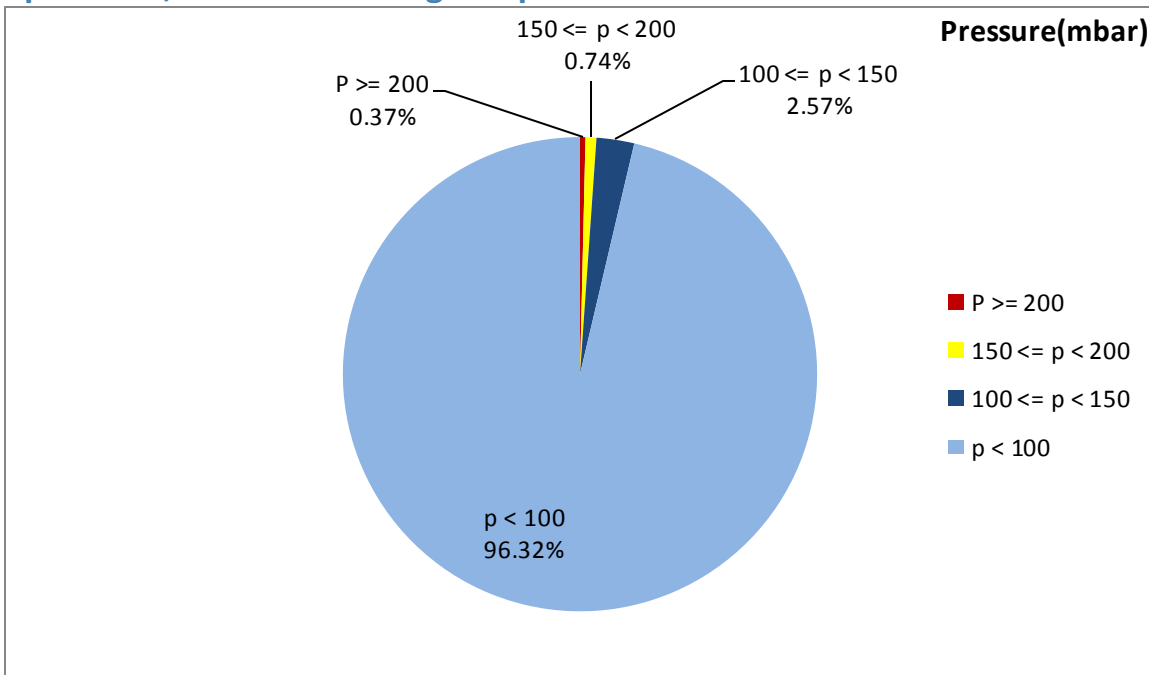


Figure 1- Pressure distribution over the working hours

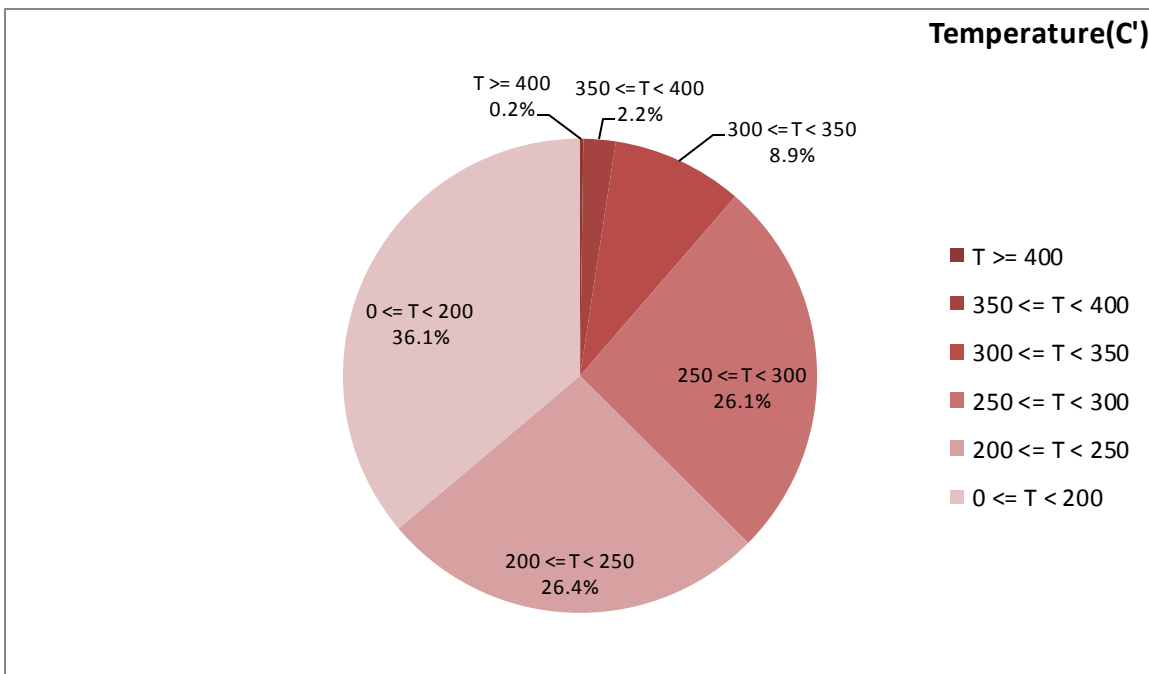


Figure 2-Temperature distribution over the working hours

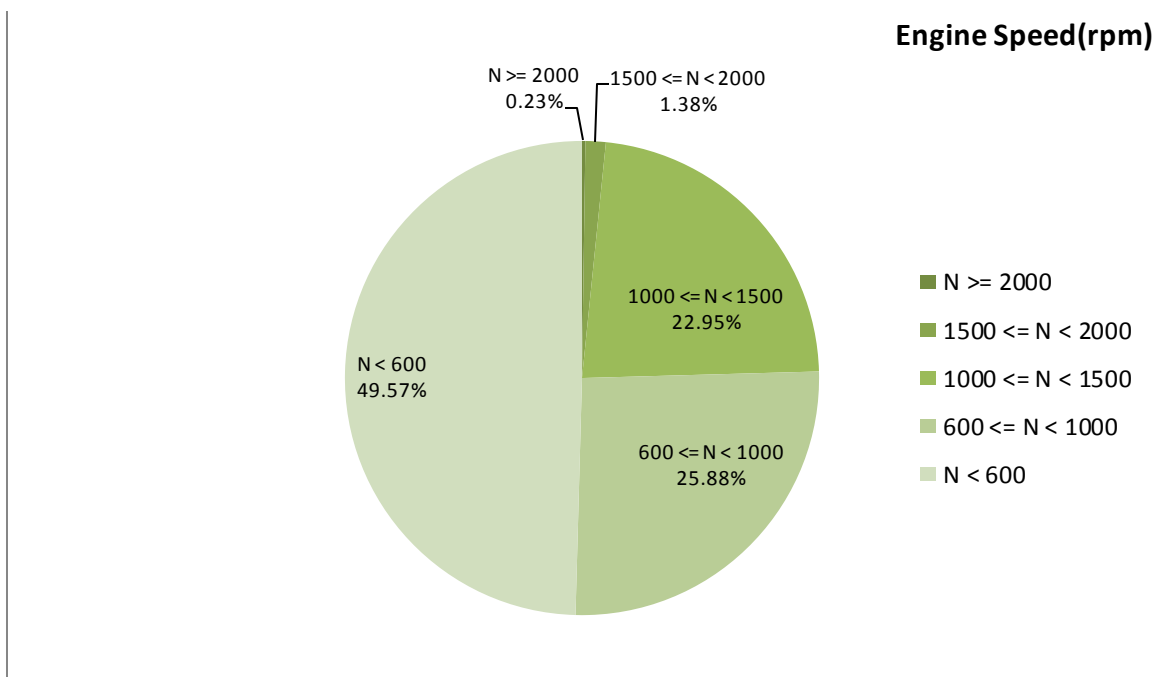


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
223.84	24.57	766

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
266.93	45.6	983

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
434-50	312-0	2144-528

## Detailed Pressure Analysis

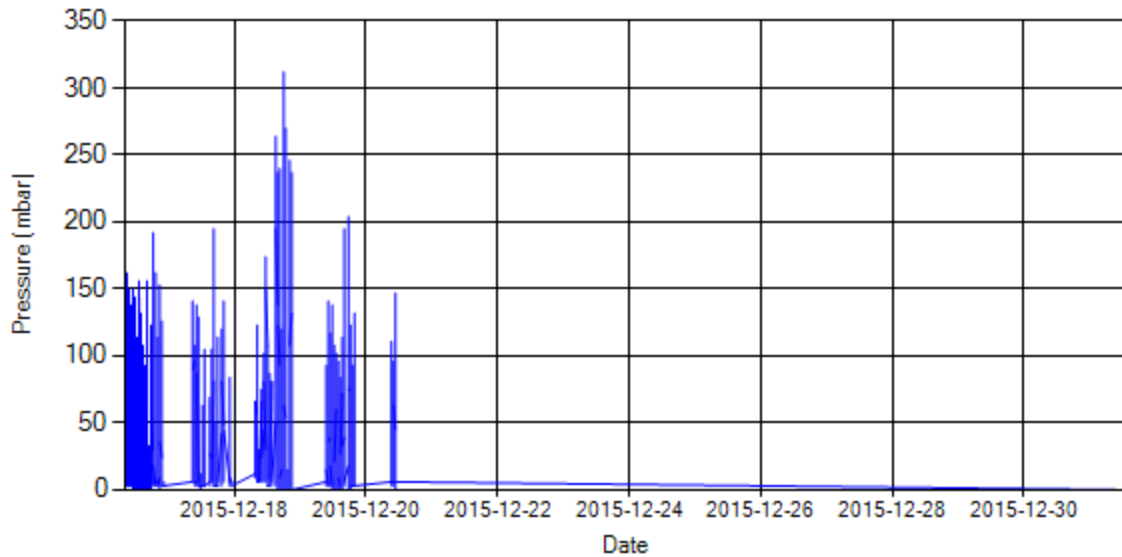


Figure 4- Pressure distribution over the period

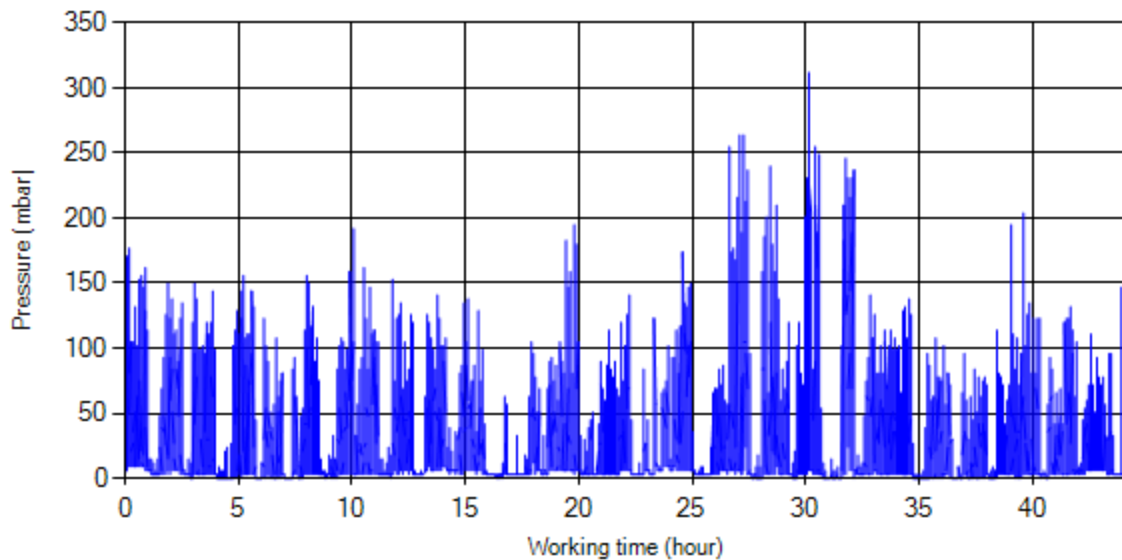


Figure 5- Pressure vs. working hours

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

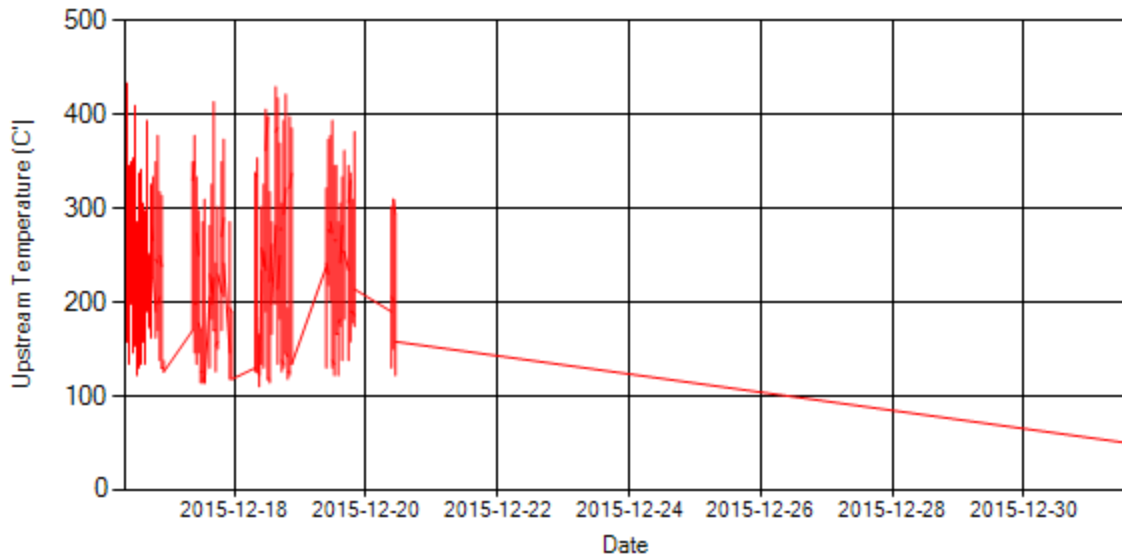


Figure 6- Temperature distribution over the period

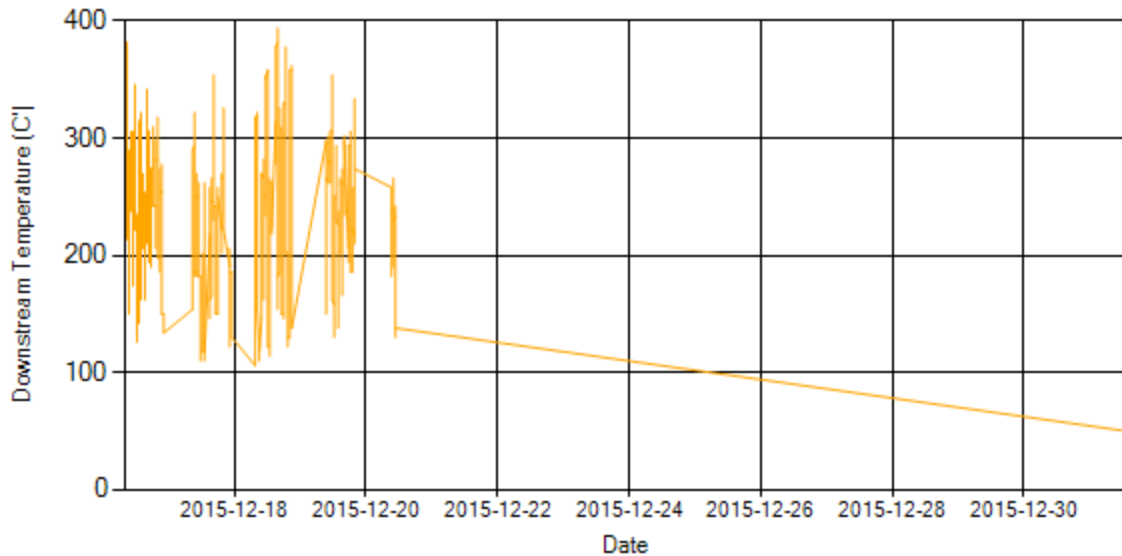
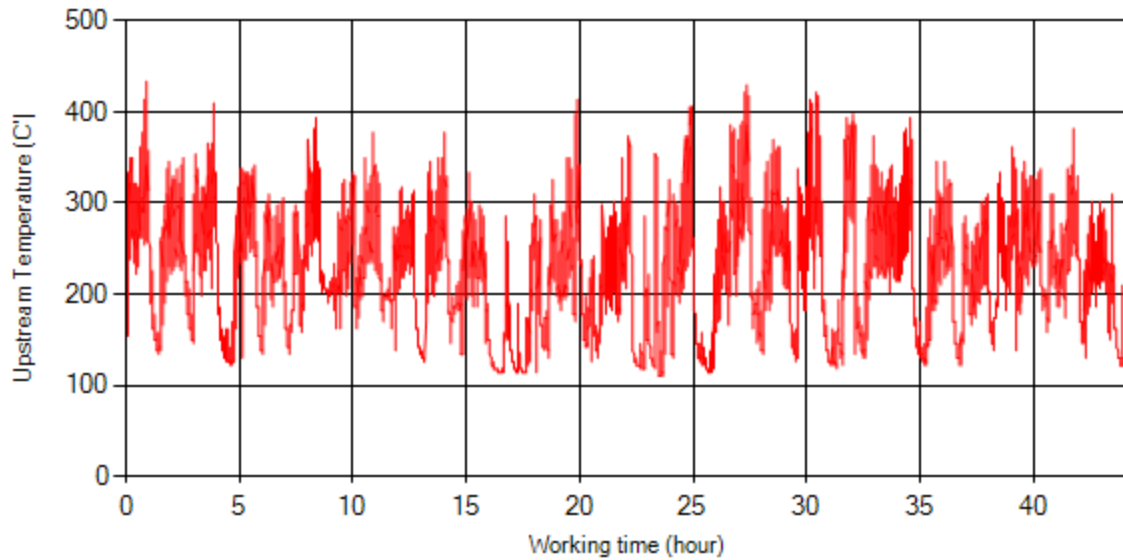
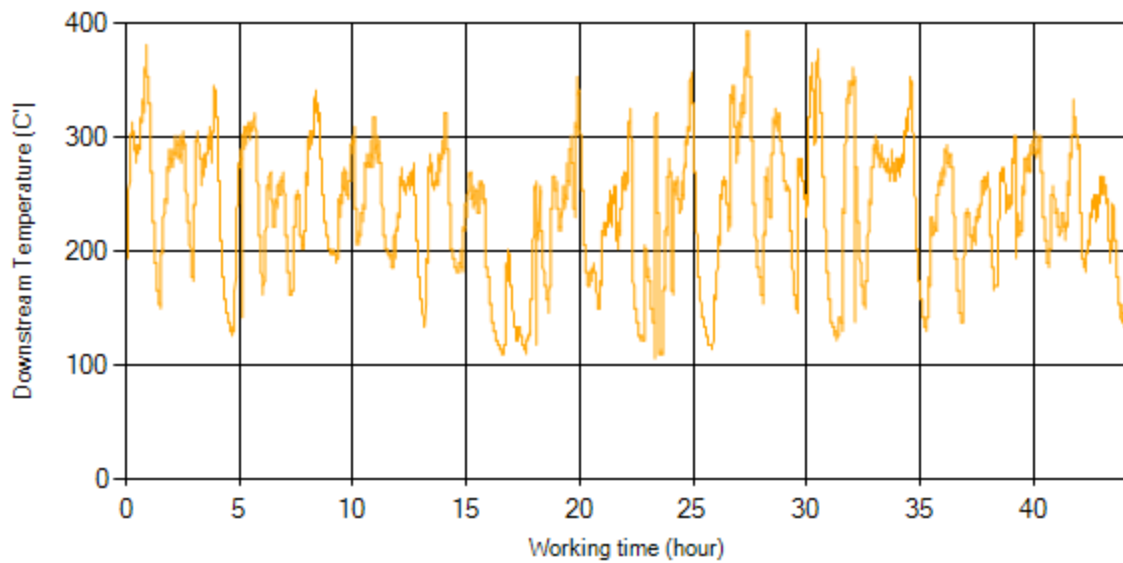


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

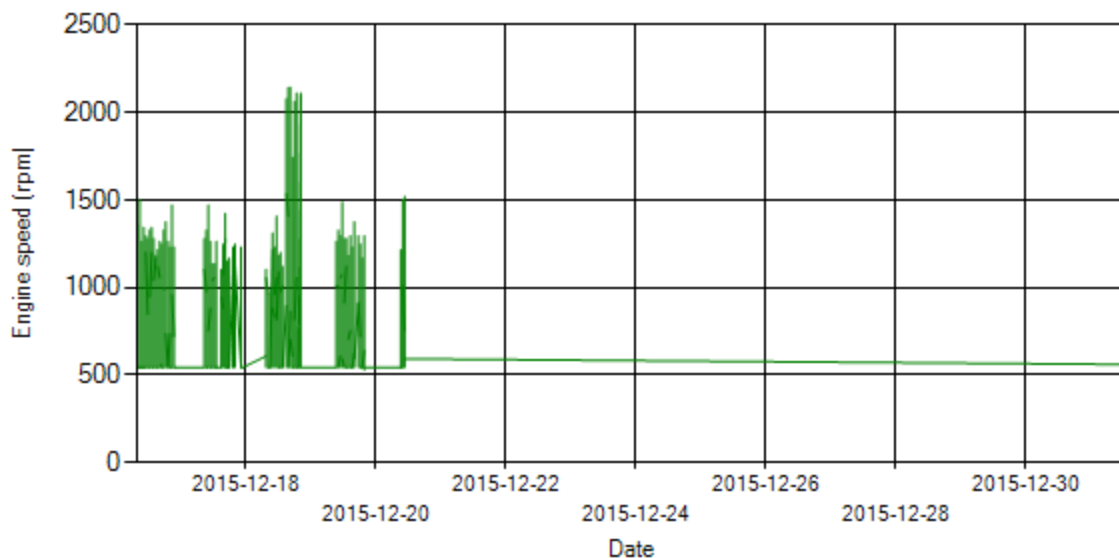


Figure 10- Engine speed distribution over the period

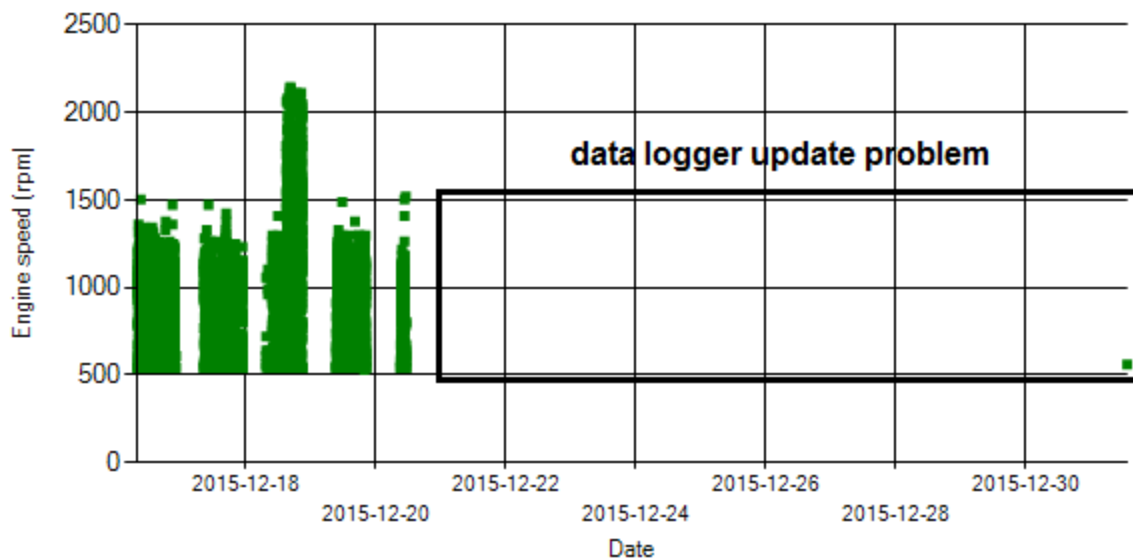


Figure 11- Engine speed diagram for calculating CPK's working days

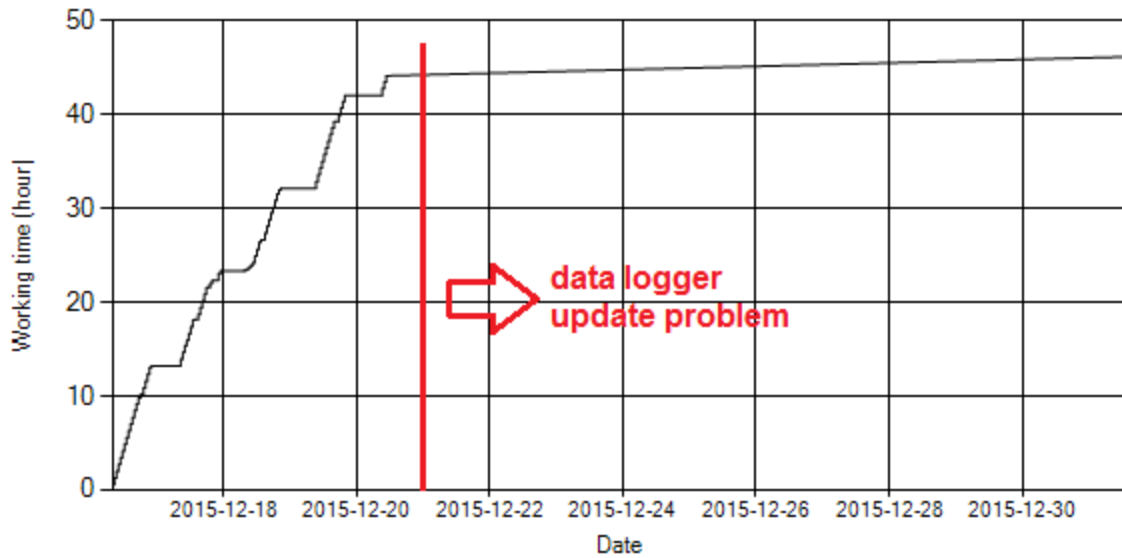


Figure 12- Time diagram for calculating CPK's working days

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

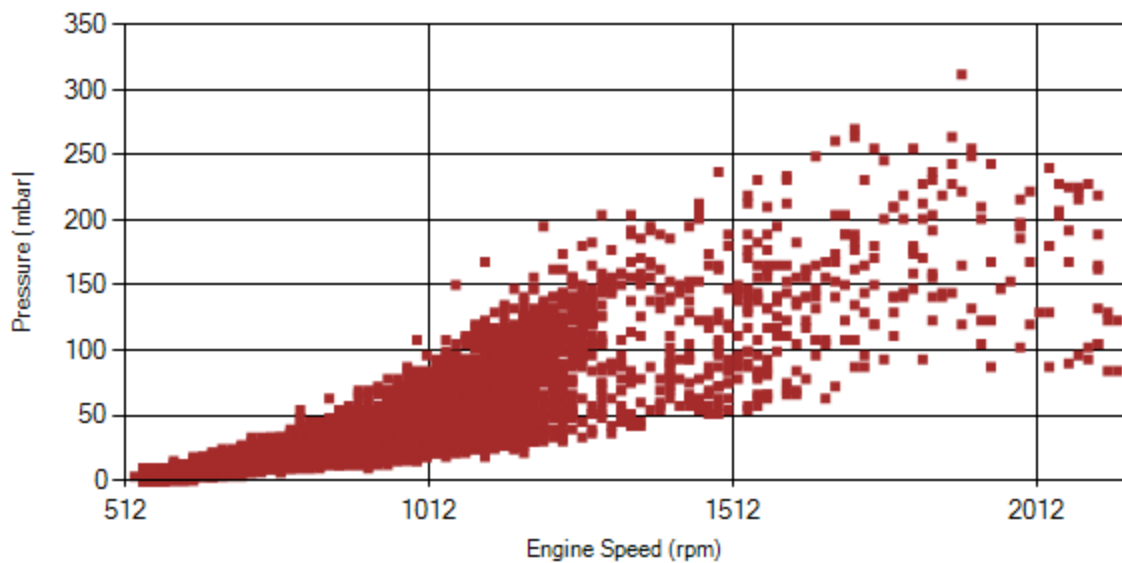


Figure 13- Pressure against engine speed



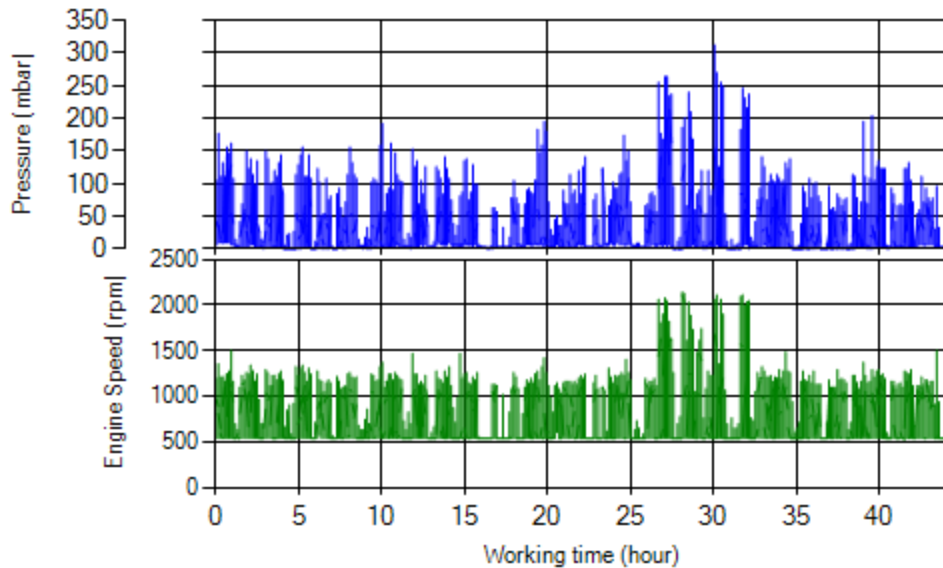


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

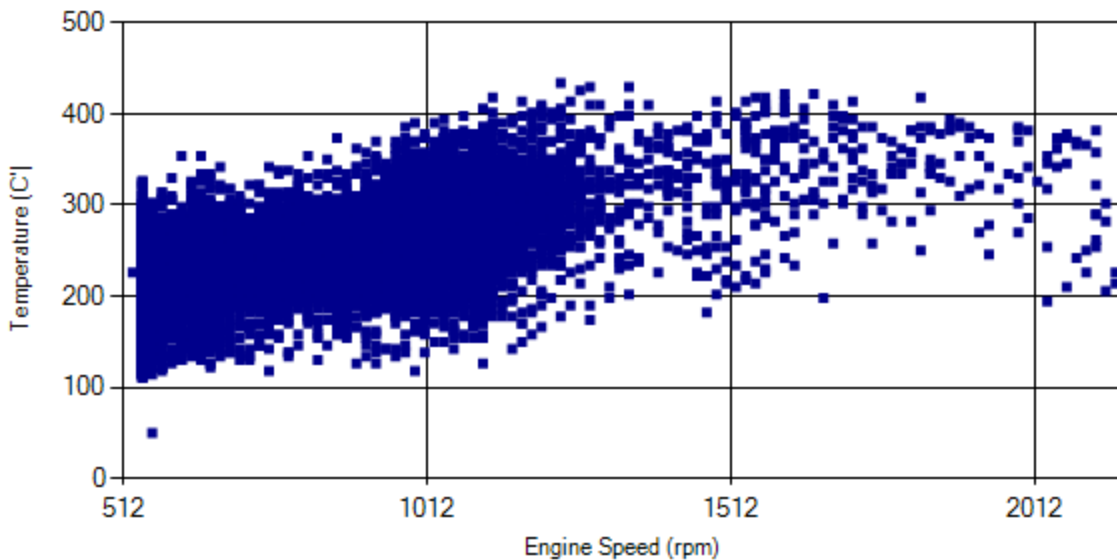


Figure 15- Temperature against engine speed

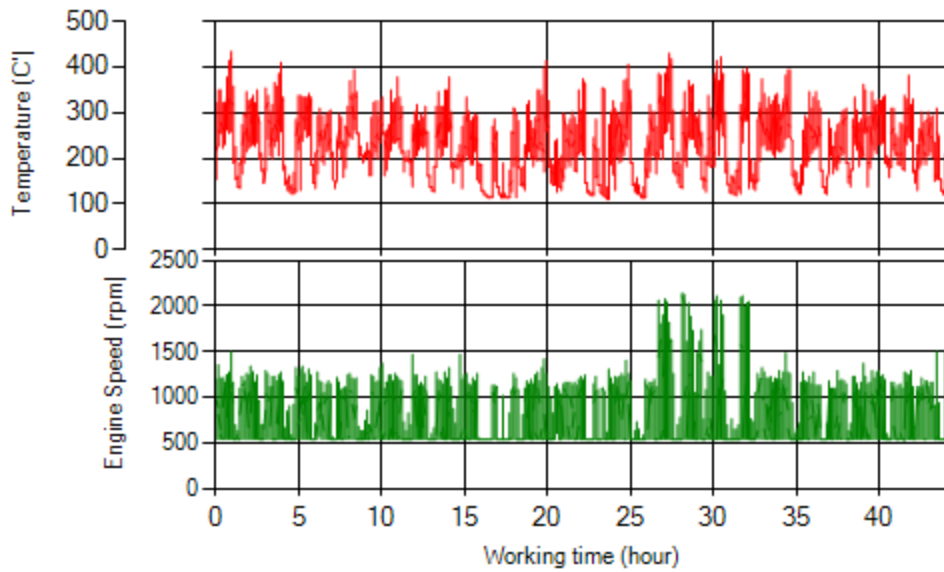


Figure 16- T, N distribution vs. working hours

### Filter Operation Analysis

Considering high pressure distribution on Dec 19<sup>th</sup>, DPF's ECU warned cleaning time and DPF was cleaned on Dec 19<sup>th</sup> for the second time. Unfortunately data logger got problem on Dec 20<sup>th</sup> and first ten days information after second cleaning missed.

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



All right reserved by ASA company – confidential no passing to third parties.

**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/Dec/2015 – 15/Dec/2015 (fifteen days)
K value - DPF upstream	2.00 [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	2071 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	234 hours 52 minutes
Average working hours per day (including stop days)	15 hours 39 minutes
Bus average speed	8.82 km/hr
idle speed time to all working time ration	62.16 %
Total Bus fuel consumption over the period	1200 lit
Fuel consumption per hour	5.11 lit/hr
Average fuel consumption	0.58 lit/km

### Temperature, Pressure and Engine Speed Overview

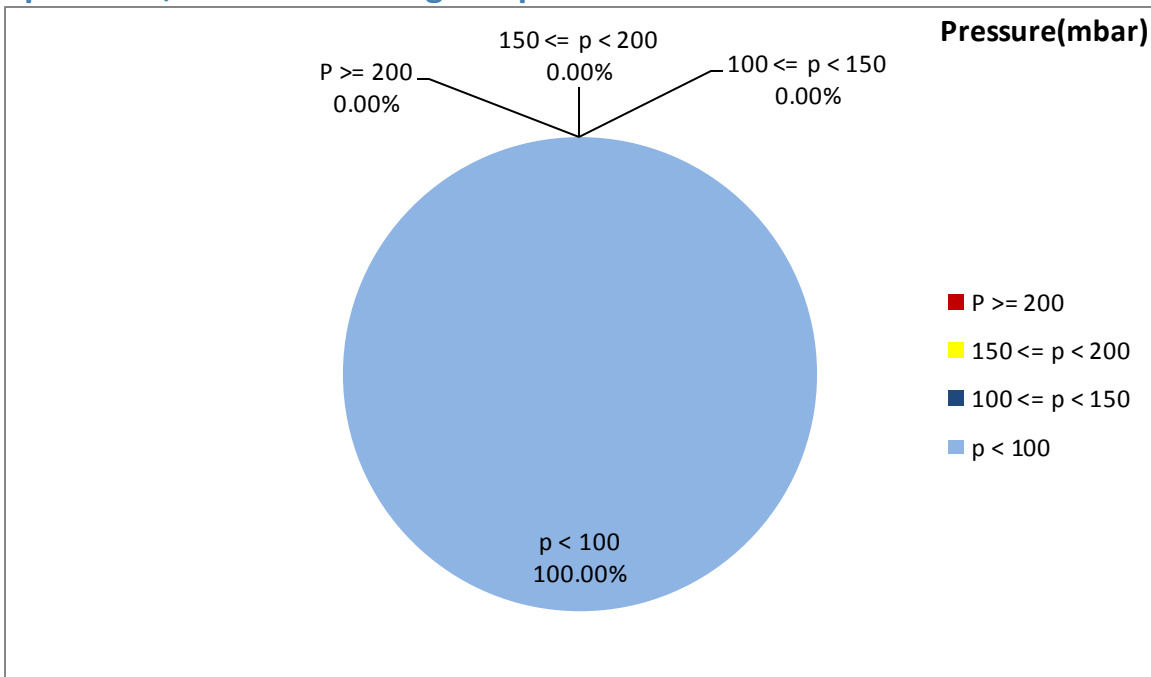


Figure 1- Pressure distribution over the working hours

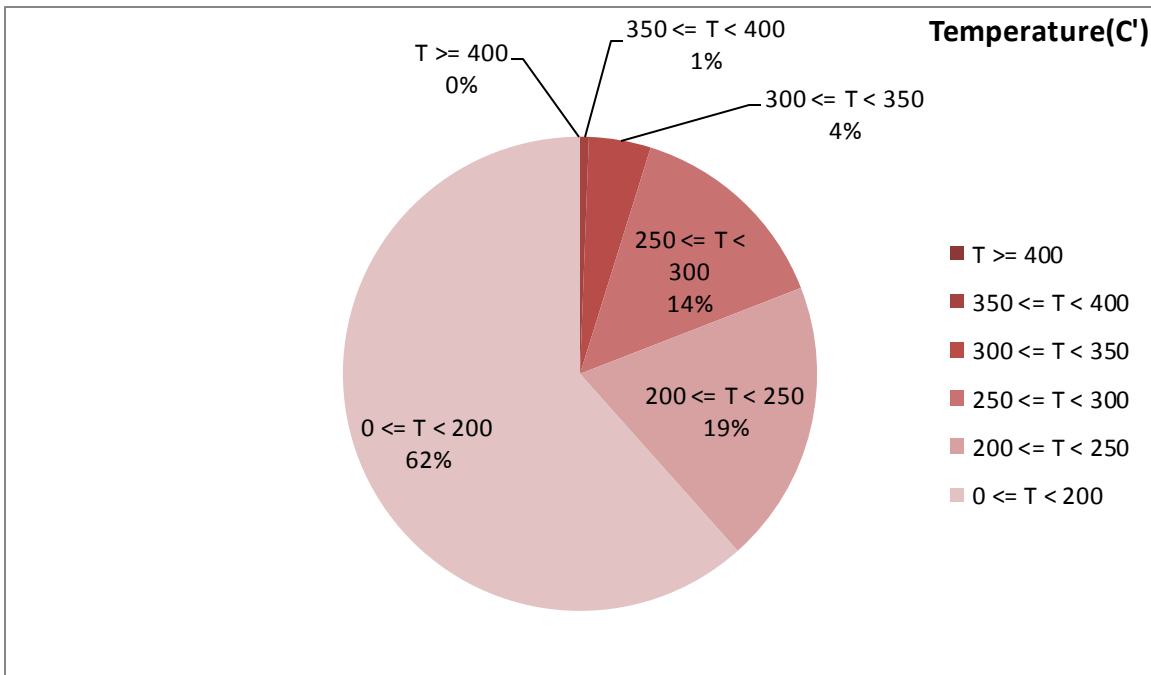


Figure 2-Temperature distribution over the working hours

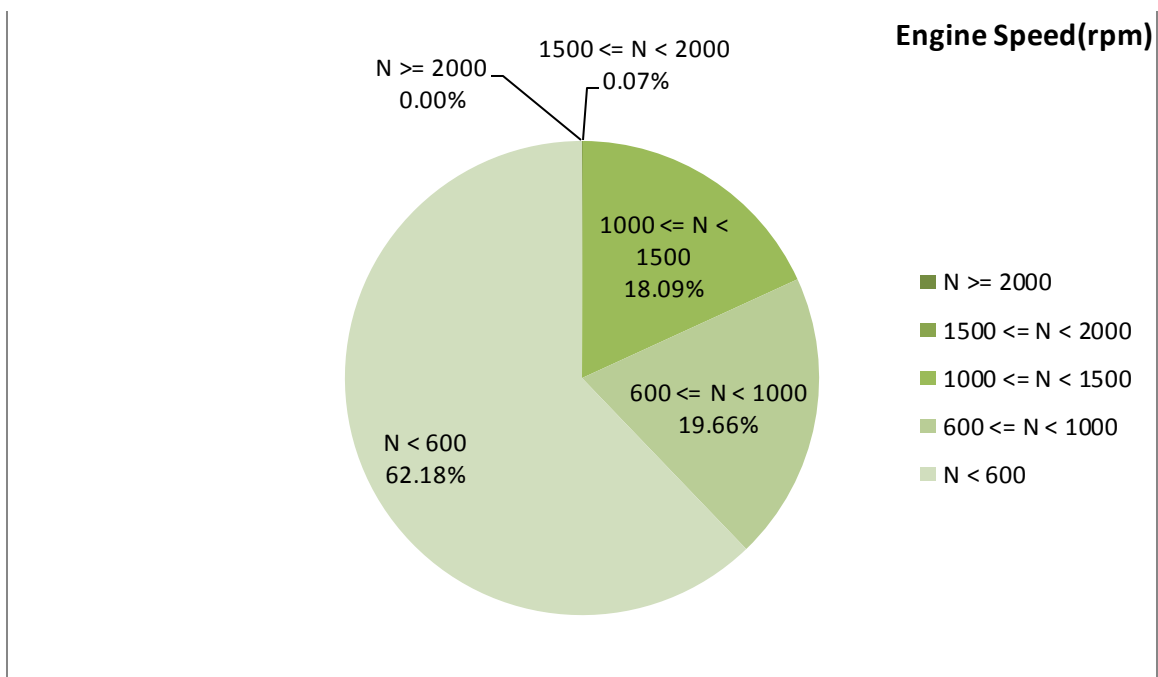


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
180.01	0.7	704

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
246.53	1.85	964

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
414-50	75-0	1936-288

## Detailed Pressure Analysis

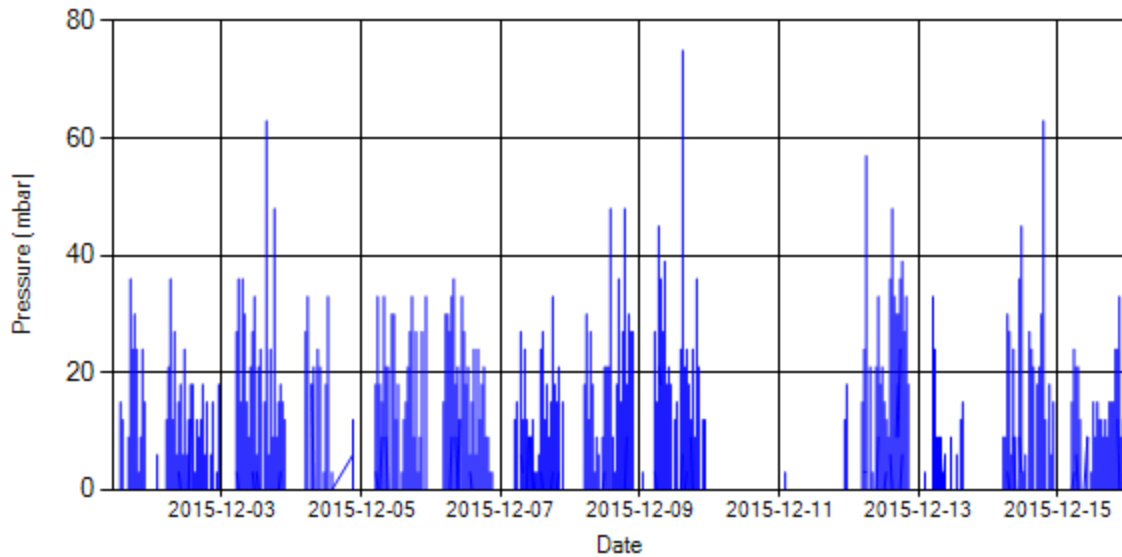


Figure 4- Pressure distribution over the period

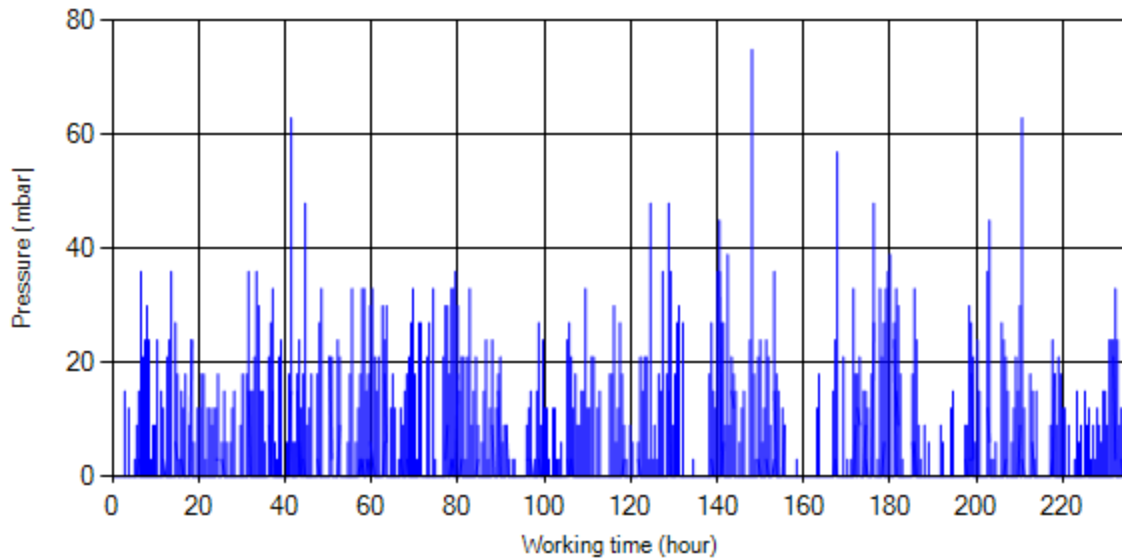


Figure 5- Pressure vs. working hours

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

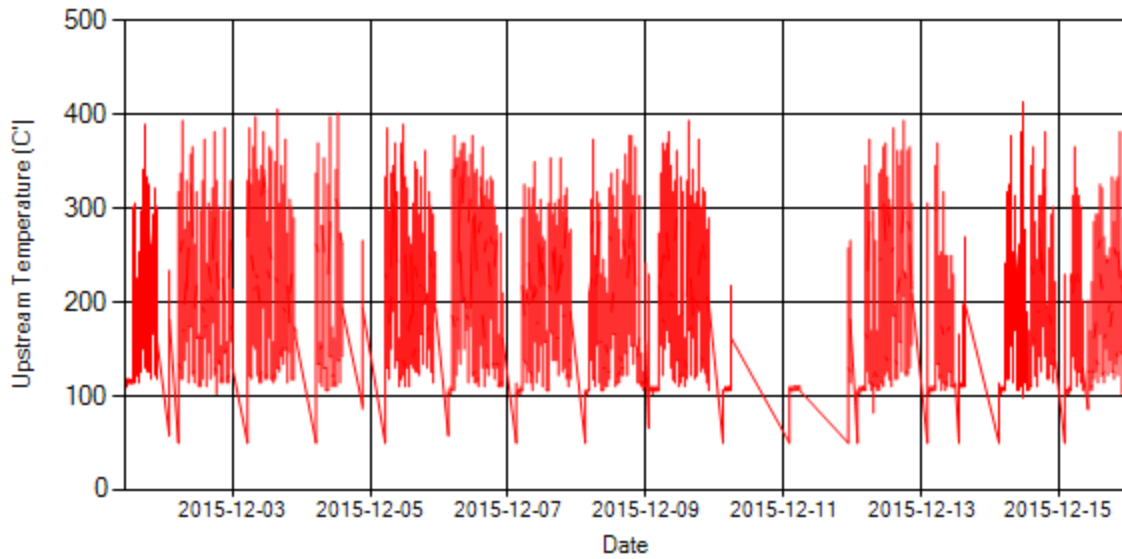


Figure 6- Temperature distribution over the period

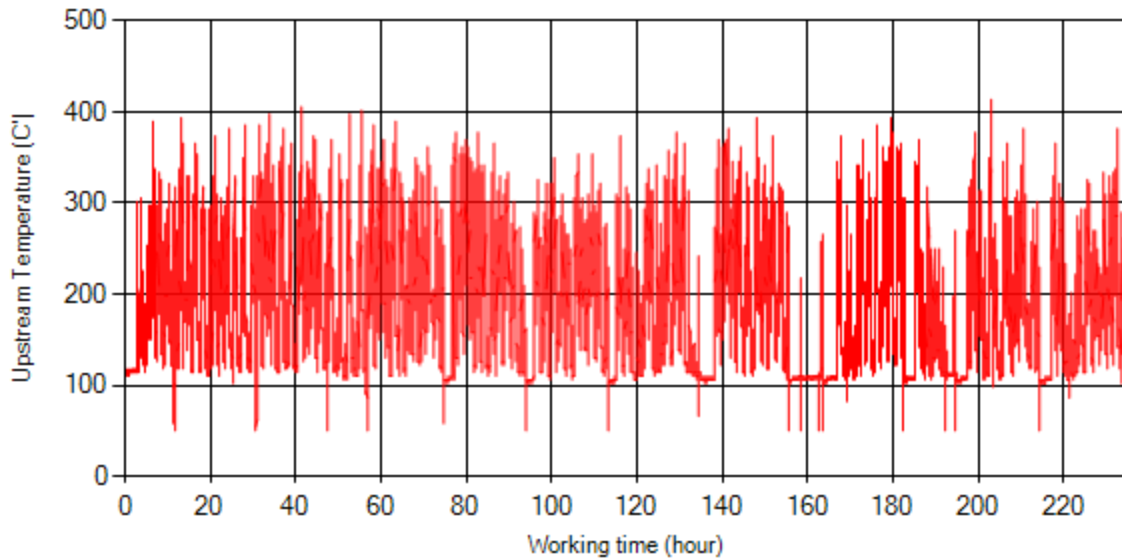


Figure 7- Temperature vs. working hours

## Engine Speed Diagrams

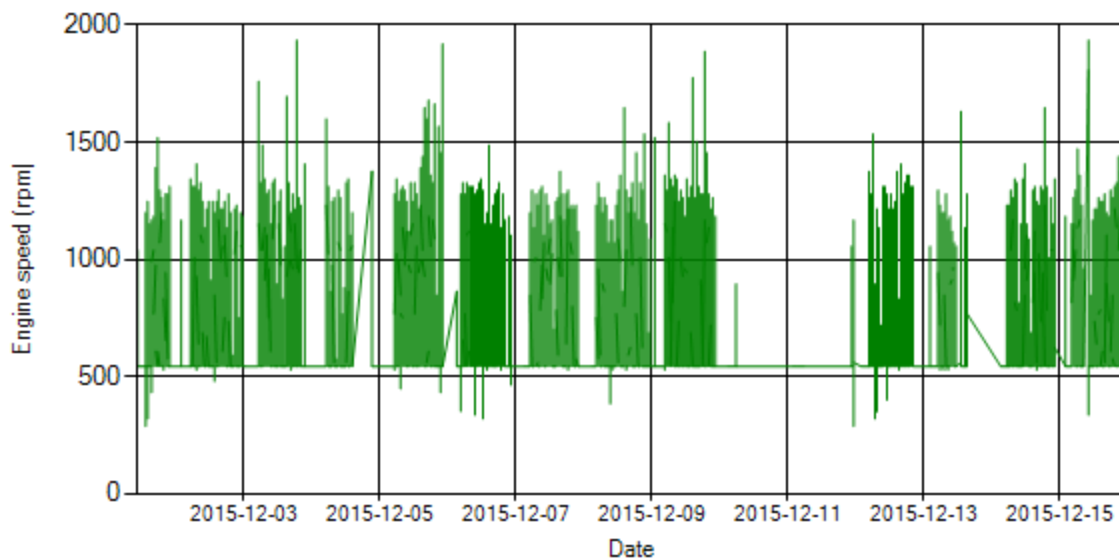


Figure 8- Engine speed distribution over the period

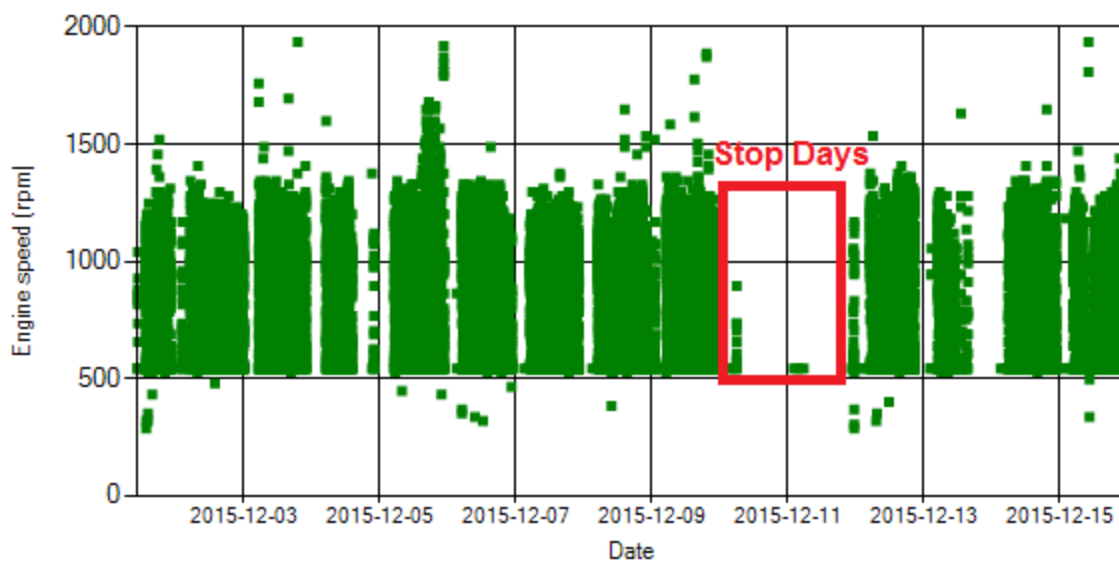


Figure 9- Engine speed diagram for calculating CPK's working days

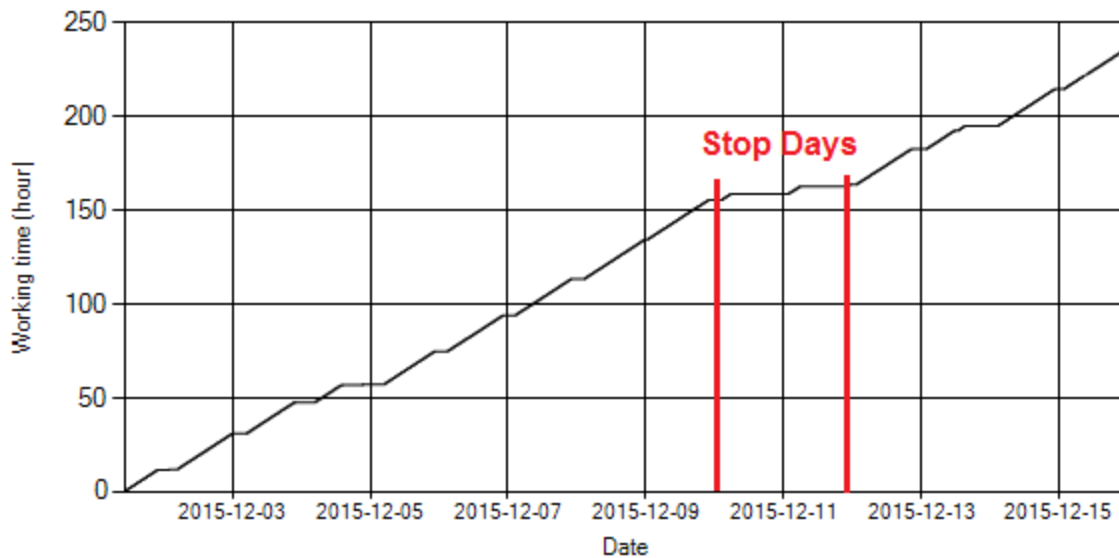


Figure 10- Time diagram for calculating CPK's working days

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

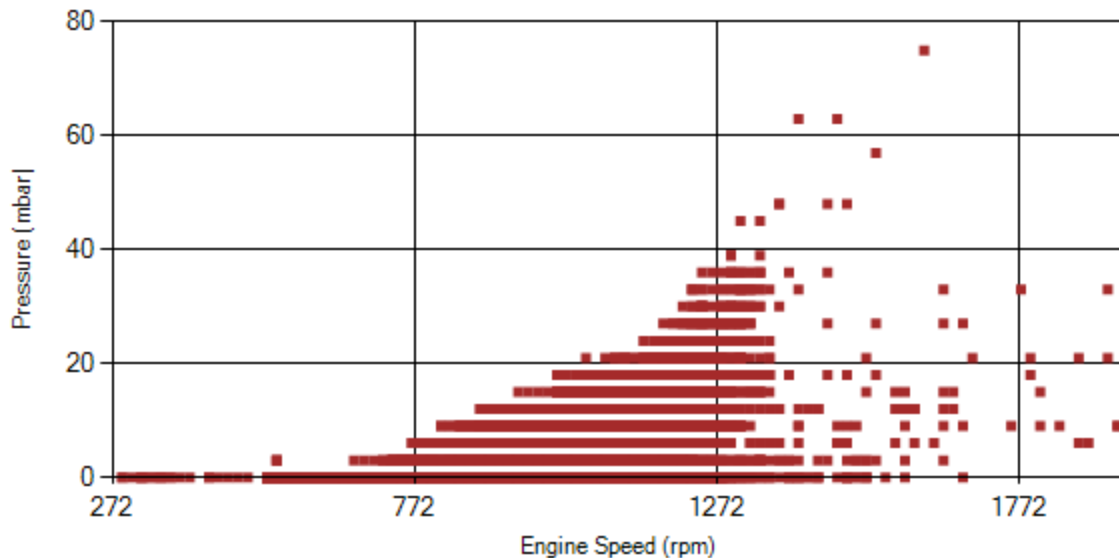


Figure 11- Pressure against engine speed

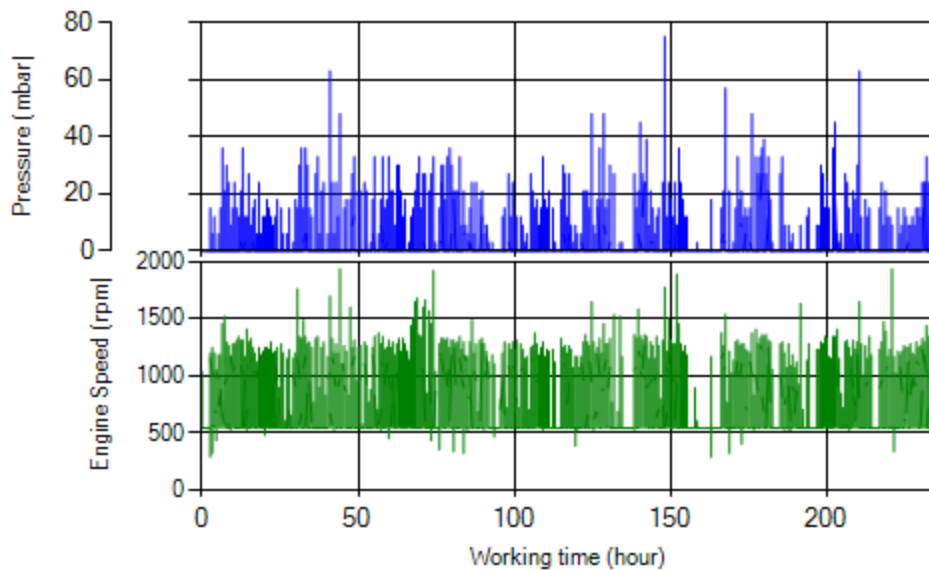


Figure 12- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

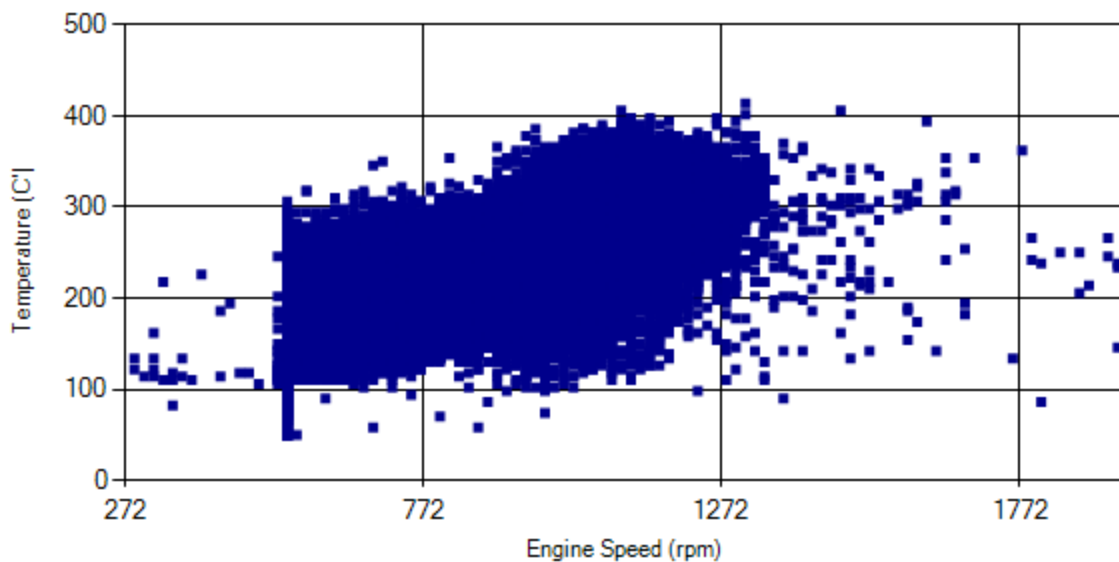
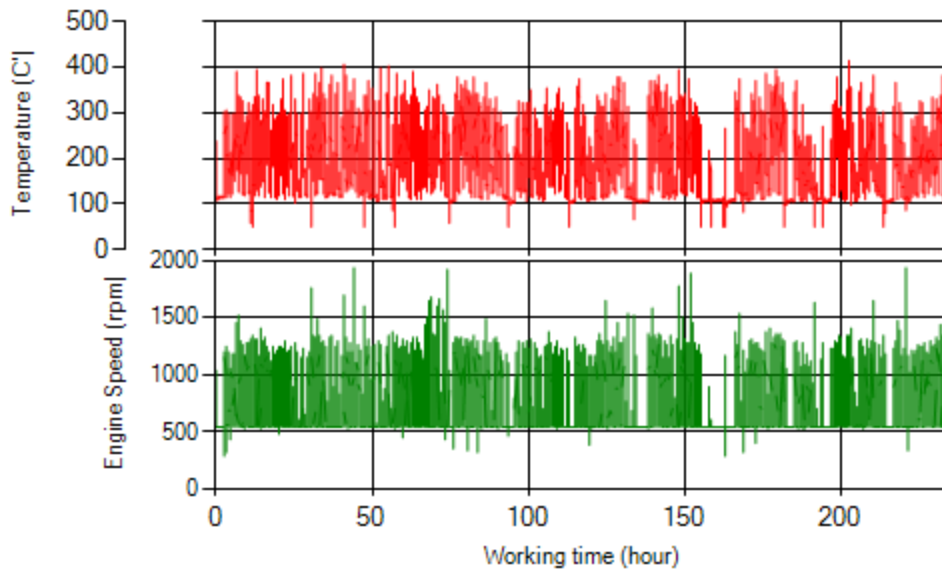


Figure 13- Temperature against engine speed



*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/Dec/2015 – 31/Dec/2015 (sixteen days)
K value - DPF upstream	2.00 [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	2156 km
Working days over the period	15 days
Stop days	1 day
Data logger working days	15 dyas
Working hours over the period	250 hours 54 minutes
Average working hours per day (including stop days)	15 hours 40 minutes
Bus average speed	8.59 km/hr
idle speed time to all working time ration	62.38 %
Total Bus fuel consumption over the period	1360 lit
Fuel consumption per hour	5.42 lit/hr
Average fuel consumption	0.63 lit/km

### Temperature, Pressure and Engine Speed Overview

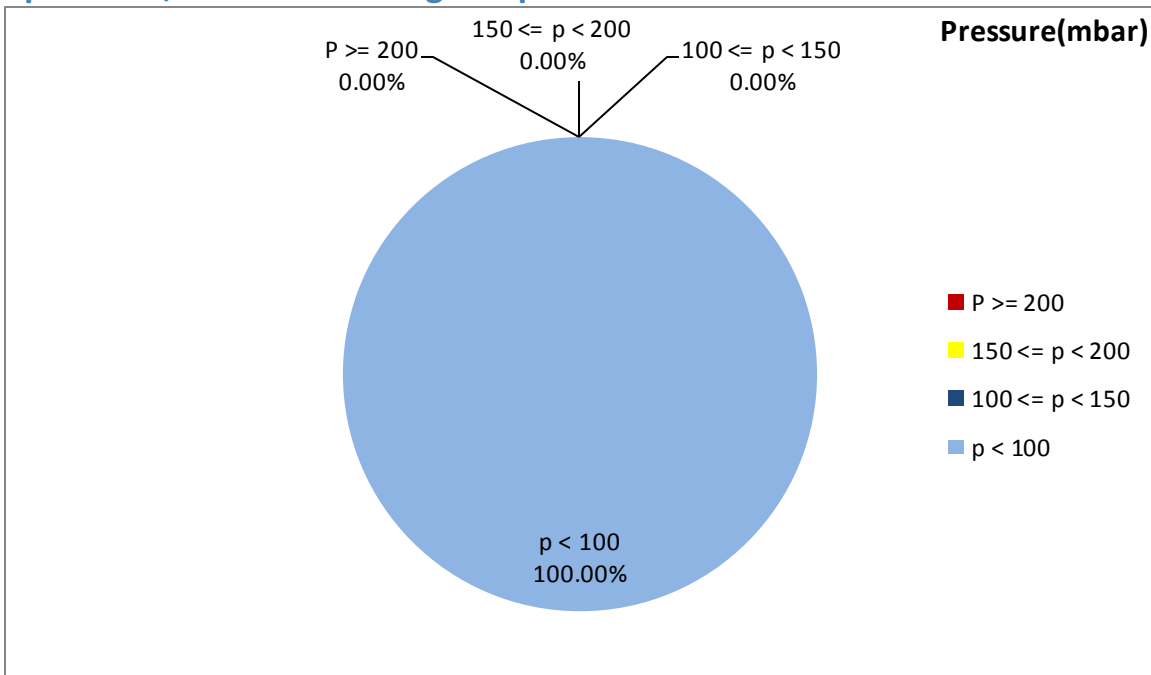


Figure 1- Pressure distribution over the working hours

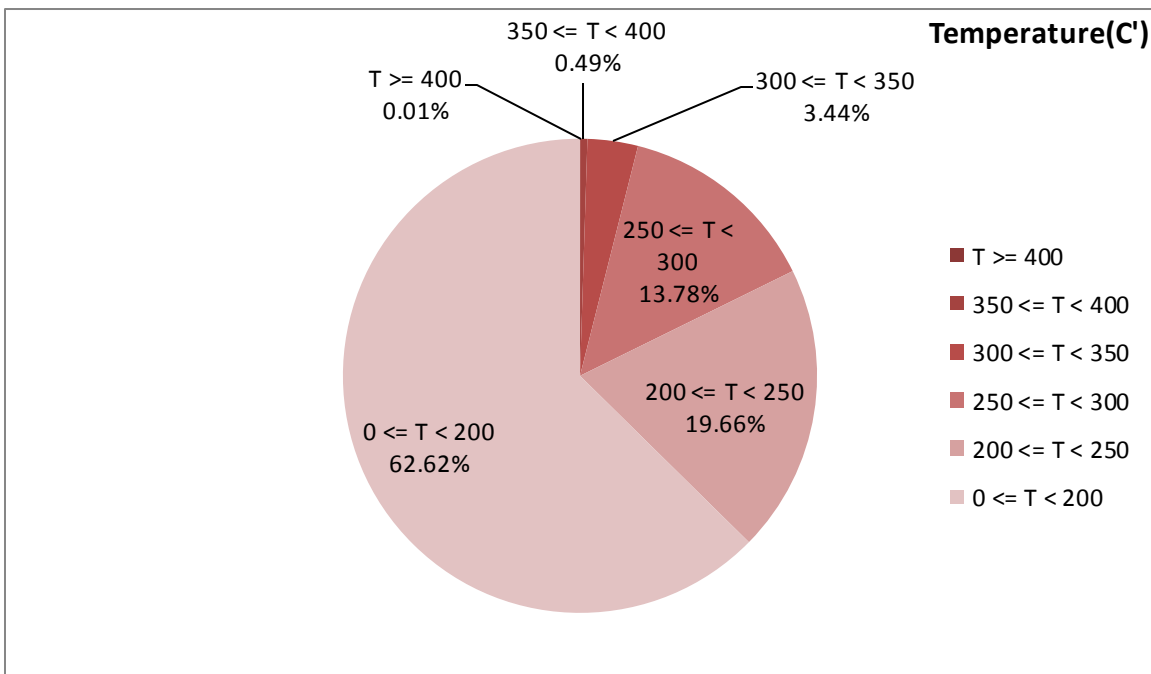


Figure 2- Temperature distribution over the working hours



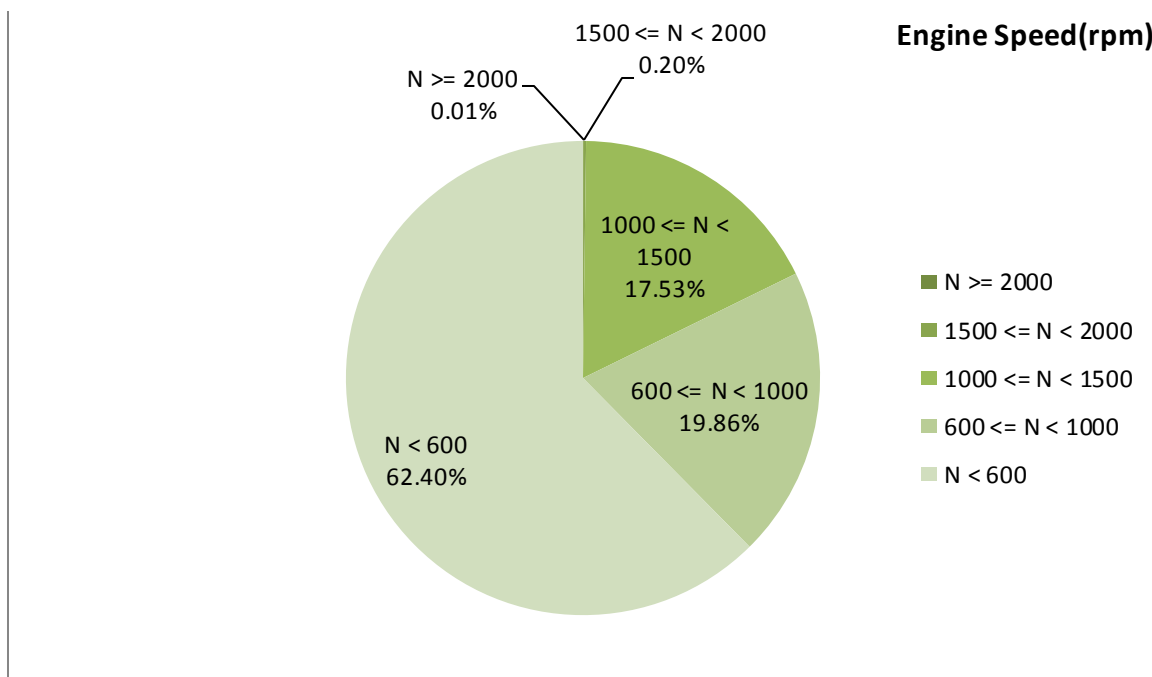


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
179.44	0.68	703

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
242.66	1.8	964

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
414-50	81-0	2144-288

## Detailed Pressure Analysis

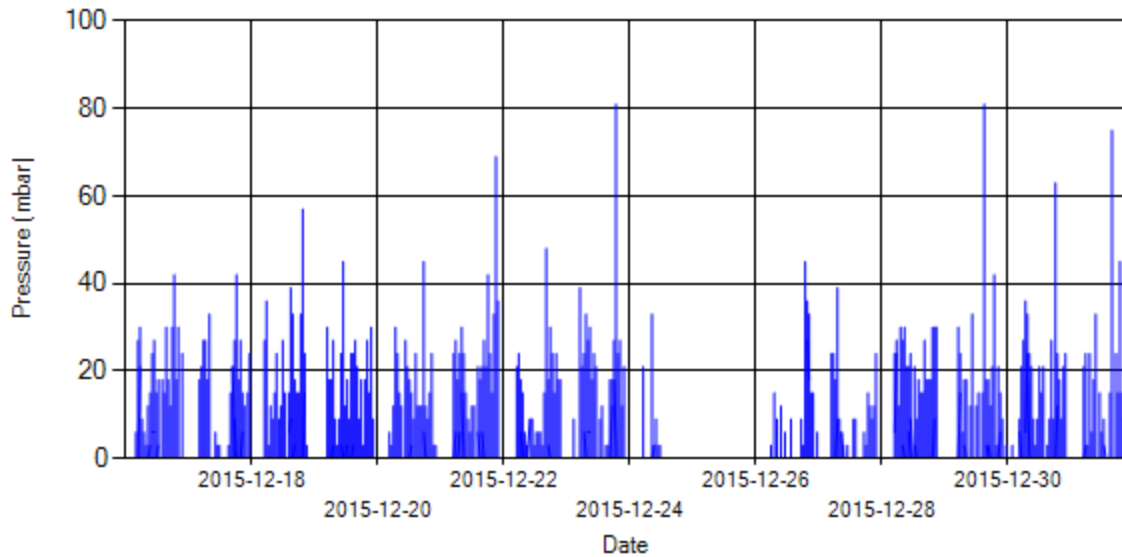


Figure 4- Pressure distribution over the period

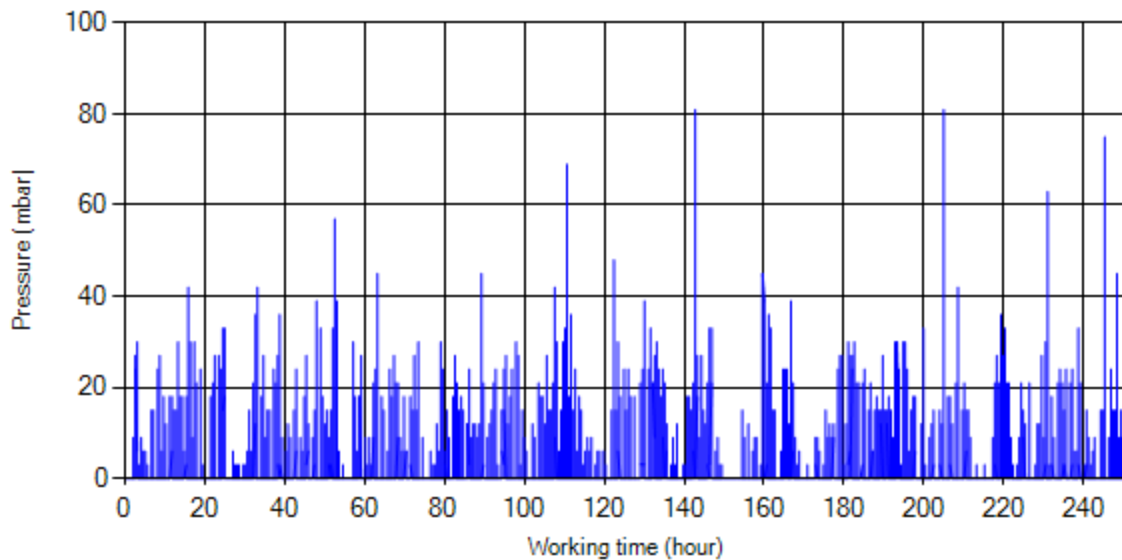


Figure 5- Pressure vs. working hours

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

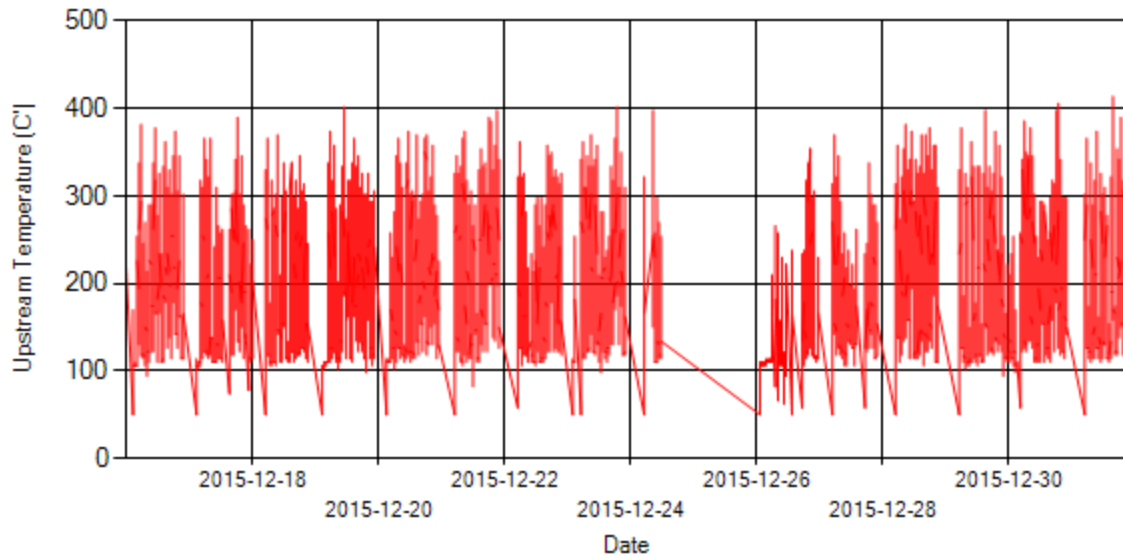


Figure 6- Temperature distribution over the period

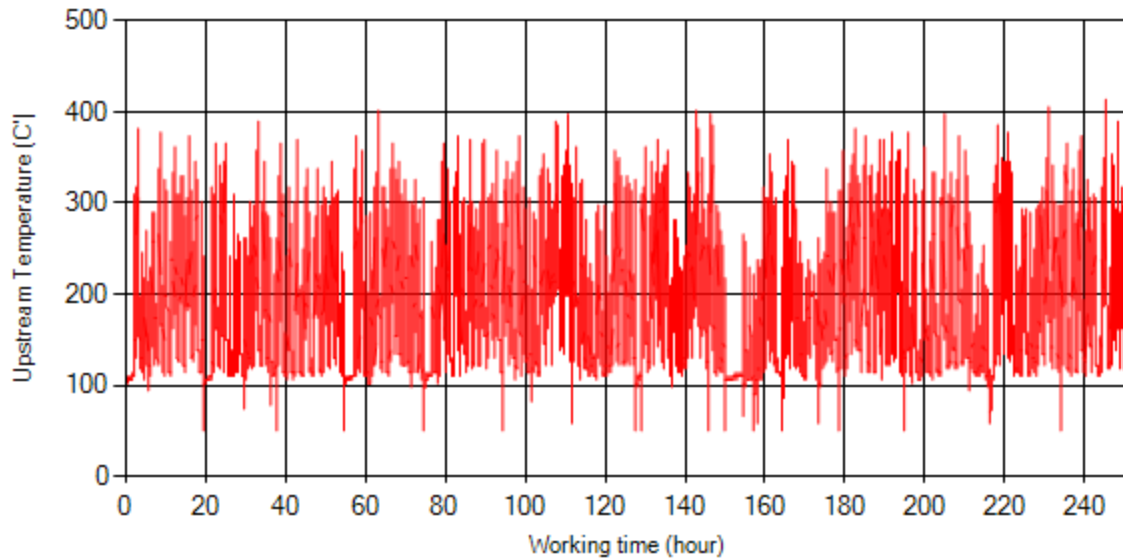


Figure 7- Temperature vs. working hours

## Engine Speed Diagrams

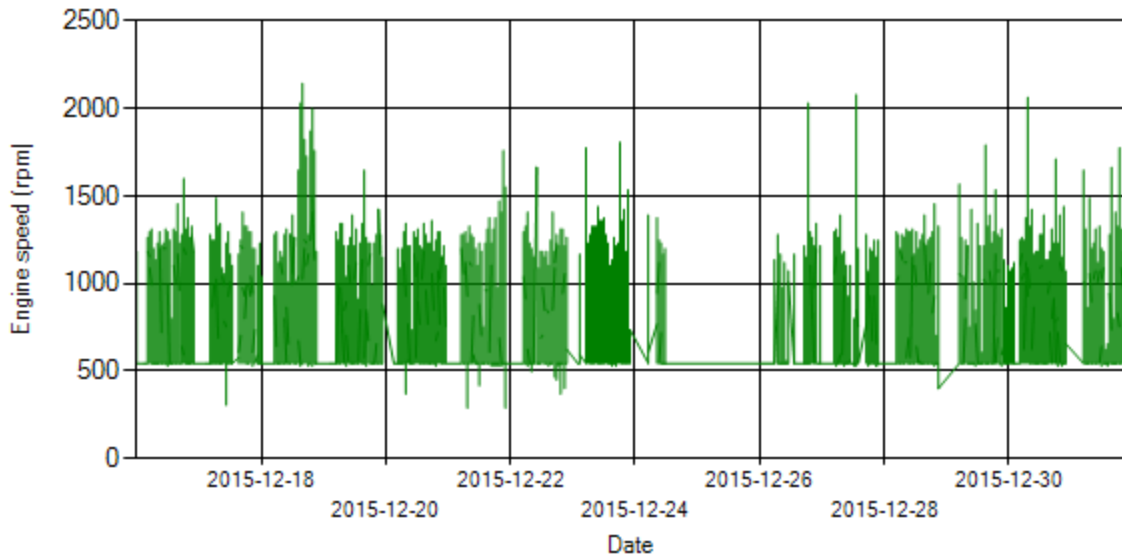


Figure 8- Engine speed distribution over the period

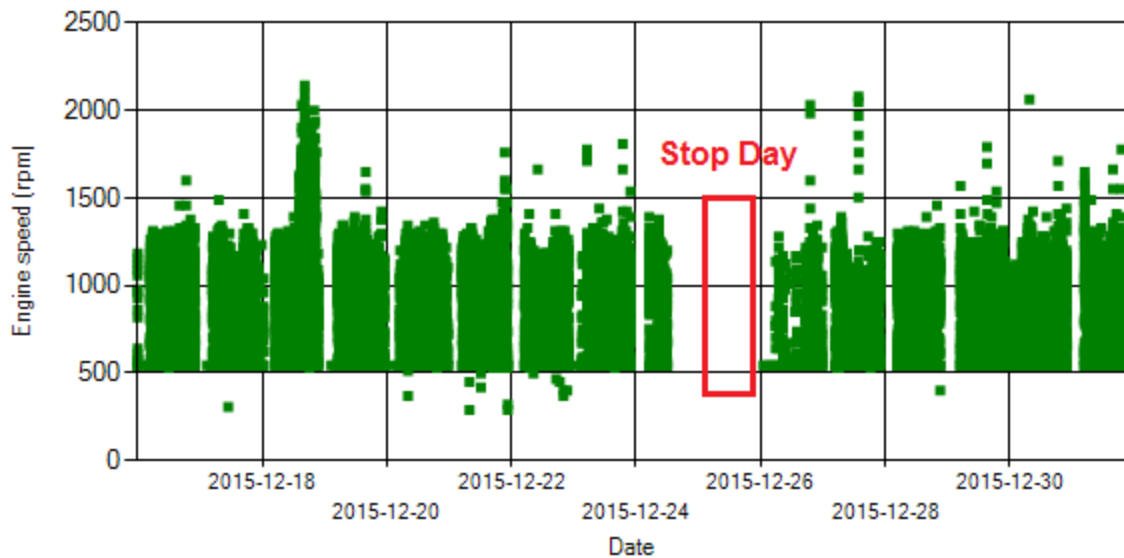


Figure 9- Engine speed diagram for calculating CPK's working days

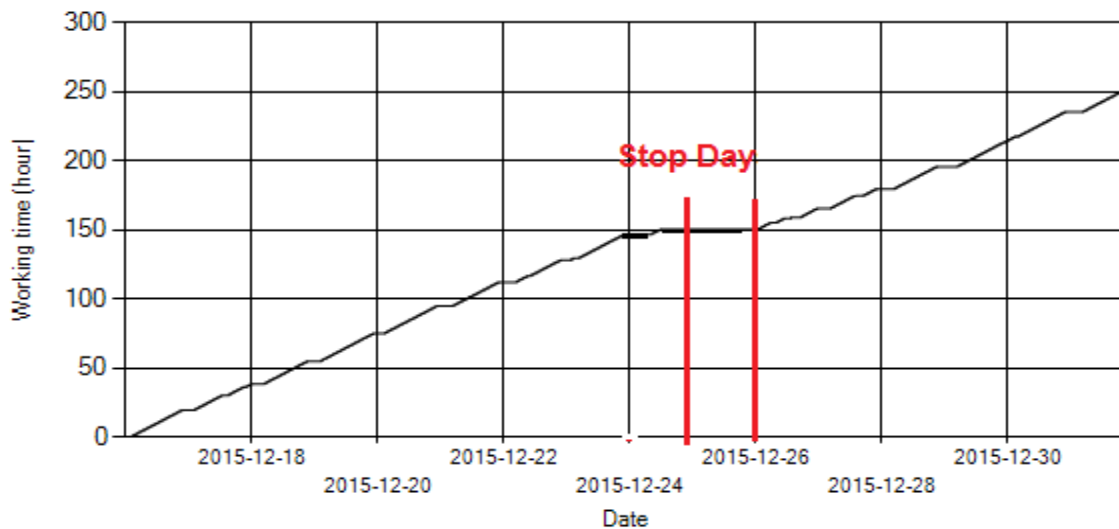


Figure 10- Time diagram for calculating CPK's working days

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

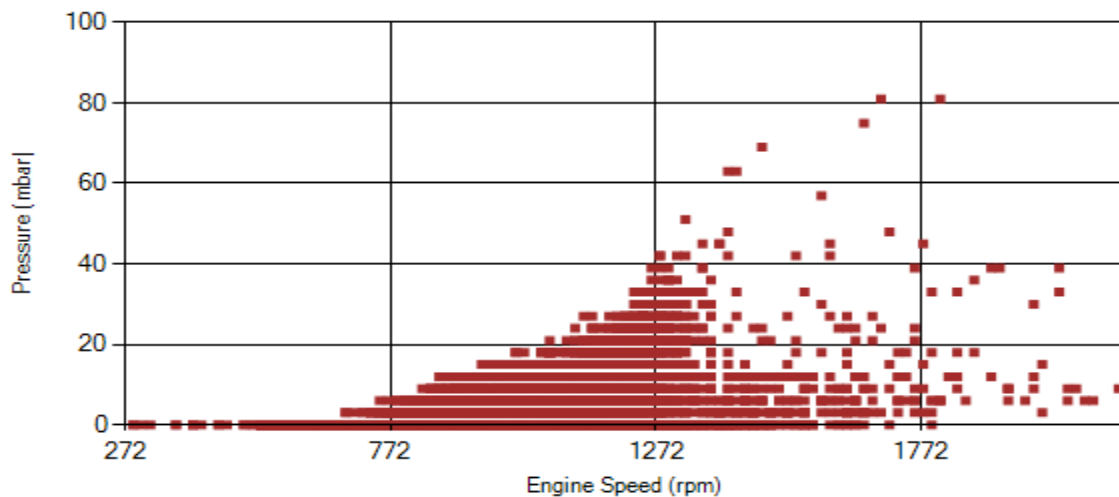


Figure 11- Pressure against engine speed

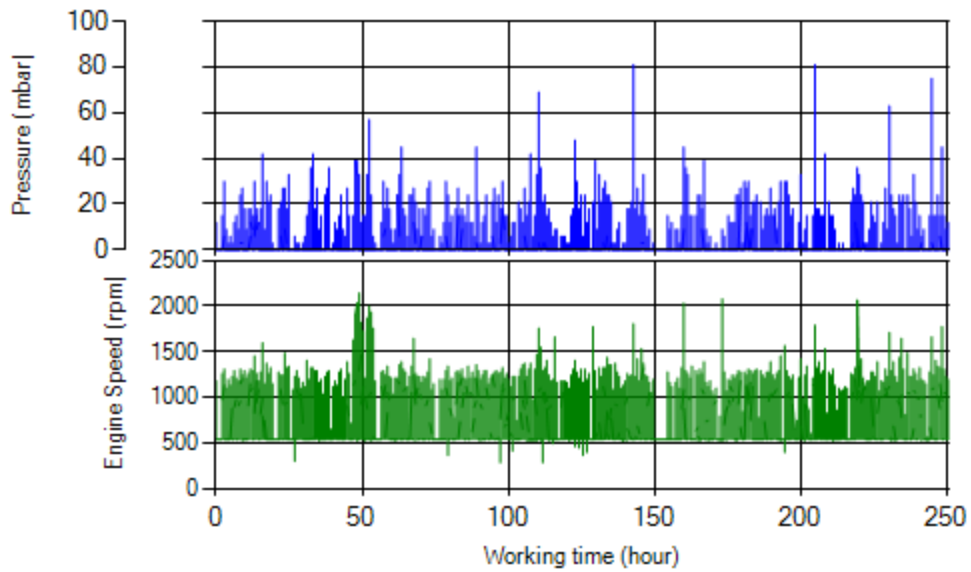


Figure 12- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

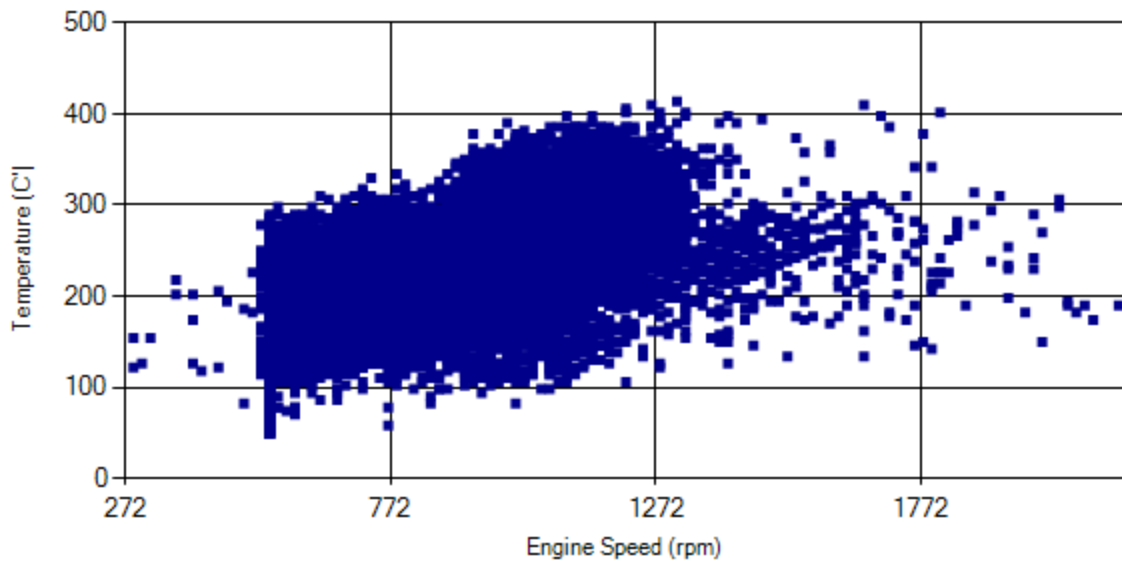
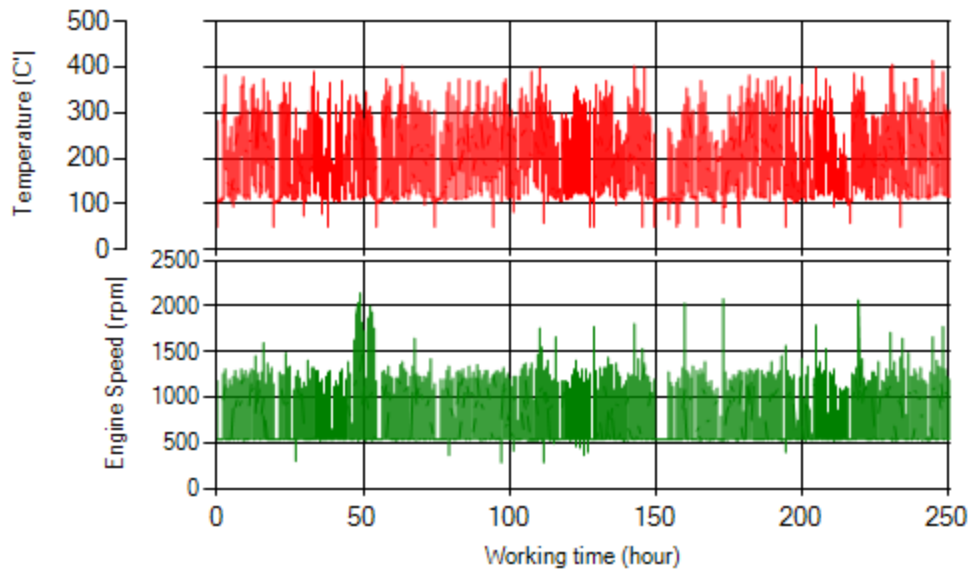


Figure 13- Temperature against engine speed

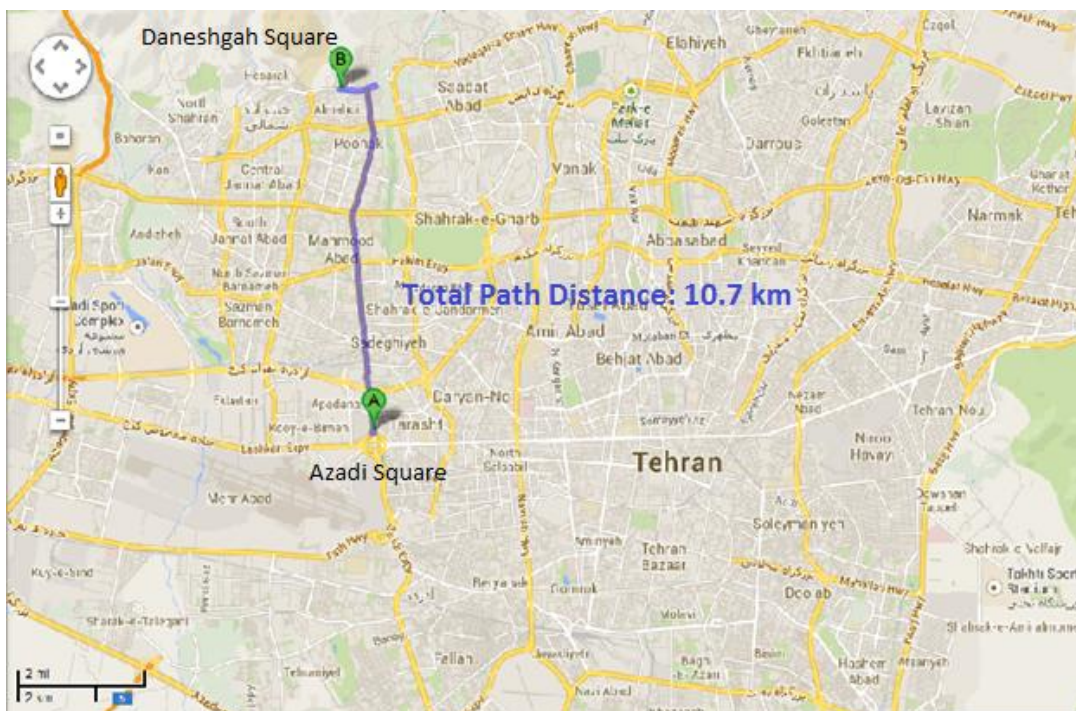


*Figure 14- T, N distribution vs. working hours*

## Filter Operation Analysis

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

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



All right reserved by ASA company – confidential no passing to third parties.



## 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/Dec/2015 – 15/Dec/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	DPF was cleaned on 22 <sup>nd</sup> Jul for the first time and on 15 <sup>th</sup> Dec for the second time after 44355 km mileage from installation date.
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)	44355 km
Bus mileage over the period	2289 km
Working days over the period	15 days
Stop days	0 day
Data logger working days	8 days
Working hours over the period	-
Average working hours per day (including stop days)	-
Bus average speed	-
idle speed time to all working time ration	56.76 %
Total Bus fuel consumption over the period	1550 lit
Fuel consumption per hour	-
Average fuel consumption	0.68 lit/km
Total Bus additive consumption over the period	0.65 lit
Average additive consumption	284 cc/km
Additive consumption to fuel ration	419 cc/1000lit

Notice: Data logger got problem on Dec 8<sup>th</sup> and some data missed. So some related parameters were left blank in the table 3.

**Notice:** Data from 1st to 8th Dec was used to draw all following figures.

### Temperature, Pressure and Engine Speed Overview

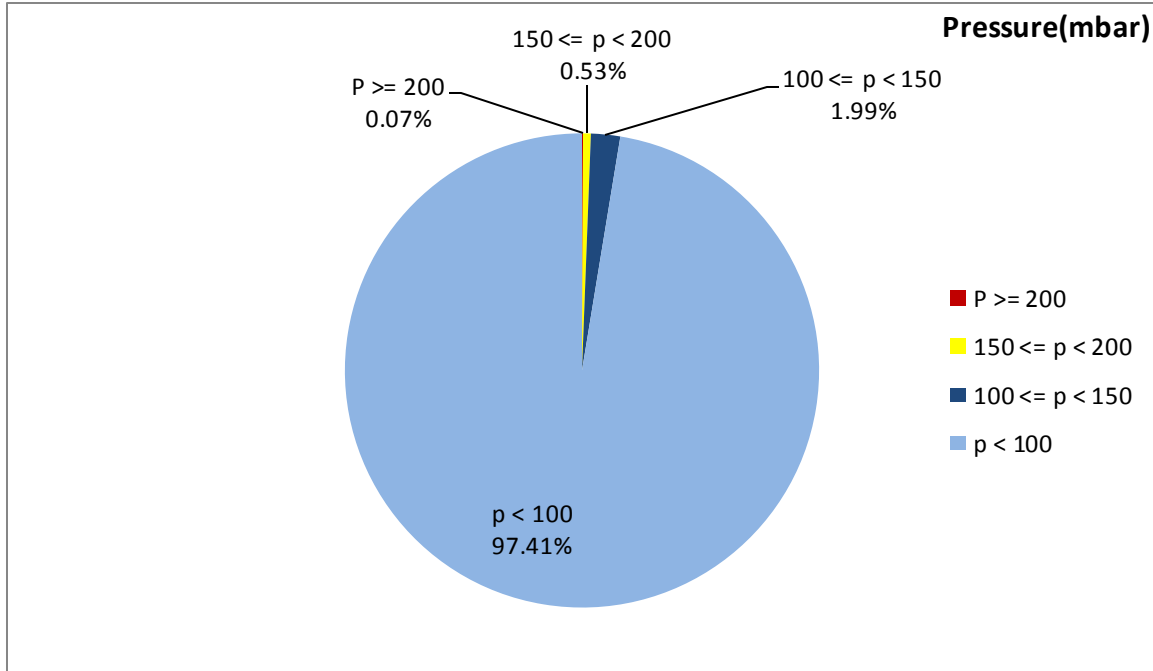


Figure 1- Pressure distribution over the working hours

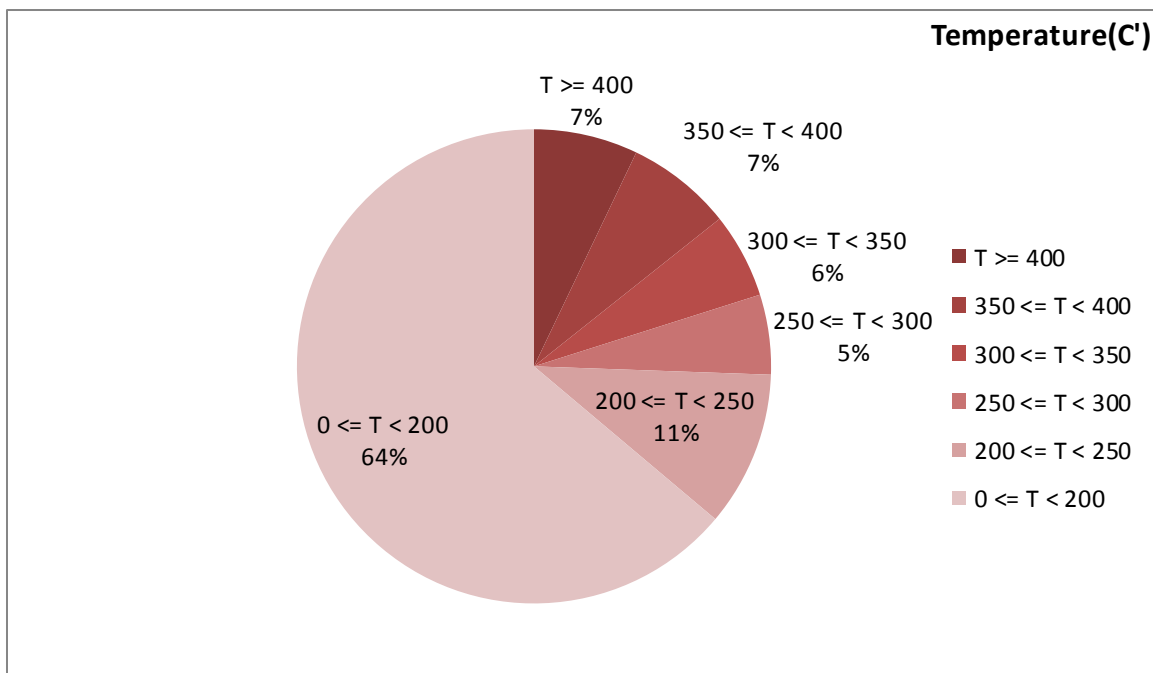


Figure 2-Temperature distribution over the working hours

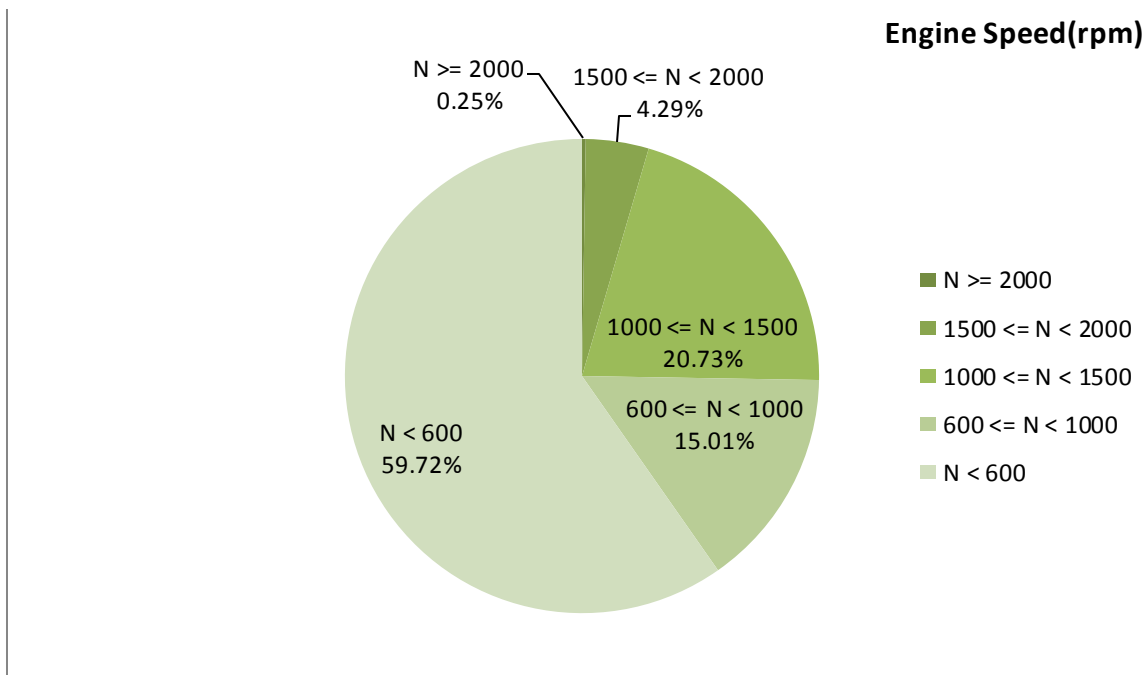


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
207.67	17.6	783

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
261.88	34.82	1065

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
514-50	216-0	2176-256

## Detailed Pressure Analysis

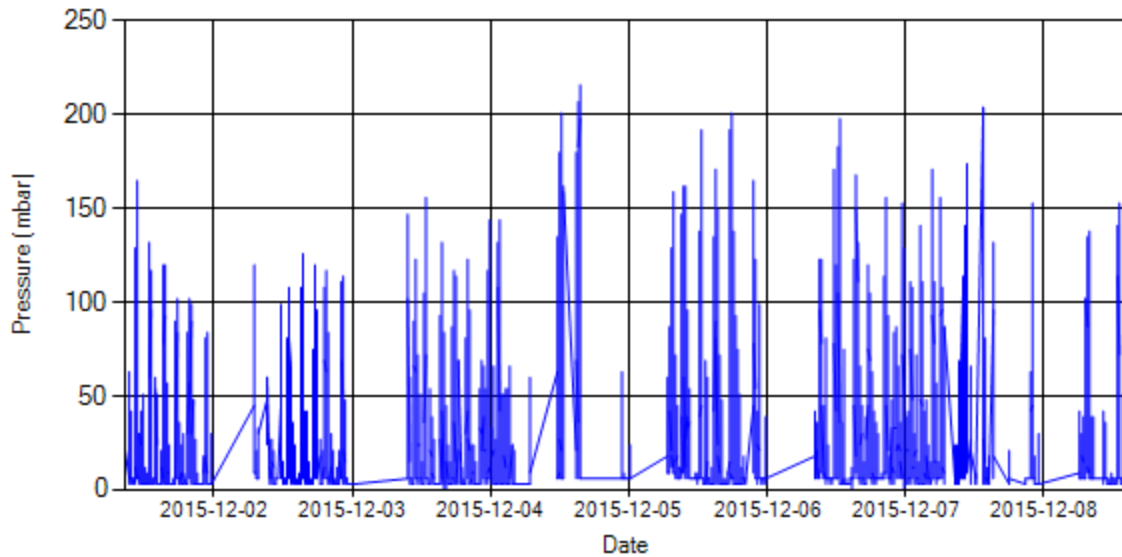


Figure 4- Pressure distribution over the period

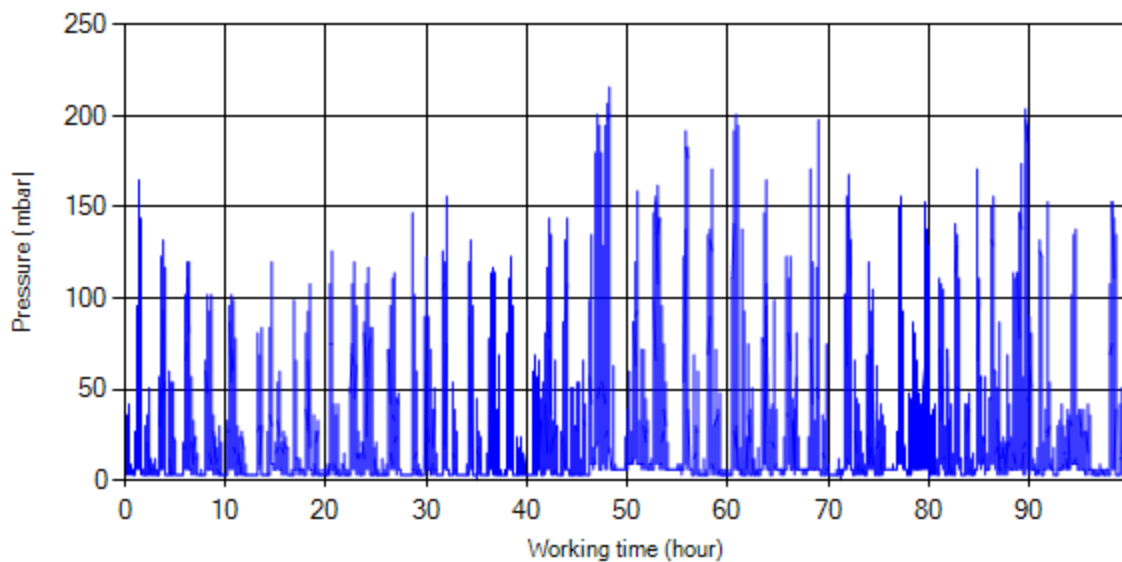


Figure 5- Pressure vs. working hours

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

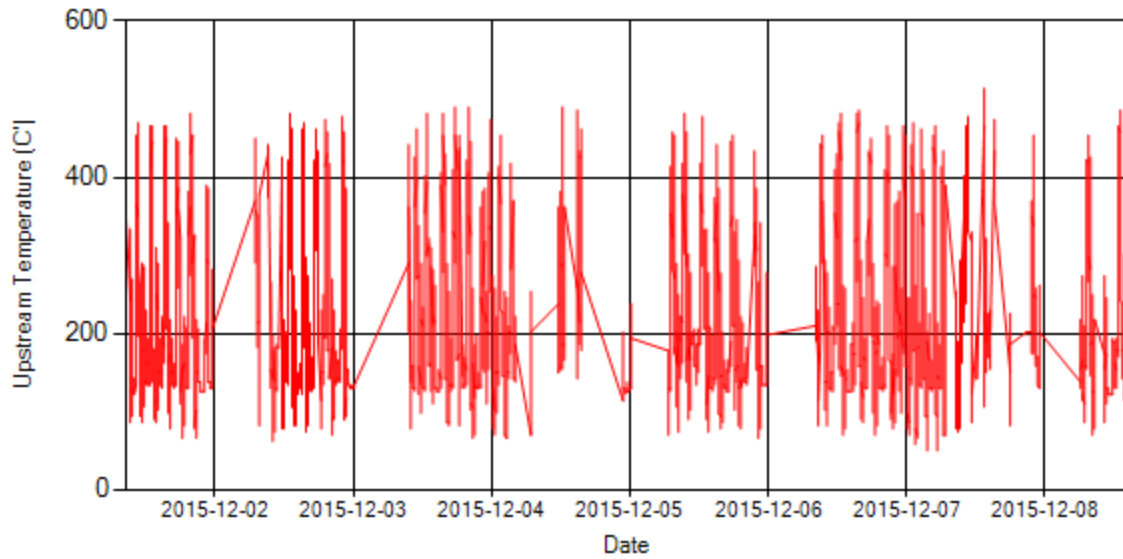


Figure 6- Temperature distribution over the period

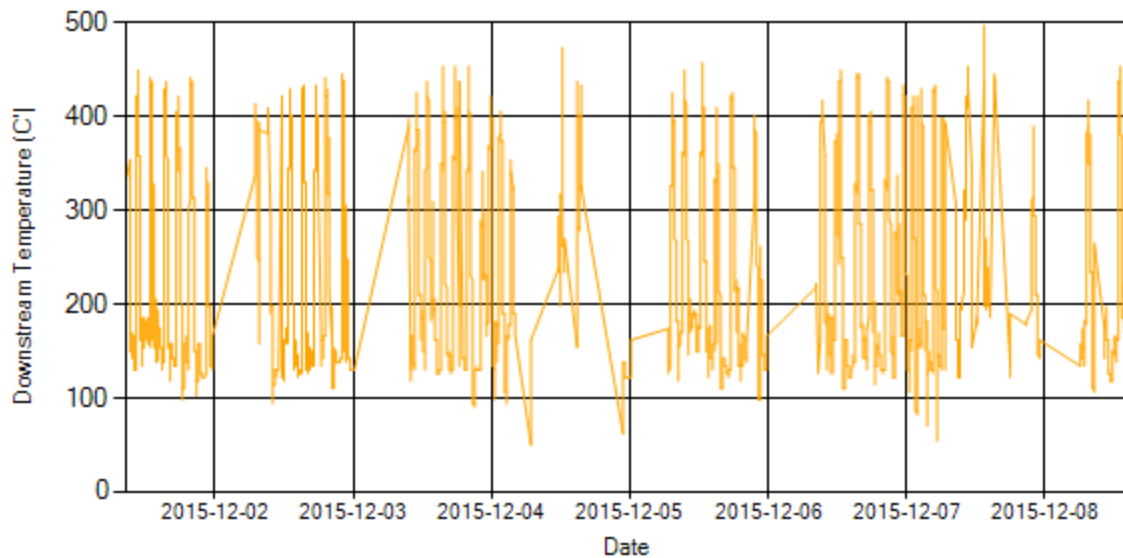


Figure 7- Temperature distribution over the period

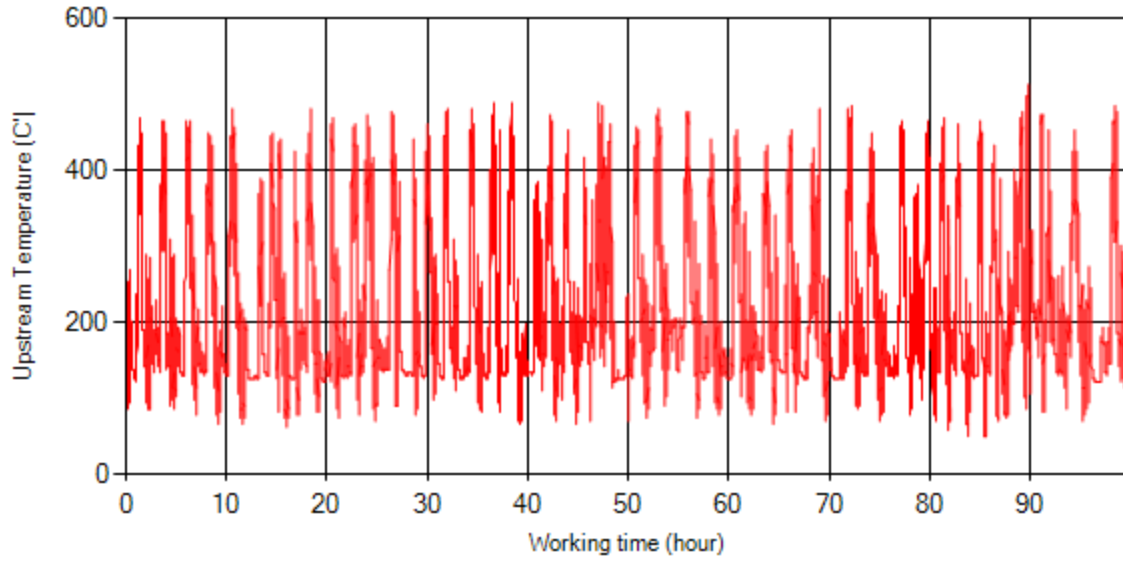


Figure 8- Temperature vs. working hours

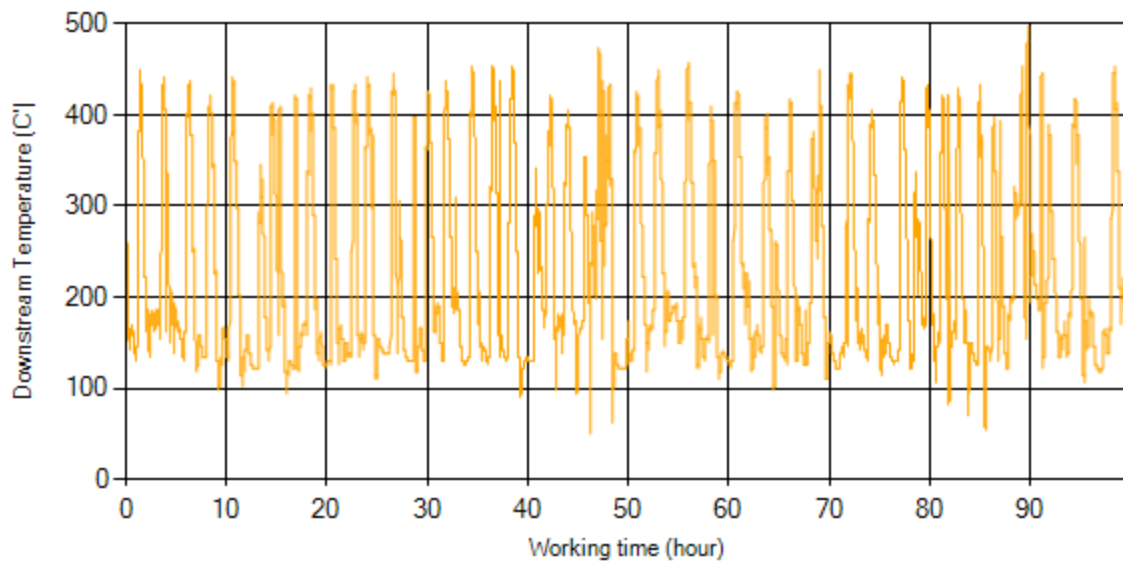


Figure 9- Temperature vs. working hours

## Engine Speed Diagrams

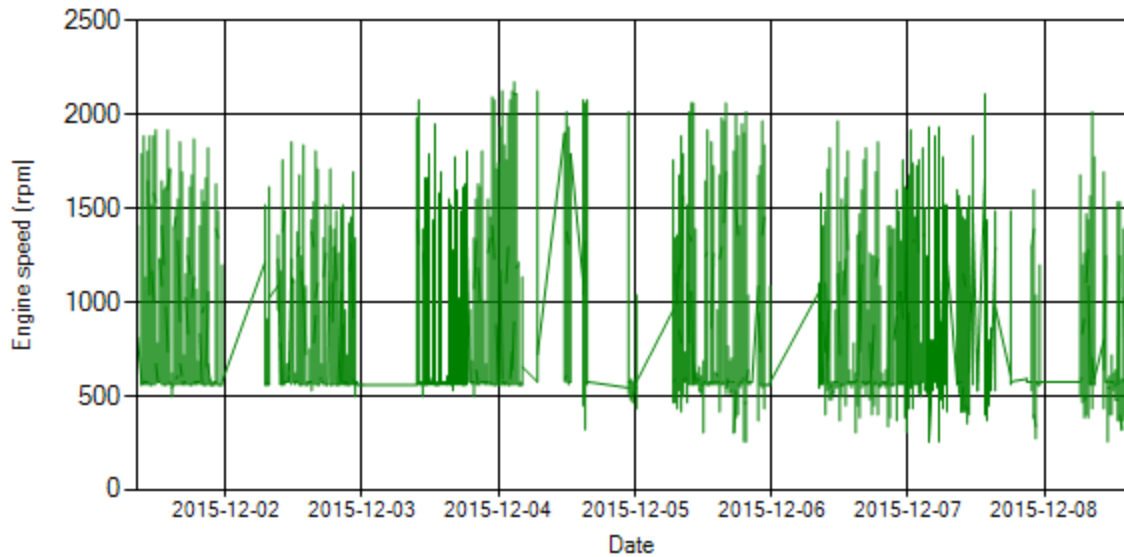


Figure 10- Engine speed distribution over the period

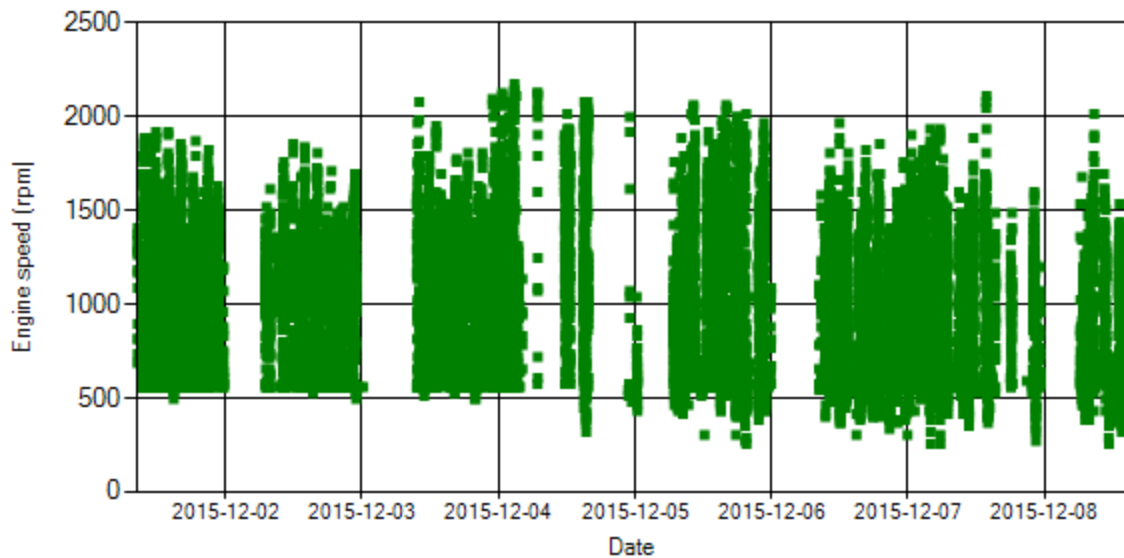


Figure 11- Engine speed diagram for calculating CPK's working days



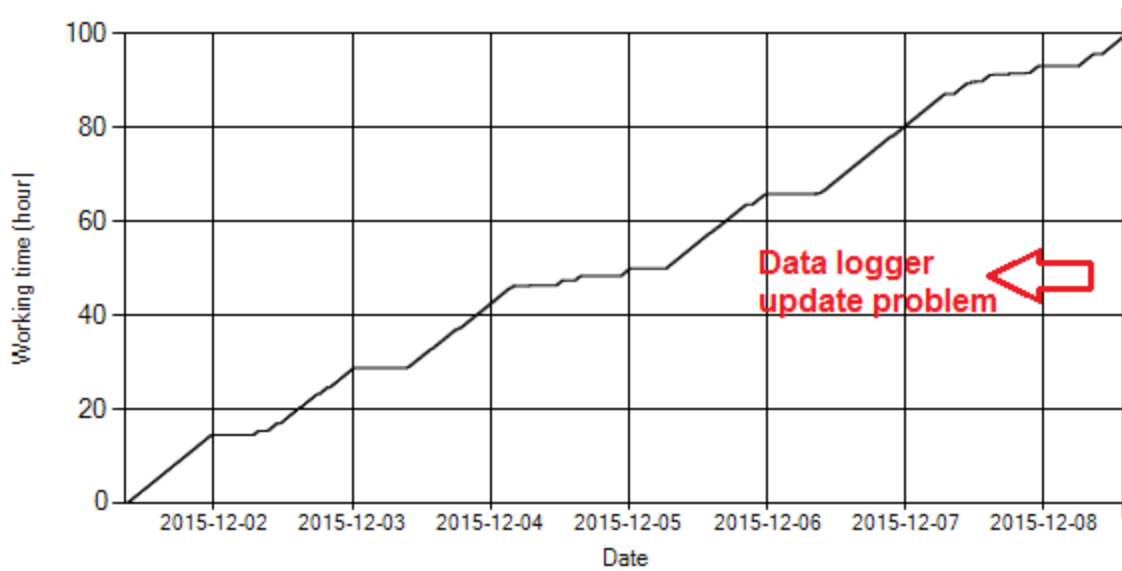


Figure 12- Time diagram for calculating CPK's working days

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, data logger got problem on Dec 8<sup>th</sup>.

### Pressure-Engine Speed diagrams

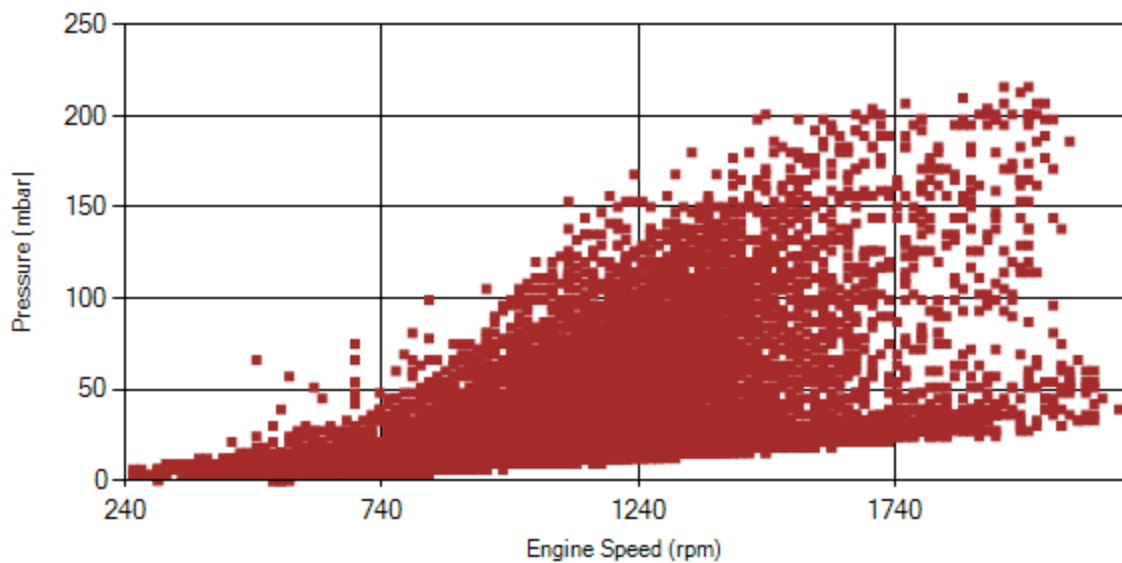


Figure 13- Pressure against engine speed

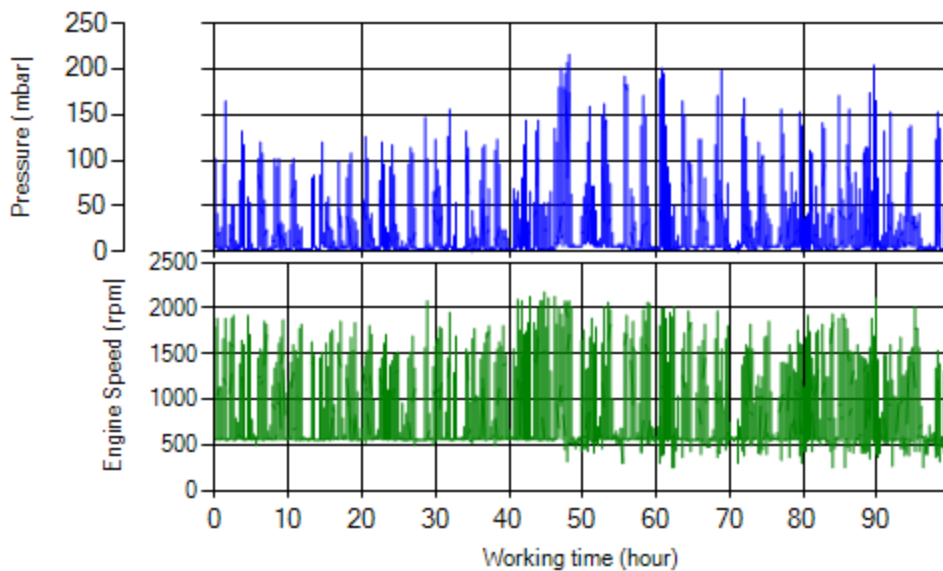


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

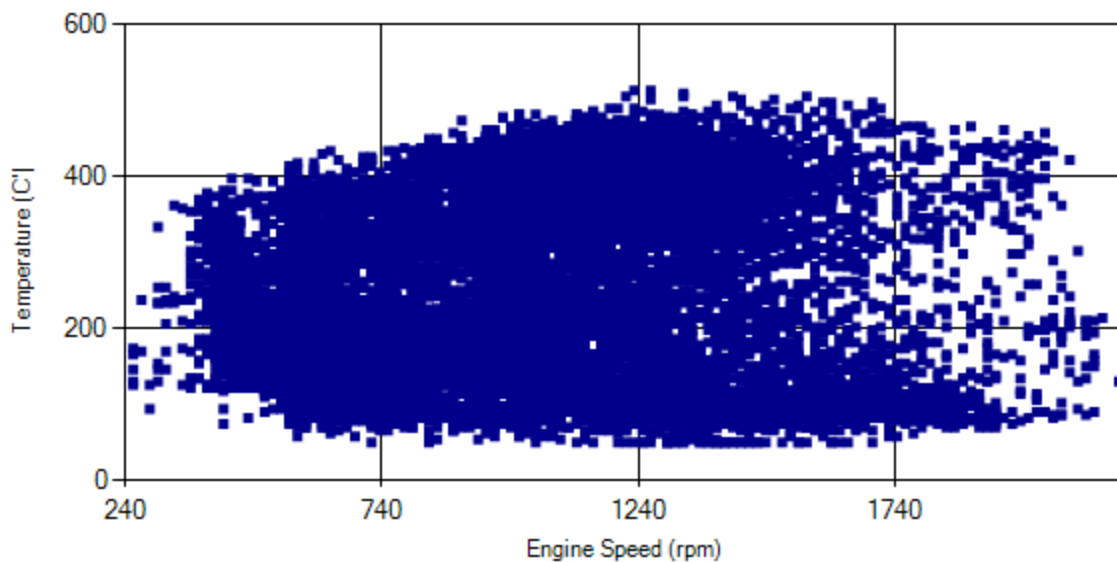


Figure 15- Temperature against engine speed

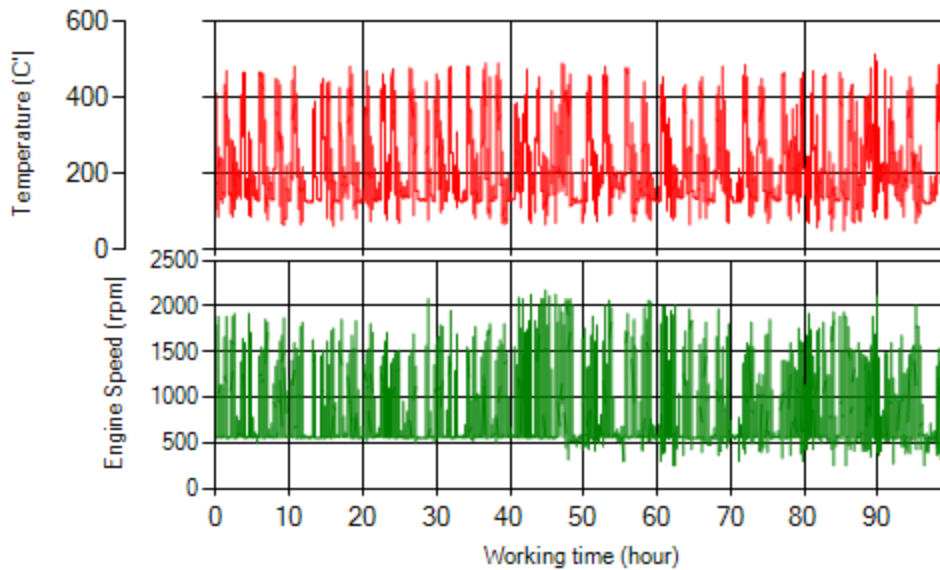


Figure 16- T, N distribution vs. working hours

## Filter Operation Analysis

### Considering the first 8 days of Dec:

- As depicted in figure 1, only 0.07% of working time pressure was above 200 mbar and 0.6% above 150 mbar.
- It can be obviously observed that 7% of total working-time temperature is above 400 °C and 14% above 350°C.
- Despite the excellent operation for the first 8 days of the month, system ECU warned cleaning time arrival which might be due to additive system problem. So DPF was cleaned on Dec 15<sup>th</sup> for the second time.

Filter operation status	Excellent <input type="checkbox"/>	Good <input type="checkbox"/>
	Maintenance required <input checked="" 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/Dec/2015 – 31/Dec/2015 (sixteen 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	DPF was cleaned on 22 <sup>nd</sup> Jul for the first time and on 15 <sup>th</sup> Dec for the second time after 44355 km mileage from installation date.
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)	46255 km
Bus mileage over the period	1900 km
Working days over the period	15 days
Stop days	1 day
Data logger working days	9 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	64.98 %
Total Bus fuel consumption over the period	1235 lit
Fuel consumption per hour	- lit/hr
Average fuel consumption	0.65 lit/km
Total Bus additive consumption over the period	0.550 lit
Average additive consumption	289 cc/km
Additive consumption to fuel ration	445 cc/1000lit

Notice: Data logger got problem on Dec 8<sup>th</sup> and was repaired on Sec 22<sup>nd</sup>. So some data missed and some of related parameters were left blank in the table 3.

**Notice:** Data from 22<sup>nd</sup> to 31<sup>st</sup> Dec was used to draw all following figures.

### Temperature, Pressure and Engine Speed Overview

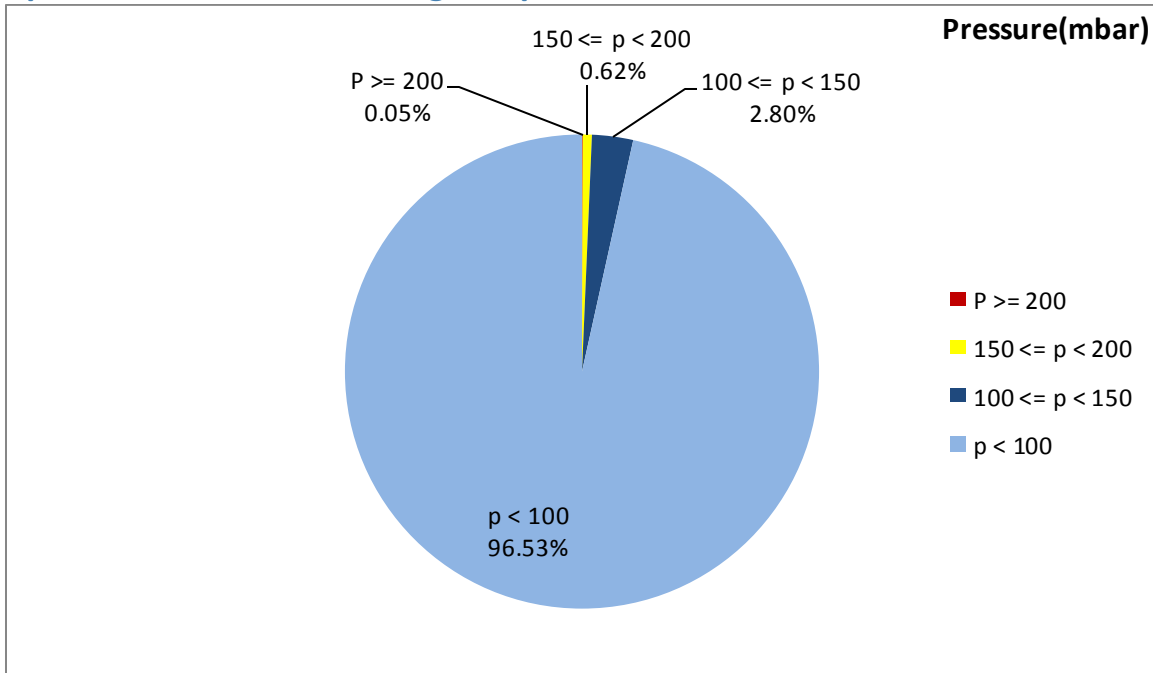


Figure 1- Pressure distribution over the working hours

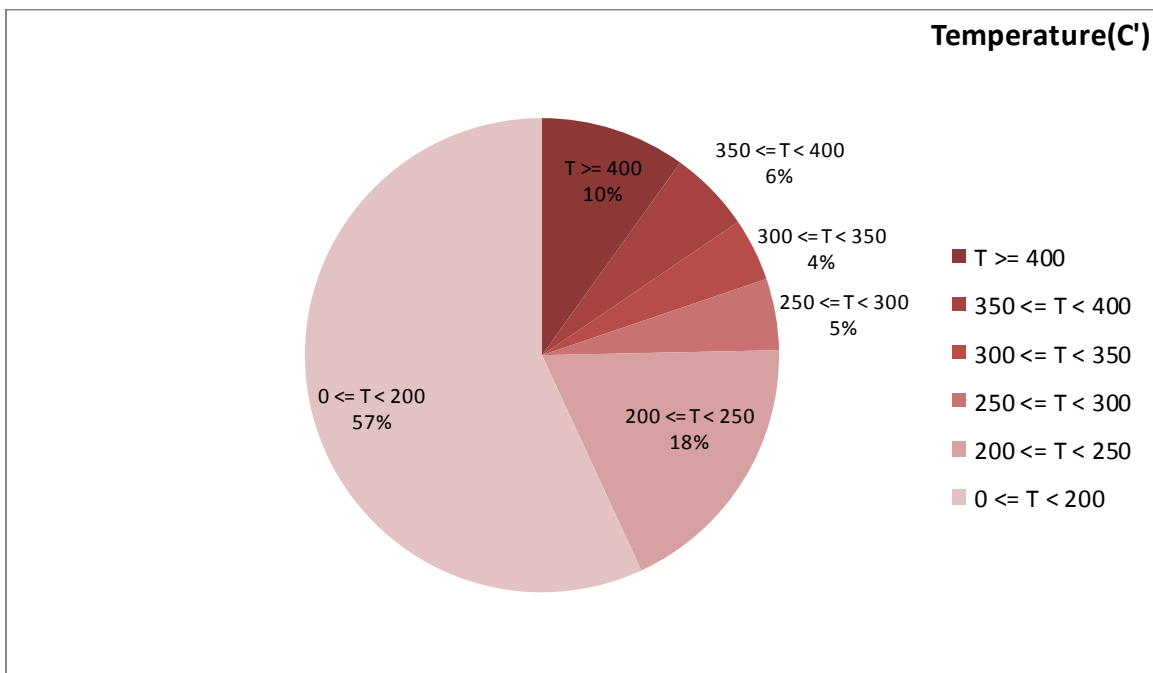


Figure 2-Temperature distribution over the working hours

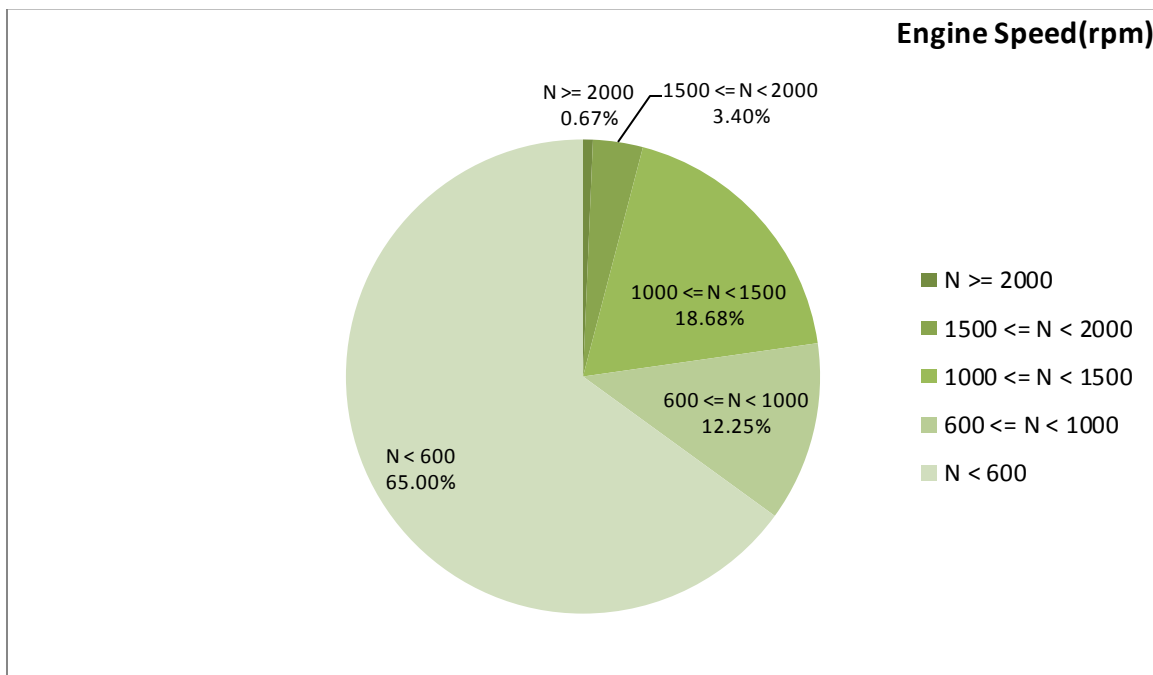


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
218.29	22.24	759

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
286.54	46.26	1127

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
578-50	249-0	2608-256

## Detailed Pressure Analysis

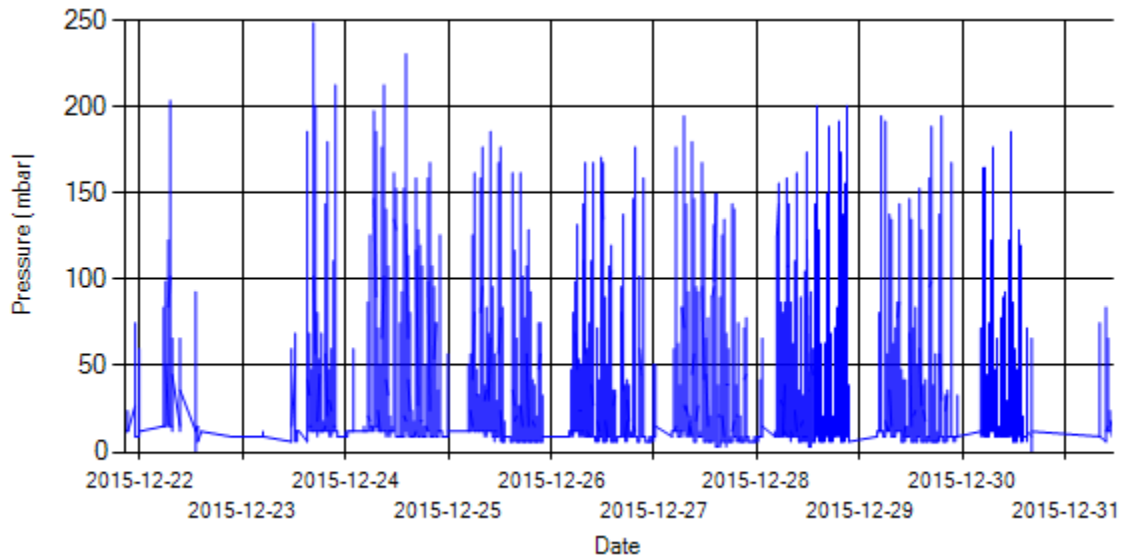


Figure 4- Pressure distribution over the period

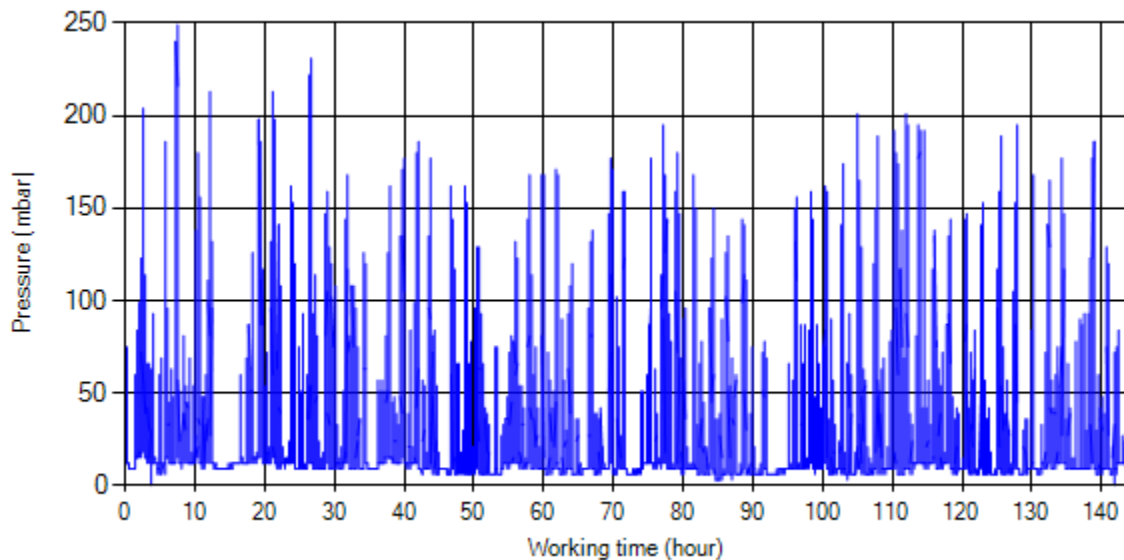


Figure 5- Pressure vs. working hours

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

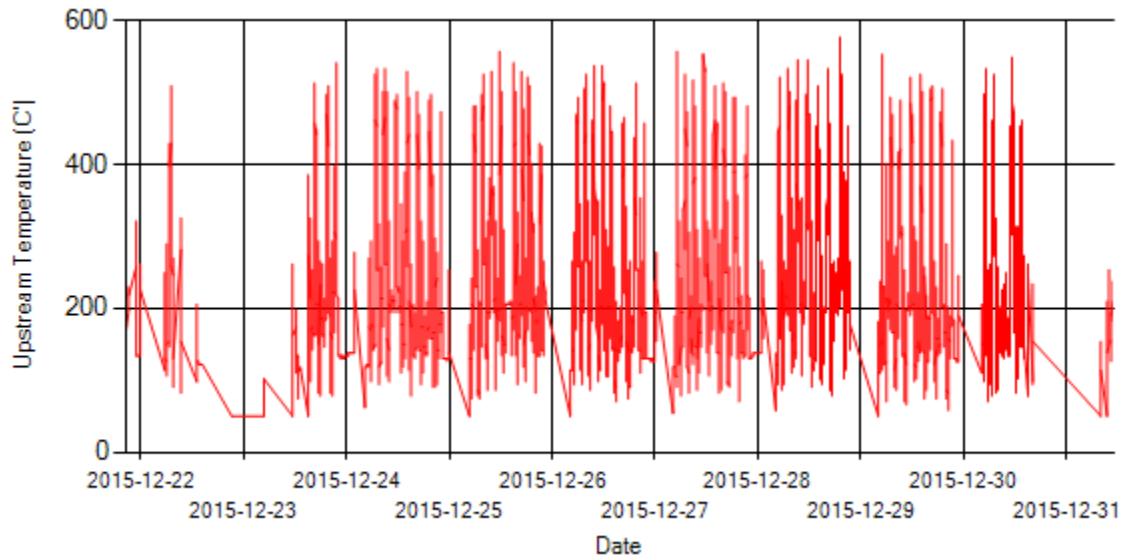


Figure 6- Temperature distribution over the period

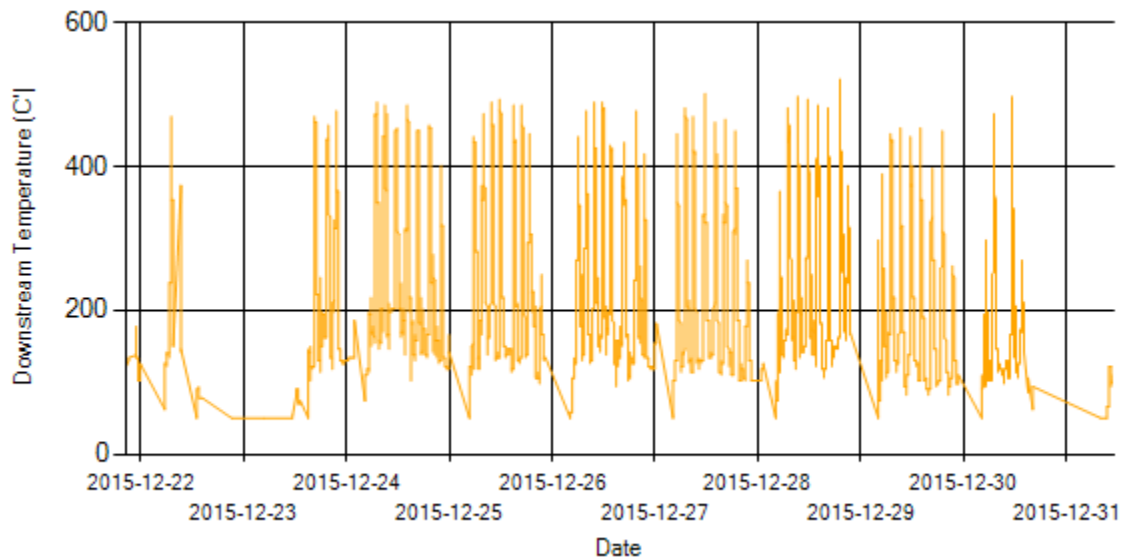
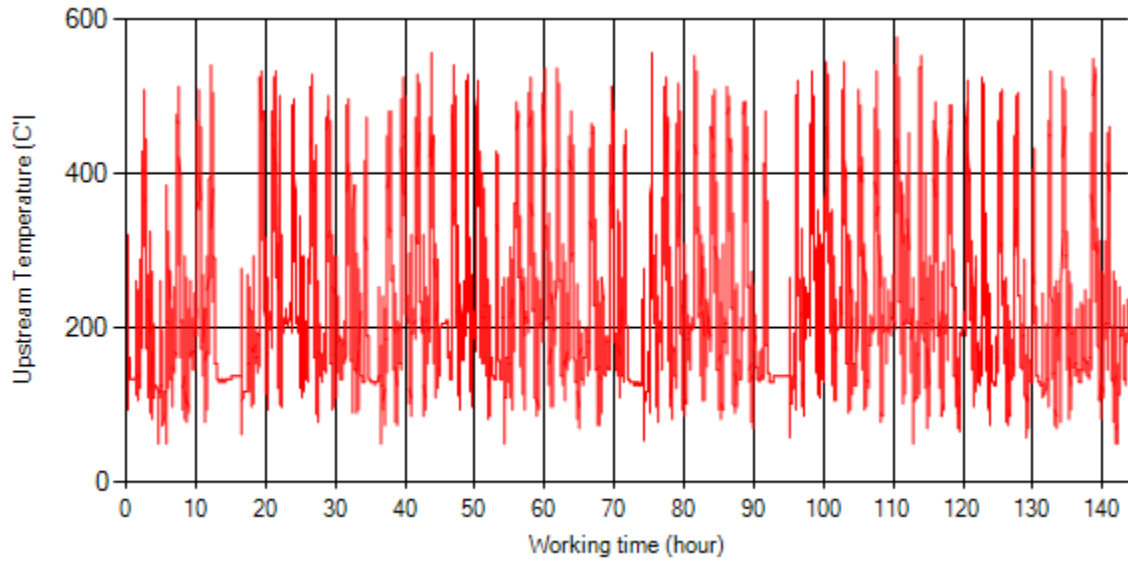
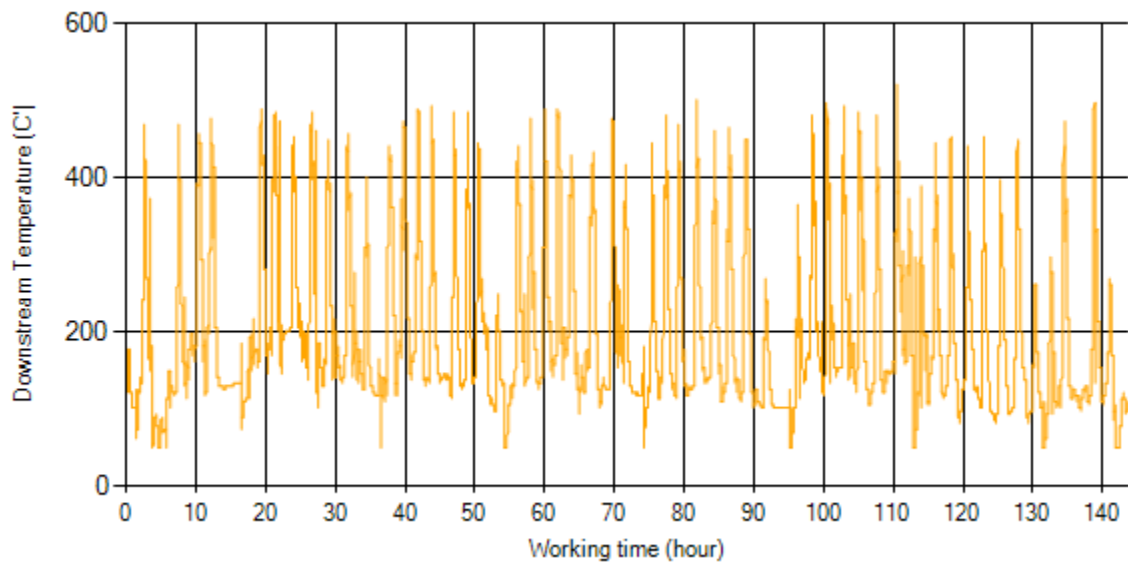


Figure 7- Temperature distribution over the period



*Figure 8- Temperature vs. working hours*



*Figure 9- Temperature vs. working hours*

## Engine Speed Diagrams

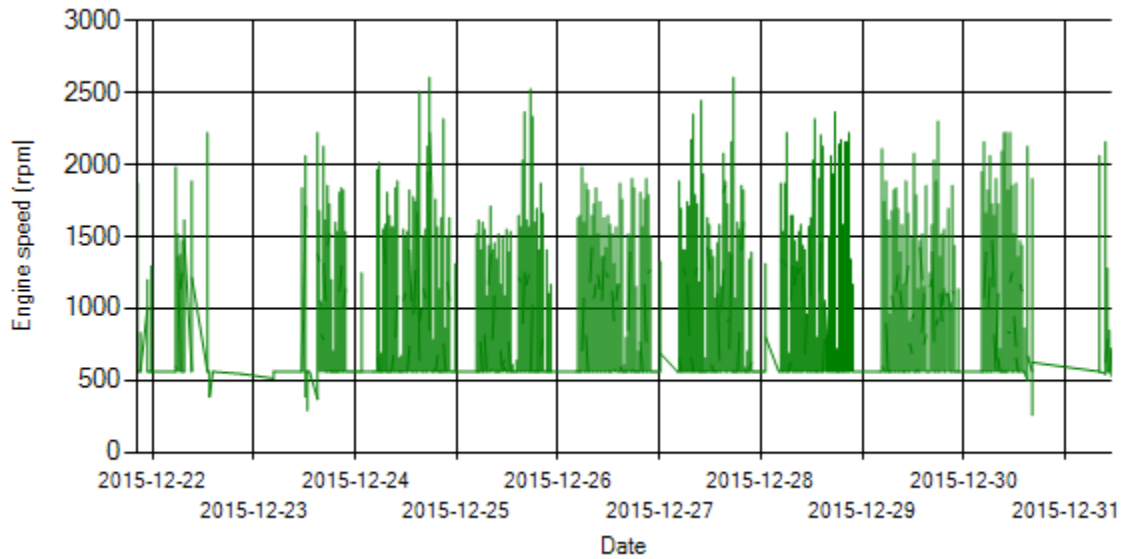


Figure 10- Engine speed distribution over the period

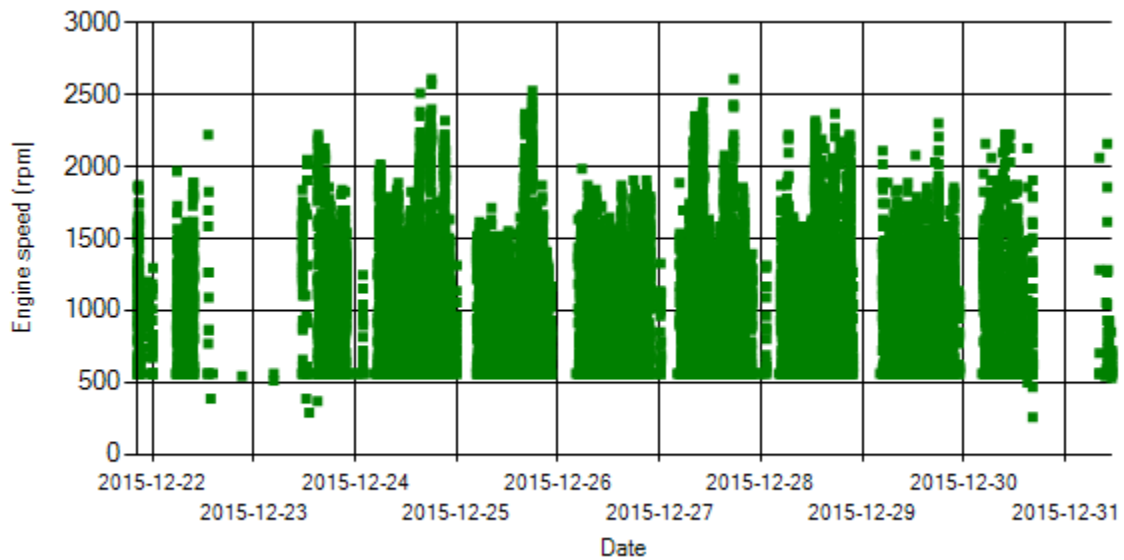


Figure 11- Engine speed diagram for calculating CPK's working days

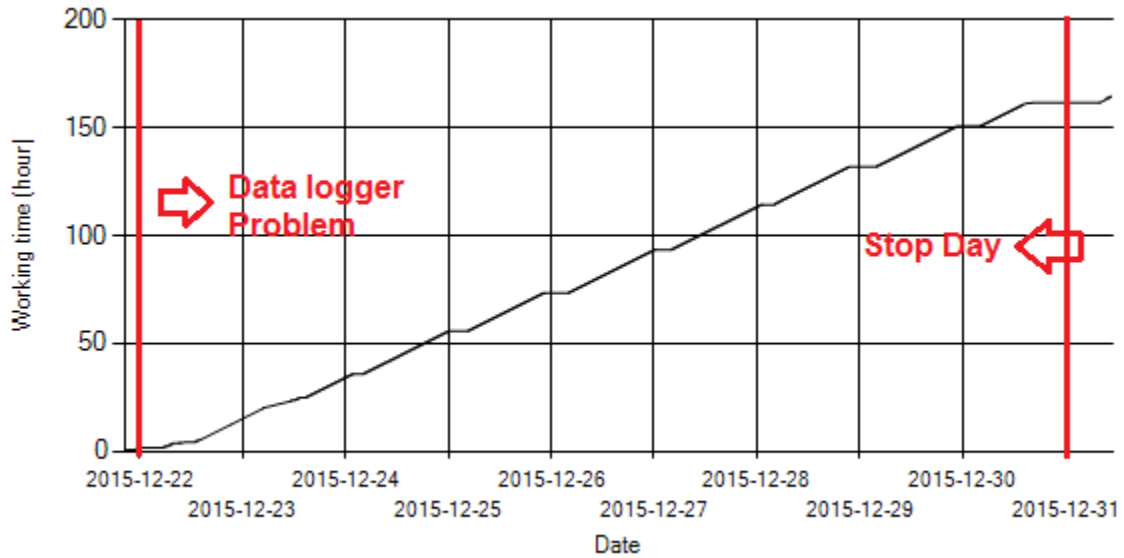


Figure 12- Time diagram for calculating CPK's working days

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, data logger didn't sample first six days of the period because of update problem and Dec 31<sup>st</sup> was stop day.

### Pressure-Engine Speed diagrams

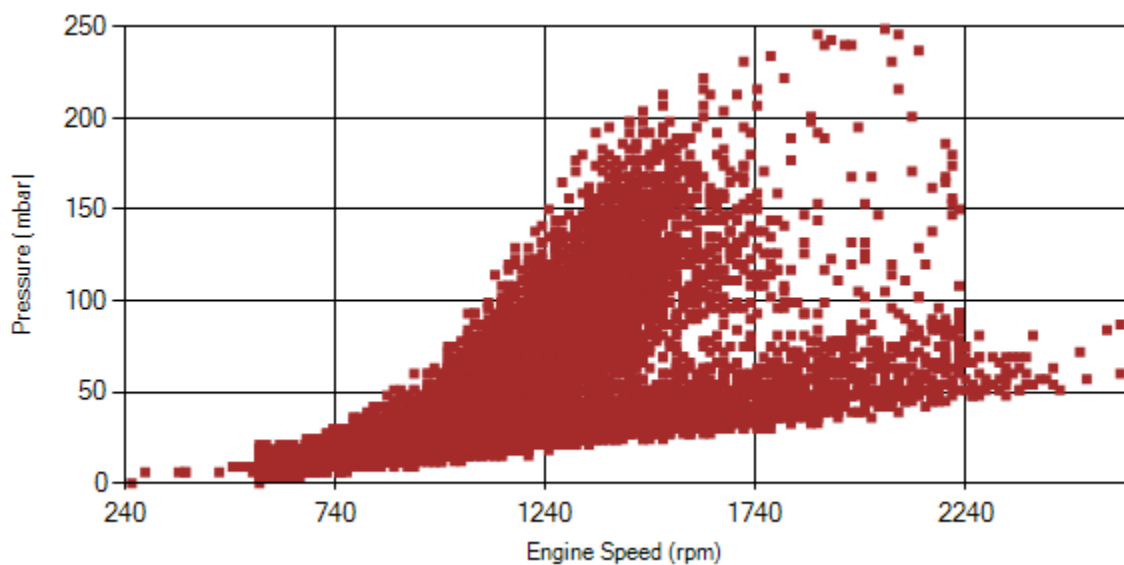


Figure 13- Pressure against engine speed

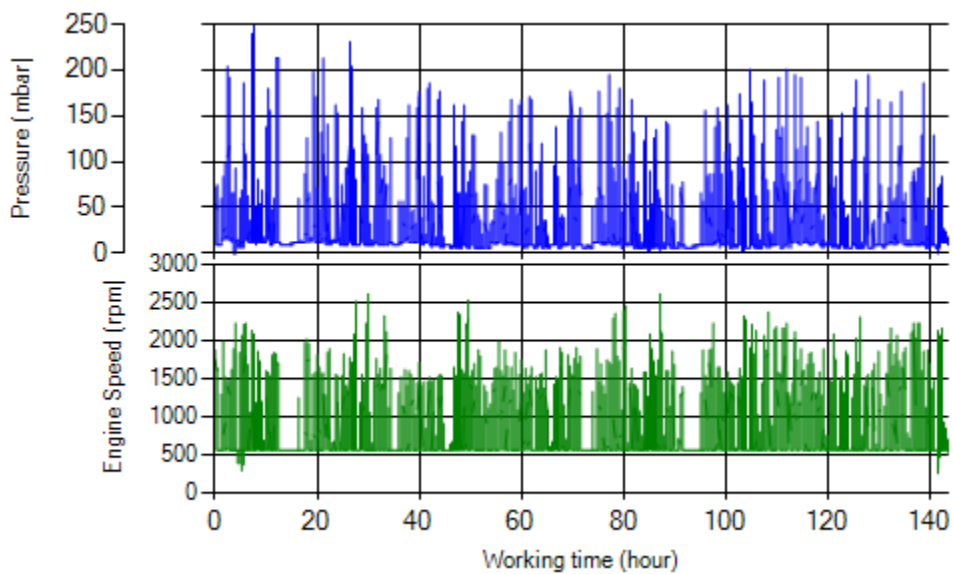


Figure 14- P, N distribution vs. working hours

### Temperature-Engine Speed diagrams

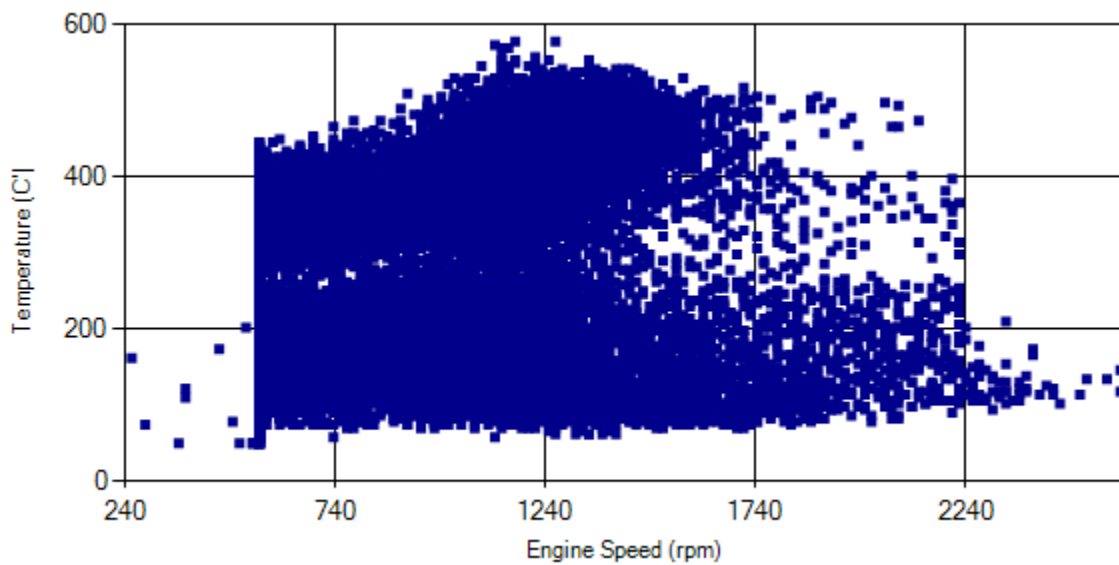


Figure 15- Temperature against engine speed

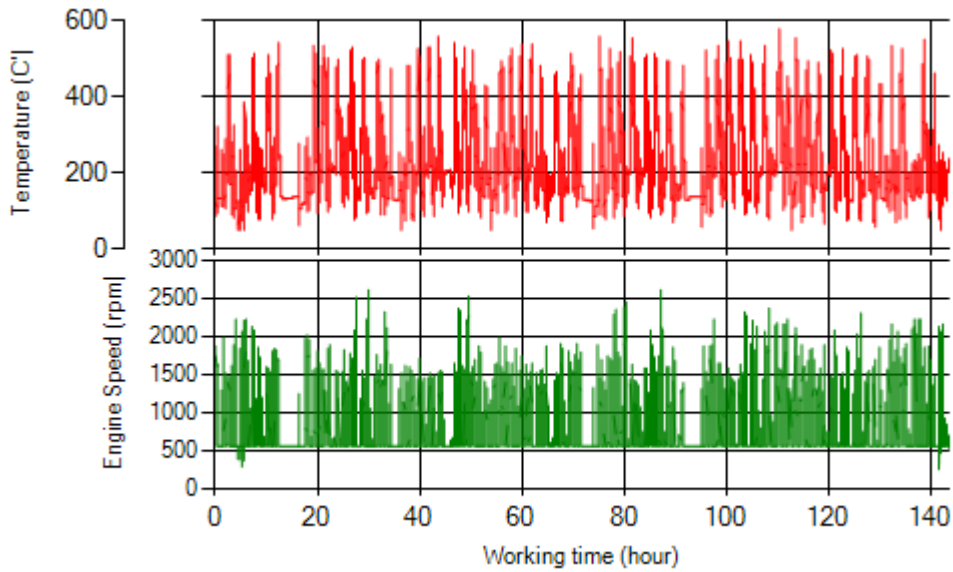


Figure 16- T, N distribution vs. working hours

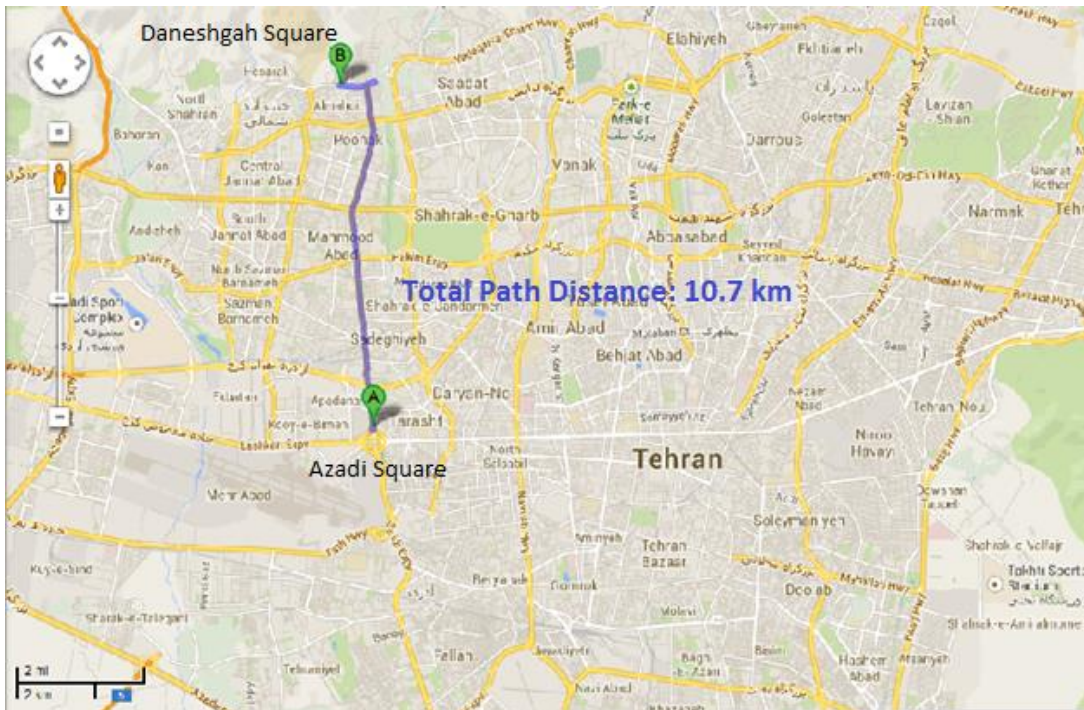
### Filter Operation Analysis

Considering the last 10 days of Dec:

- As depicted in figure 1, only 0.05% of working time pressure was above 200 mbar and 0.67% above 150 mbar.
- 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"/>

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



All right reserved by ASA company – confidential no passing to third parties.

## 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/Dec/2015 – 31/Dec/2015 (thirty one days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

*Table 2- DPF Maintenance History*

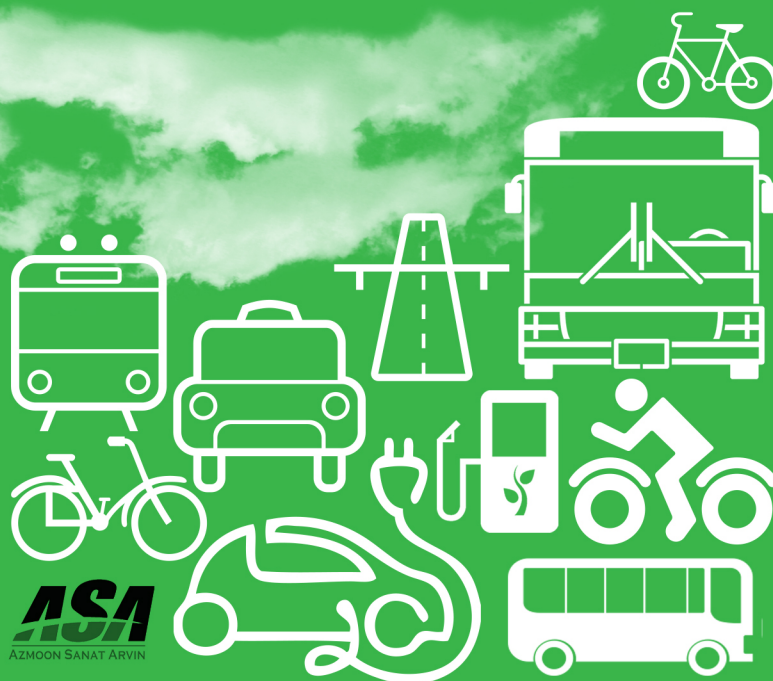
Filter maintenance date	Filter have been working from installation date without any cleaning.
Dosing status	This system doesn't use additive.

**Notice: Bus had been stopped from Nov 11<sup>th</sup> until end of December.**



# Diesel Particulate Filter

an effective way to control solid particulate



**Address:** Suite 3 | No. 25 | Nahal Alley | Koodak Square | Kashani Blvd |  
Tehran – Iran | Postal Code 1474613714  
**Phone** (+9821) 44360051-2 | **Fax** (+9821) 44360053  
[www.ASArvin.com](http://www.ASArvin.com) | [Info@asarvin.com](mailto:Info@asarvin.com)