Diesel Particulate Filters' Feasibility Study Report

Report's Period:

2016/08/01 - 2016/08/31

Tehran - Iran

ASA
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شرکت کنترل کیفیت هوا
وابسته به شهرداری تهران

معاونت حمل و نقل و ترافیک
شهرداری تهران
دفتر محیط زیست

FCE

هسته پژوهشی سوخت،
احتراق و آلایندگی

VERT certified for Health and Climate

Abstract

Iran's big cities air pollution is one of the major challenges to authorities in view of public health. Tehran City, with about 9 Million resident, has been facing more and more air quality problems over the last decade. The criteria pollutants in Tehran are PM2.5, PM10 and NO2. 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[1] test procedure, by FCE[2] 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[3]	• Exhaust Gas mixture. • emitted PM, PN during test points • Temperature and pressure analysis before and after DPF	• MRU (Gas Analyzer) • NM3 (Particle counter) • AVL sampling unit (particle mass collector) • Pressure and Temperature sensors
Engine Equipped with DPF		
Regeneration test		
PM and PN efficiency test		

[1] . VERT filtration test
[2] . Fuel ,Combustion and Emissions group
[3] . Stationary 4-points-test cycle

After analyzing phase 1 results, approved DPFs were sent to Tehran, for fieldwork tests. 18 BRT[4] from different lines with various working paths, were selected and equipped with data logger by ASA[5] Company. By the time, 9 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/Aug/2016.

Table 2. Installed DPFs

DPF Producer Company	Operation Report			Maintenance and Cleaning History
	Installation date	Working days	Bus mileage	
HJS_01 (Passive system with FBC) V. ID: 78514 (line 4)	10/Sep/2014	721 days	91208 km	DPF core was cleaned on 2015/Jun/13 for the first time. The second cleaning was done on 2016/Jul/11. Due to some wiring problems, the DPF core was replaced with muffler on Jul 13th.
Dinex_01 (Passive system with FBC) V. ID: 78515 (line 4)	22/Oct/2014	403 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.)
PURItech (Passive system with FBC) V. ID: 78524 (line 4)	28/Jan/2015	582 days	102548 km	DPF core was removed on Jul 22nd and was cleaned on Aug 12th for the first time. Considering system relatively high backpressure, filter isolation defect and air filter's deformation, DPF core was removed on Sep 16th and installed on Nov 17th. The third cleaning was unavoidable after only 6 days working and was done on 29th Nov. System only worked for two days and DPF was replaced by muffler on Nov 30th. DPF was installed for the fourth

[4] . Bus rapid transient
[5] . Azmoon Sanat Arvin

				time on Jan/19/2016 and was replaced by muffler after only three days working because of high backpressure. A new DPF core was installed on May/14/2016 and was cleaned on Jun/25/2016. The DPF core was replaced by muffler on Jul/10/2016 due to high backpressure.
HJS _02 (Active system with FBC - Electrical Heater) V.ID: 85423 (line 4)	19/Feb/2015	573 days	94460 km	DPF was cleaned on 2016-02-03 for the first time and on 2016-07-10 for the second time.
HJS_03 (Active system with FBC - Electrical Heater) V.ID: 33572 (line 2)	19/Feb/2015	529 days	76653 km	DPF was cleaned on Oct 5th for the first time. The second cleaning was done on Dec 19th. The third cleaning was done on Apr 2nd after 55613 km. A new core was installed on Jun 12th. New core was cleaned on 2016.06.25 for the first time.
HJS_04 (Passive system with FBC) V.ID:85476 (line 10)	23/Feb/2015	560 days	72668 km	DPF was cleaned on 22nd Jul for the first time and on 15th Dec for the second time after 44355 km mileage from installation date.
Dinex_02 (Passive system with FBC) V.ID: 33637 (line 2)	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.

Tehag_01 (Catalyzed DPF) V.ID: 85182 (line 10)	24/Sep/2015	323 days	25173 km	DPF has been working from installation date until now without any cleaning.
Tehag_02 (Catalyzed DPF) V.ID: 33592 (line 2)	25/Jan/2016	189 days	13489 km	DPF has been working from installation date until now without any cleaning.

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

Table 3. DPFs' operation status during Feb

Vehicle ID	DPF Producer Company	Operation Status Jun/01/2016 - Jun/15/2016	Operation Status Jun/16/2016 - Jun/30/2016
78514 (line 4)	HJS_01	5	5
85423 (line 4)	HJS _02	2	1
78515 (line 4)	Dinex_01	6	6
78524 (line 4)	PURItech	5	5
33572 (line 2)	HJS_03	2	1
33637 (line 2)	Dinex_02	5	5
85476 (line 10)	HJS_04	2	6
85182 (line 10)	Tehag_01	1	1
33592 (line 2)	Tehag_02	1	1

Status Number	Operation Status	Description
1	Excellent	Pressure above 200 mbar<0.1% ($P200 \sim 0$)
2	Good	$0.1\% \leq P200 \leq 3\%$
3	Maintenance required	$P200 > 3\%$ 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
7	No data	Data logger or sensors' problem

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)

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/Aug/2016 – 15/Aug/2016 (fifteen days)
K value - DPF upstream	1.95 [1/m]
K value – DPF downstream	0.02 [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF was cleaned on Oct 5th for the first time. The second cleaning was done on Dec 19th. The third cleaning was done on Apr 2nd after 55613 km. A new core was installed on Jun 12th. New core was cleaned on 2016.06.25 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)	75041 km
Bus mileage over the period	2669 km
Working days over the period	15 days
Stop days	0 day
Data logger working days	15 days
Working hours over the period	174 hours 22 minutes
Average working hours per day (including stop days)	11 hours 37 minutes
Bus average speed	15.3 km/hr
idle speed time to all working time ration	49.3 %
Total Bus fuel consumption over the period	1388 lit
Fuel consumption per hour	7.95 lit/hr
Average fuel consumption	0.52 lit/km
Total Bus additive consumption over the period	0.663 lit
Average additive consumption	248.5 cc/km
Additive consumption to fuel ration	478 cc/1000lit

Temperature, Pressure and Engine Speed Overview

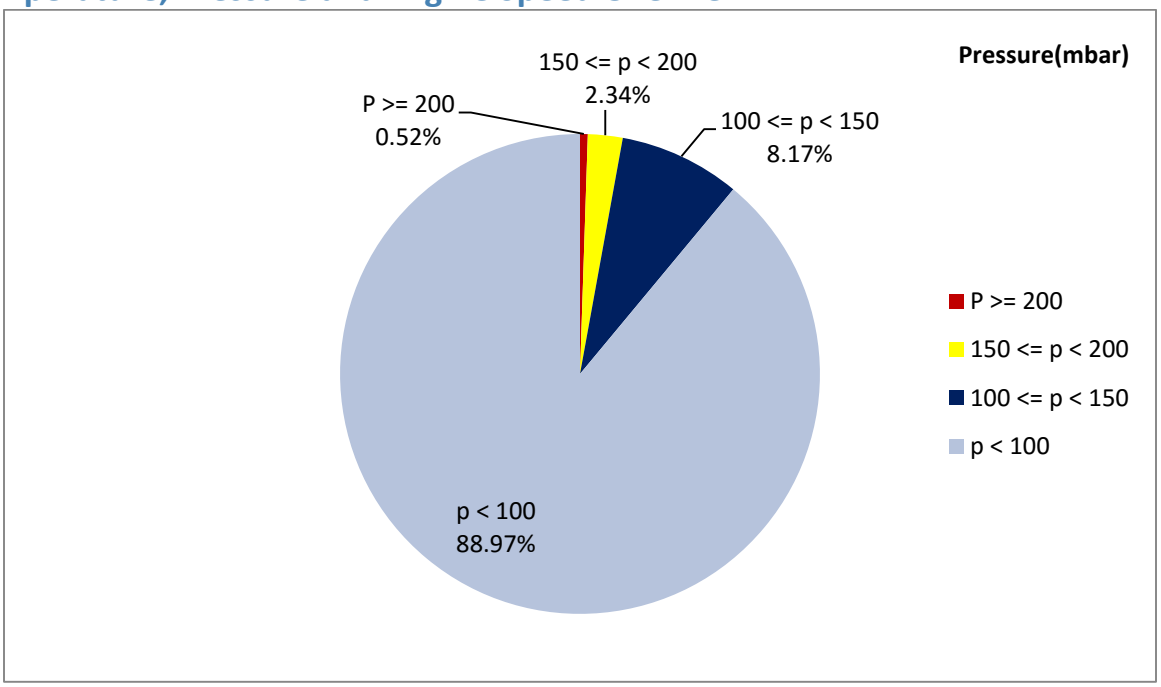


Figure 1- Pressure distribution over the working hours

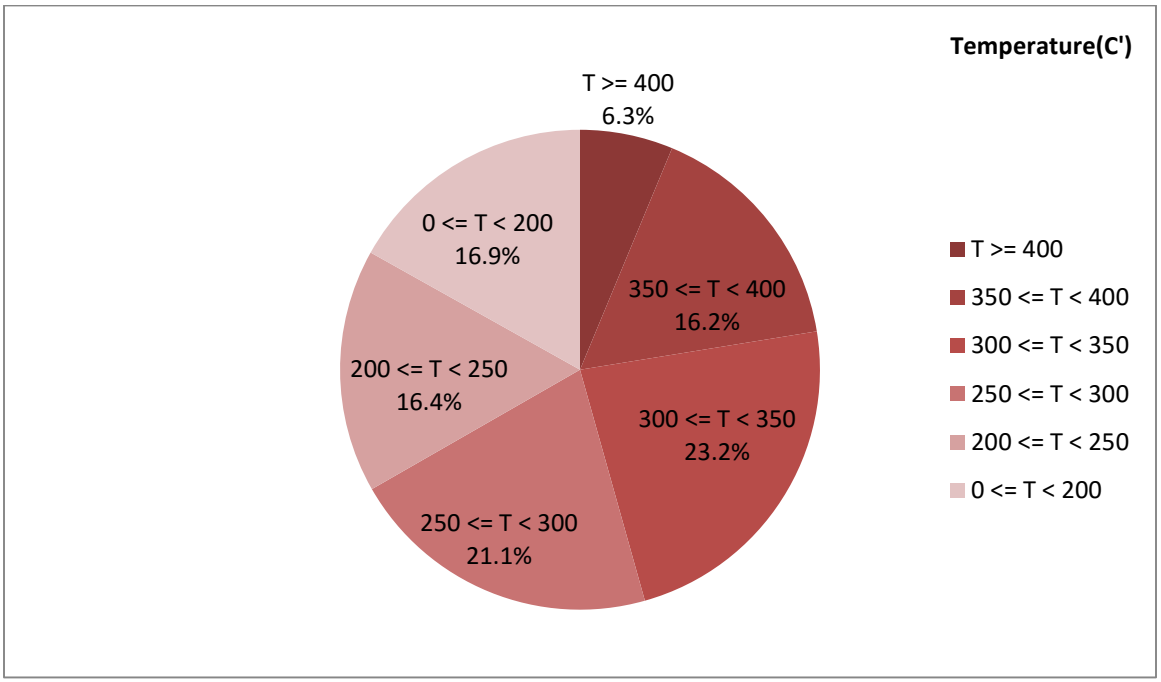


Figure 2-Temperature distribution over the working hours

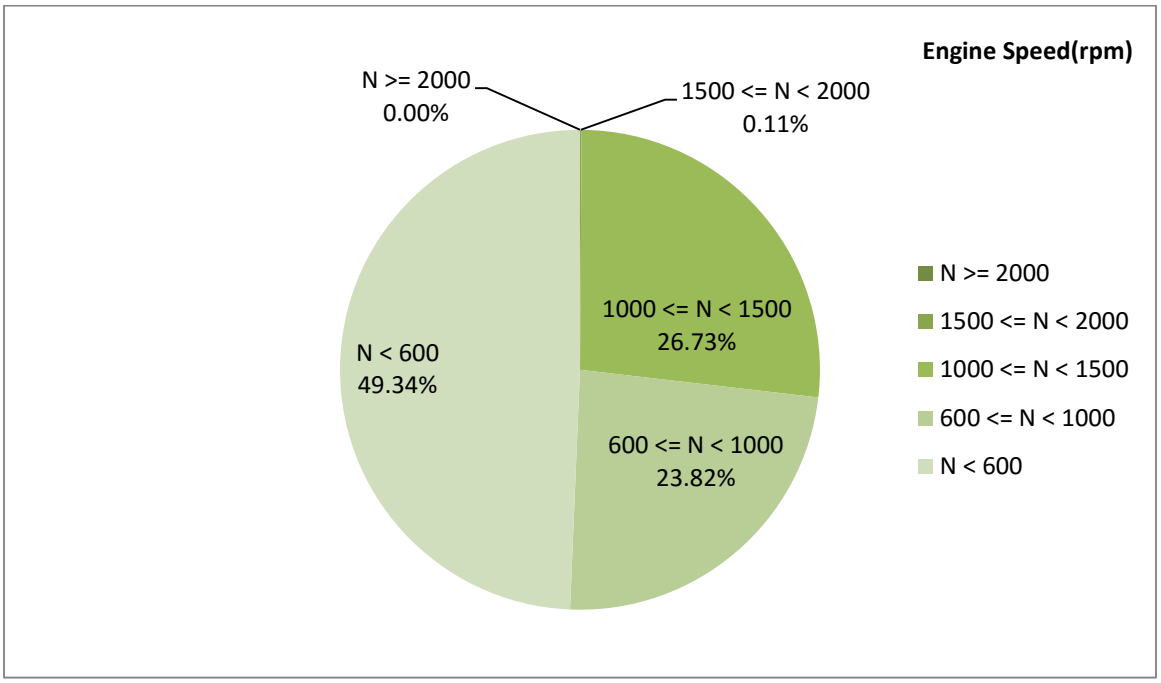


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
284.6	44.59	768

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
338.3	70.74	983

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
526-50	387-0	2064-256

Detailed Pressure Analysis

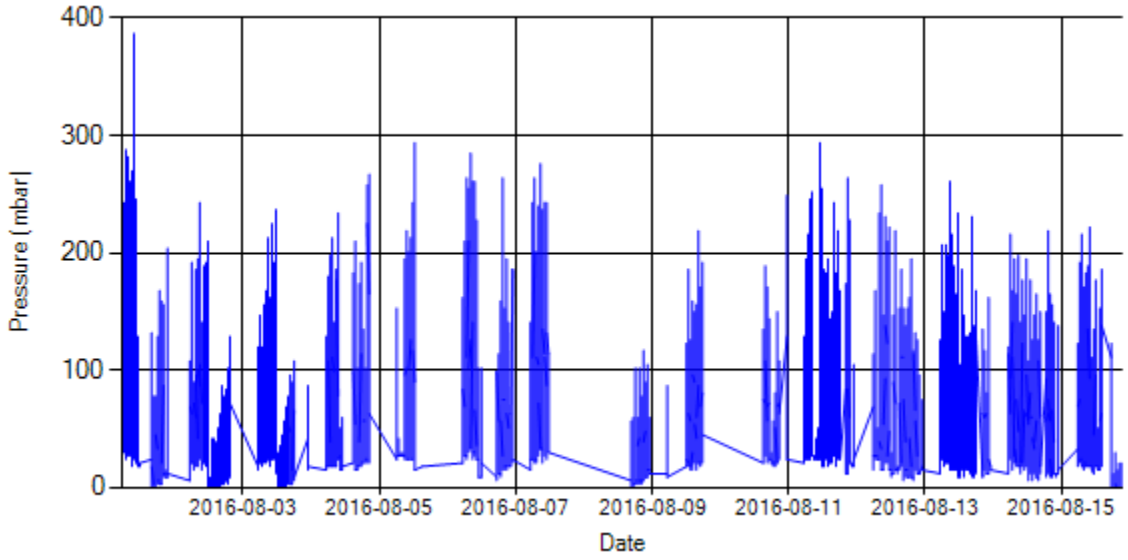


Figure 4- Pressure distribution over the period

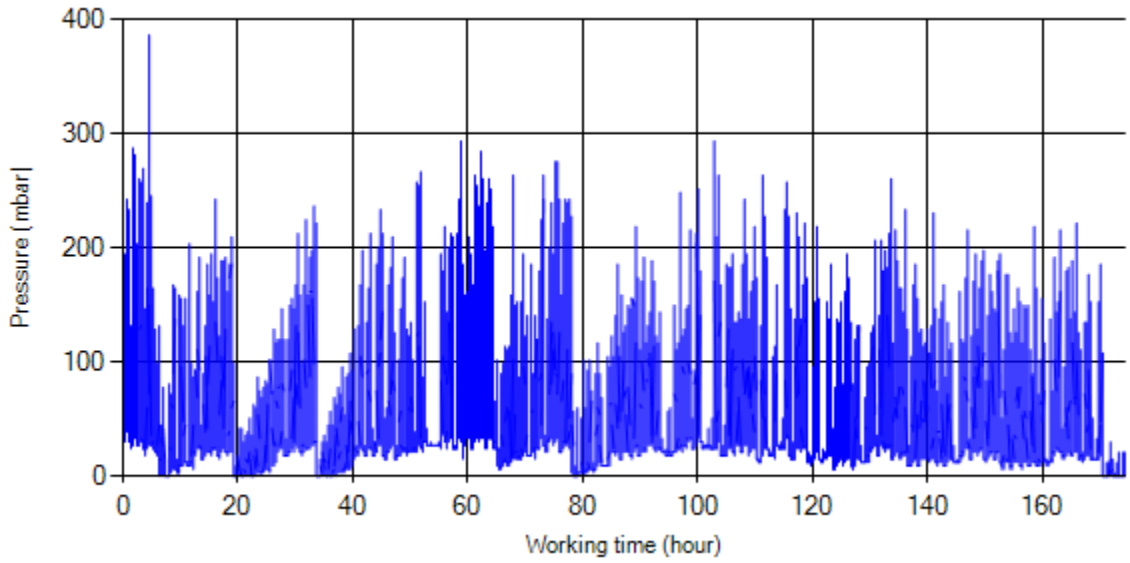


Figure 5- Pressure vs. working hours

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

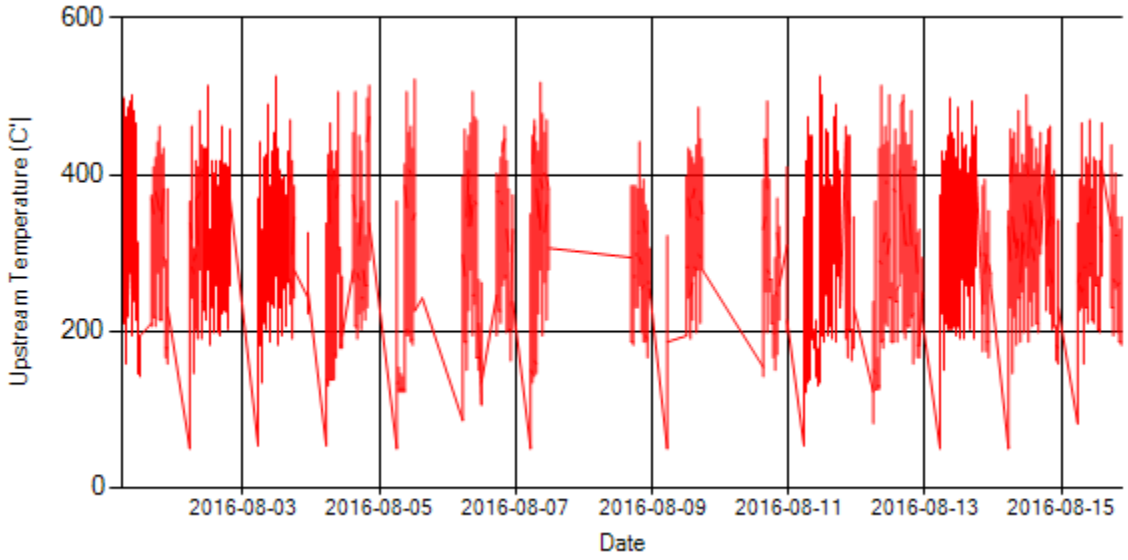


Figure 6- Temperature distribution over the period

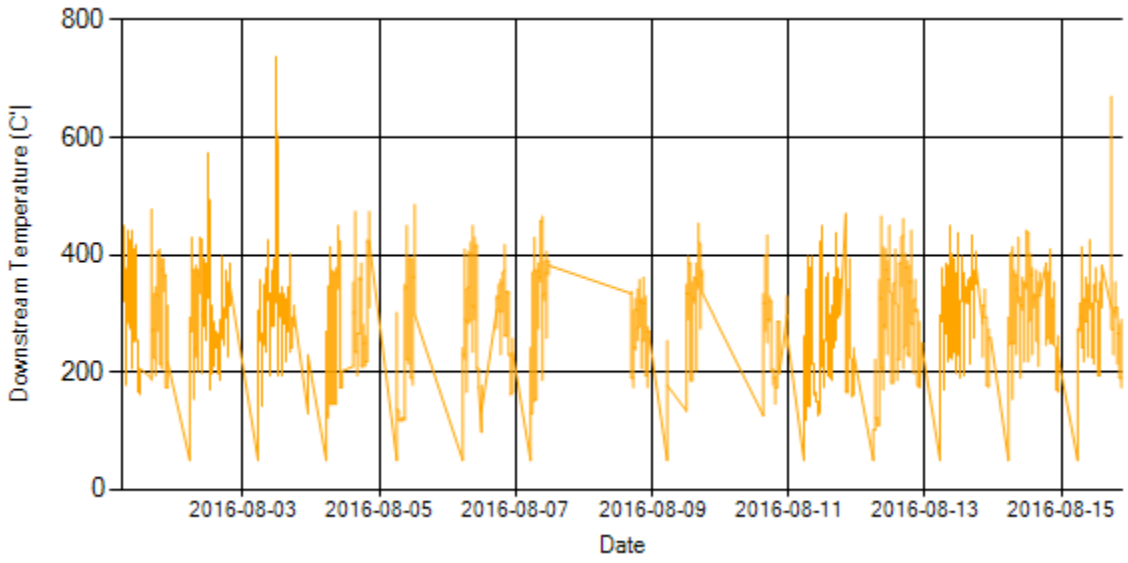


Figure 7- Temperature distribution over the period

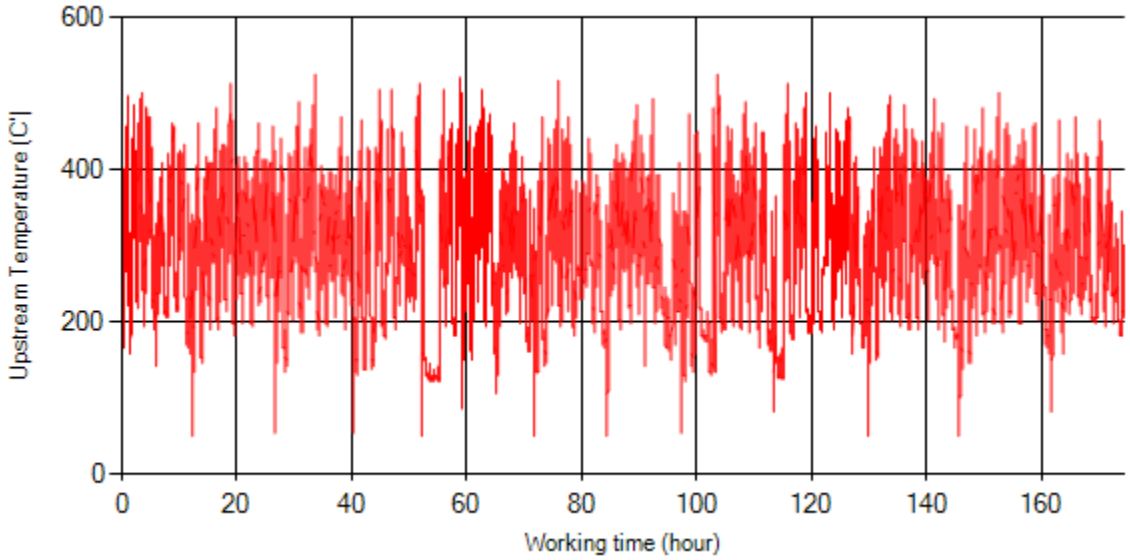


Figure 8- Temperature vs. working hours

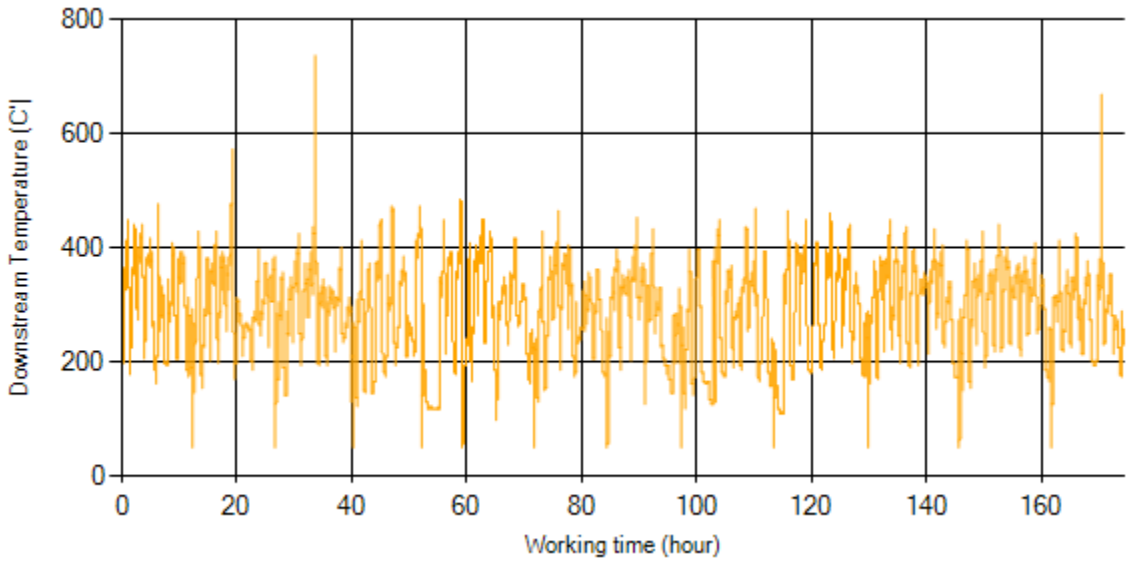


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

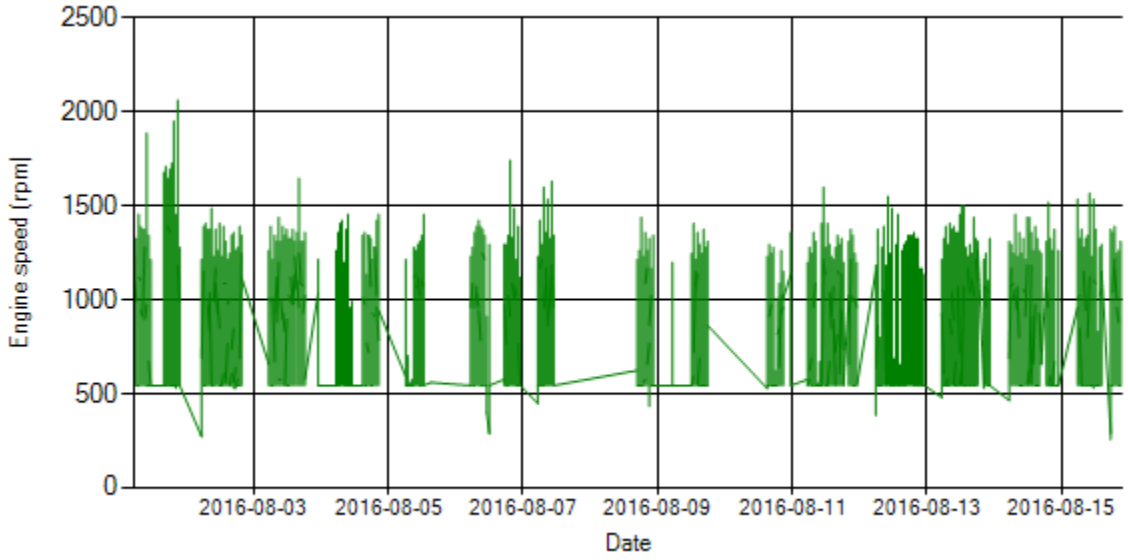


Figure 10- Engine speed distribution over the period

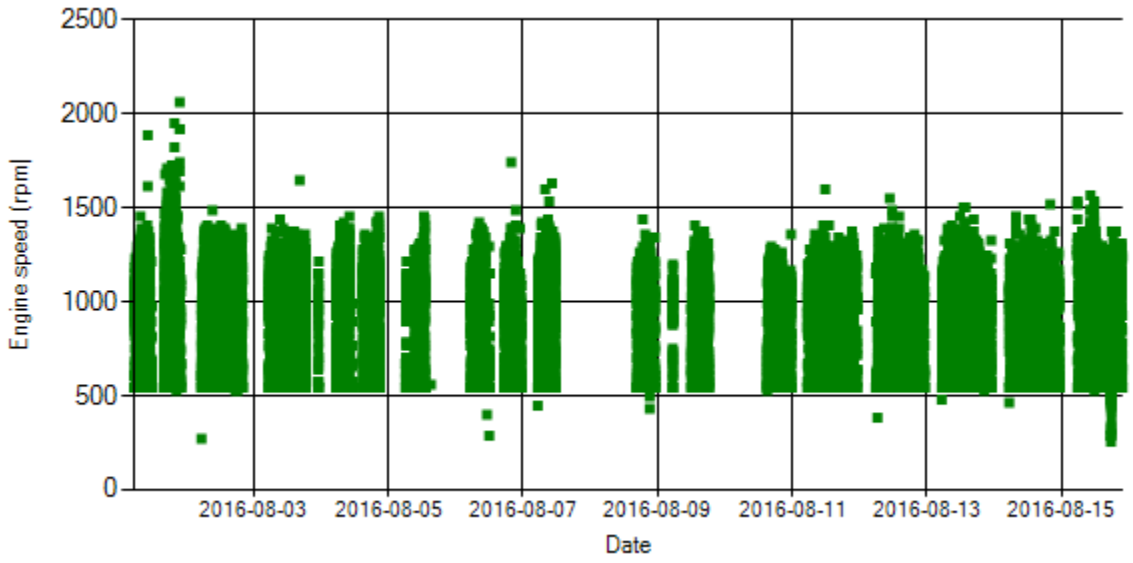


Figure 11- Engine speed diagram for calculating CPK's working days

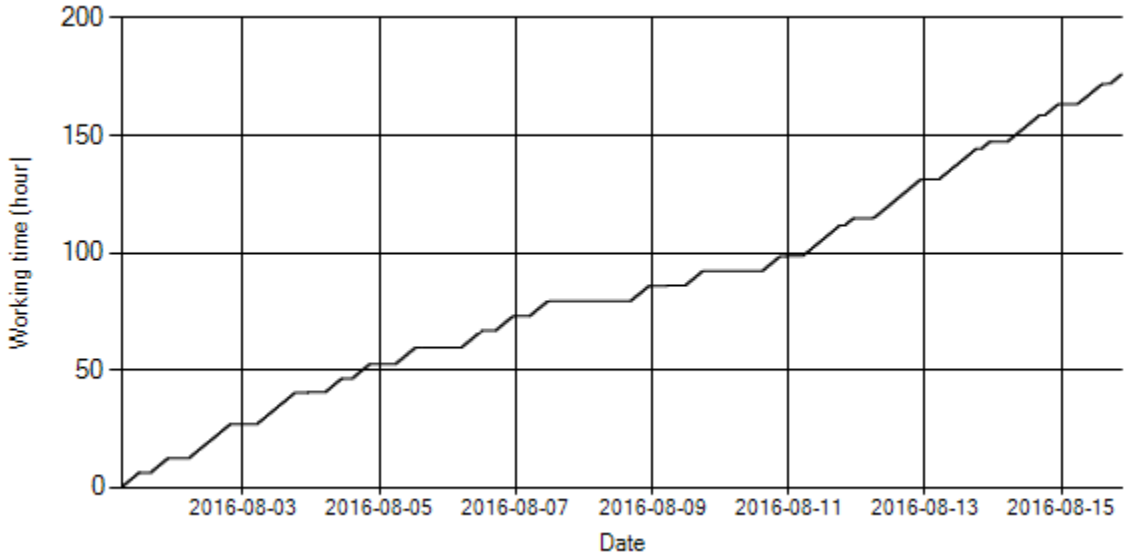


Figure 12- Time diagram for calculating CPK's working days

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 system was working all days of the period.

Pressure-Engine Speed diagrams

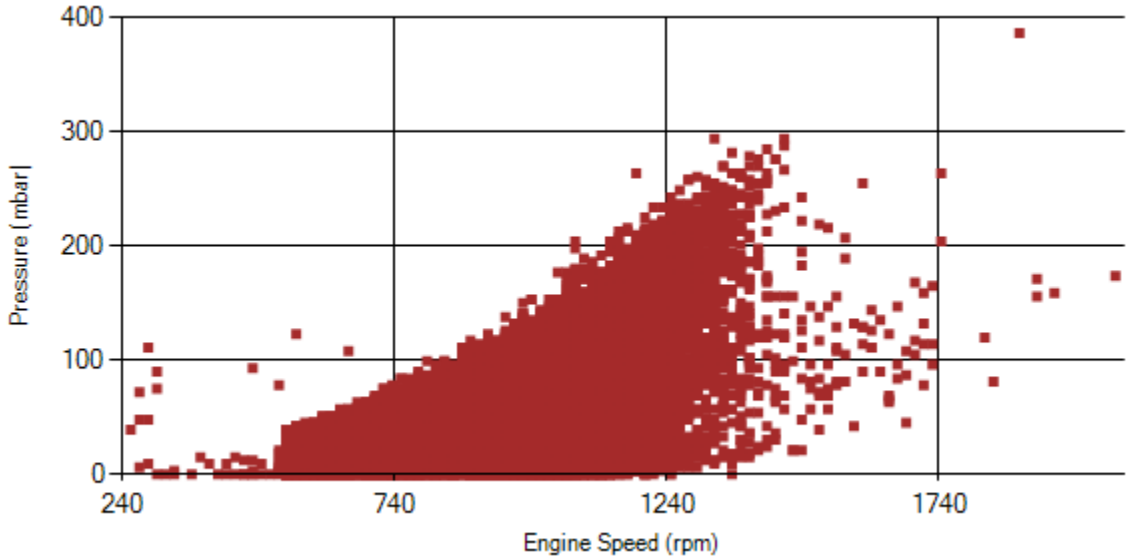


Figure 13- Pressure against engine speed

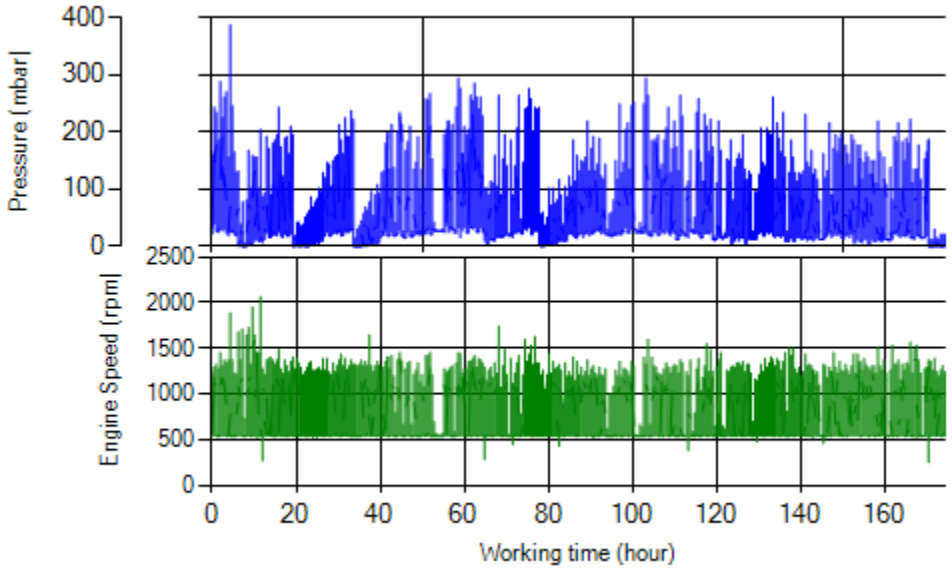


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

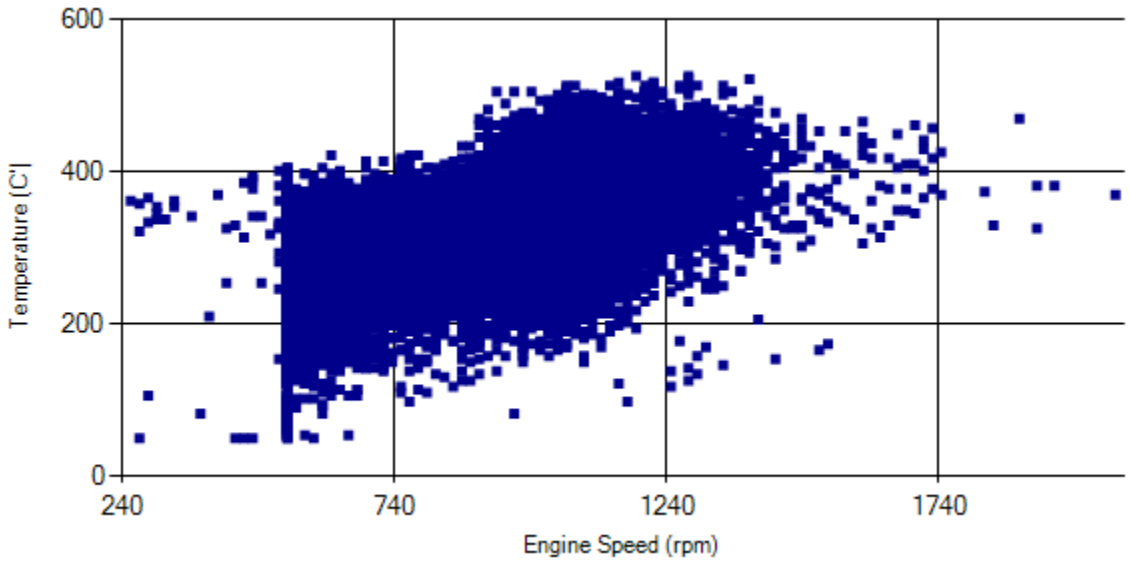


Figure 15- Temperature against engine speed

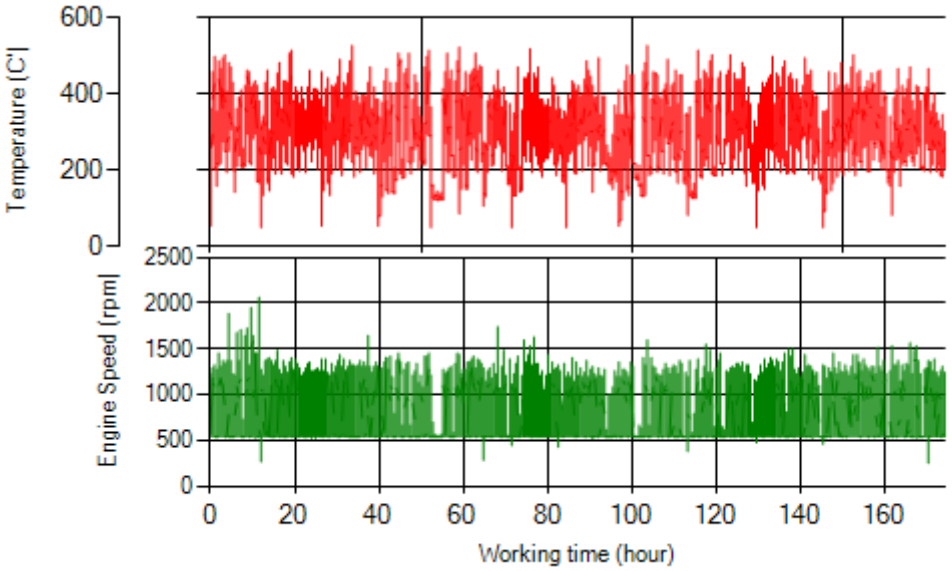


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 0.52% of total working time pressure is above 200 mbar and 2.86% above 150 mbar during this period.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed 22.5% of total working time temperature is above 350℃.

Filter operation status	Excellent ☐ Good ■ Maintenance required ☐ Failed ☐

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/Aug/2016 – 31/Aug/2016 (sixteen days)
K value - DPF upstream	1.95 [1/m]
K value – DPF downstream	0.02 [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF was cleaned on Oct 5th for the first time. The second cleaning was done on Dec 19th. The third cleaning was done on Apr 2nd after 55613 km. A new core was installed on Jun 12th. New core was cleaned on 2016.06.25 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)	76653 km
Bus mileage over the period	1612 km
Working days over the period	8 days
Stop days	8 days
Data logger working days	8 days
Working hours over the period	106 hours 46 minutes
Average working hours per day (including stop days)	6 hours 40 minutes
Bus average speed	15.1 km/hr
idle speed time to all working time ration	52.9 %
Total Bus fuel consumption over the period	838 lit
Fuel consumption per hour	7.85 lit/hr
Average fuel consumption	0.52 lit/km
Total Bus additive consumption over the period	0.398 lit
Average additive consumption	247.4 cc/km
Additive consumption to fuel ration	476 cc/1000lit

Temperature, Pressure and Engine Speed Overview

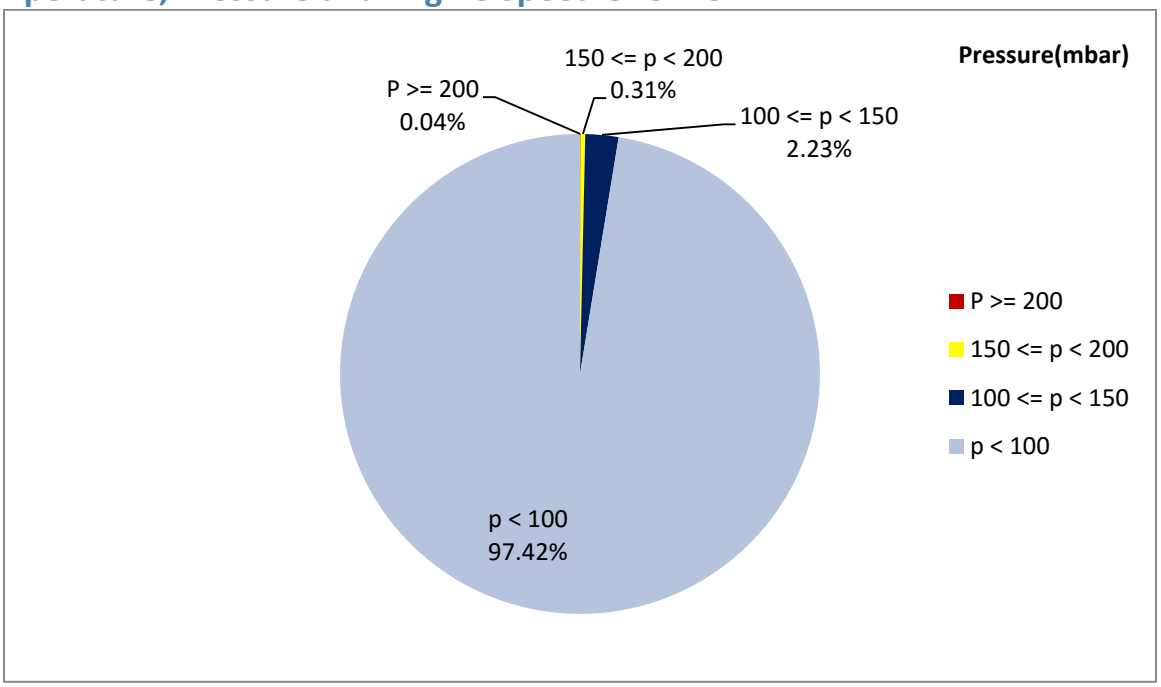


Figure 1- Pressure distribution over the working hours

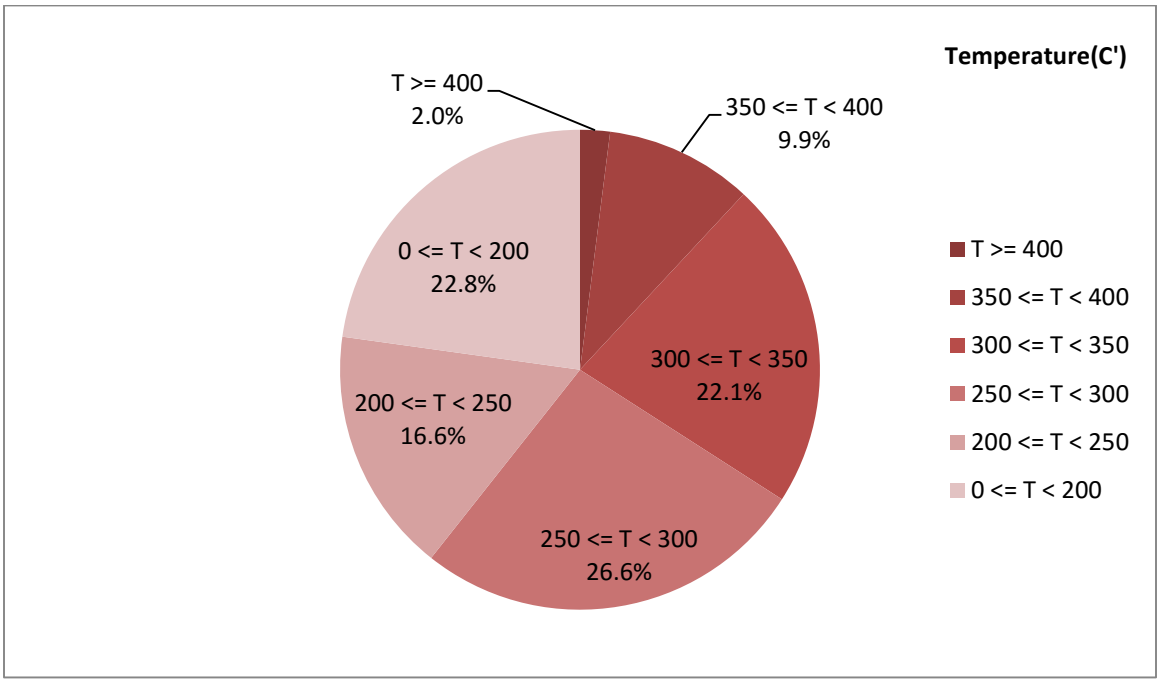


Figure 2-Temperature distribution over the working hours

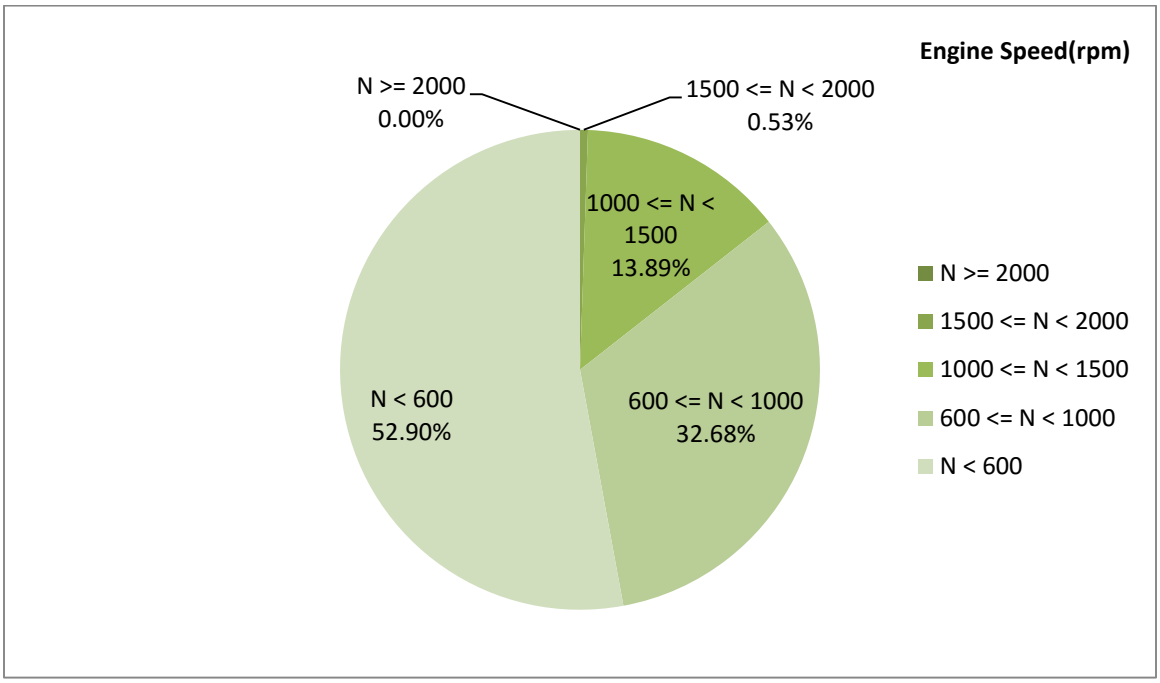


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
264.95	27.77	707

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
316.72	46.33	932

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
510-50	306-0	1952-304

Detailed Pressure Analysis

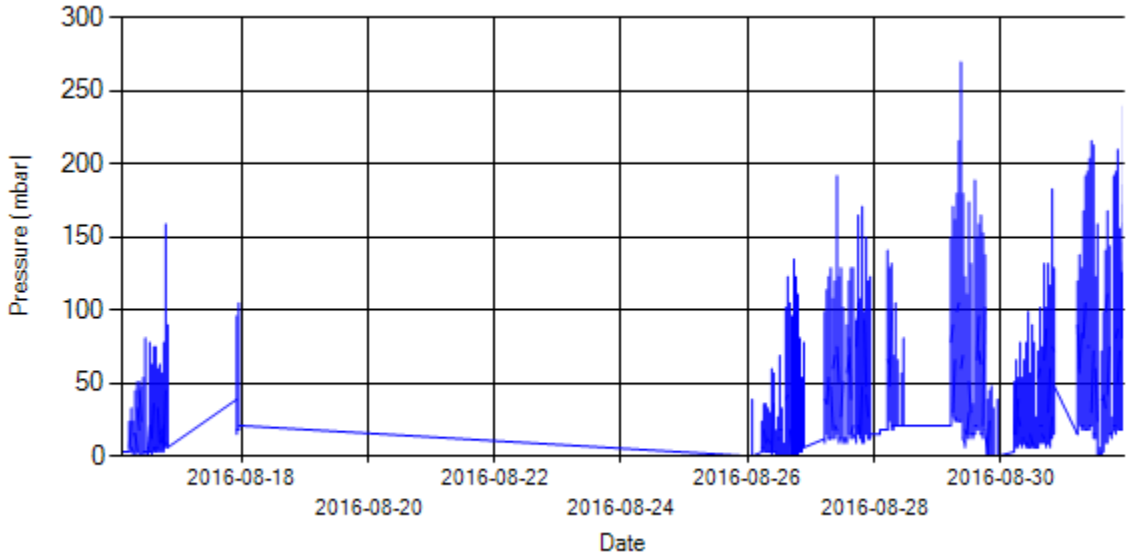


Figure 4- Pressure distribution over the period

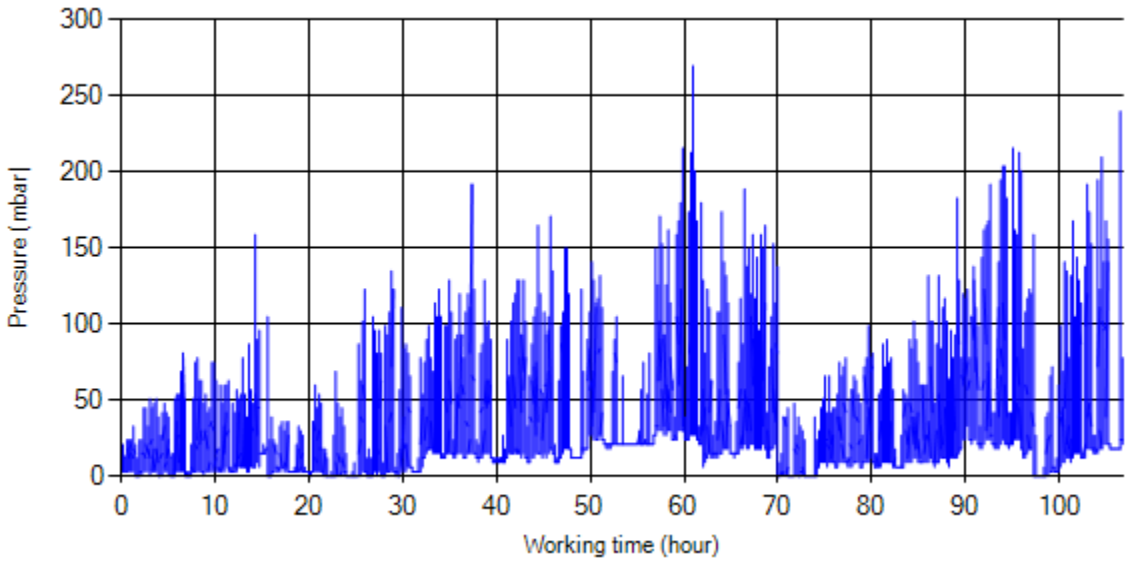


Figure 5- Pressure vs. working hours

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

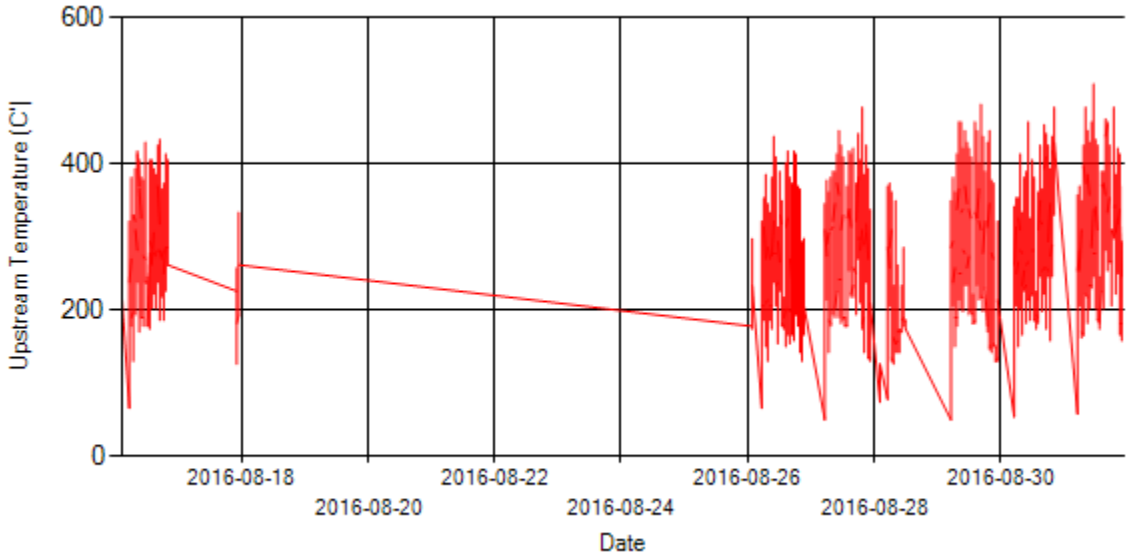


Figure 6- Temperature distribution over the period

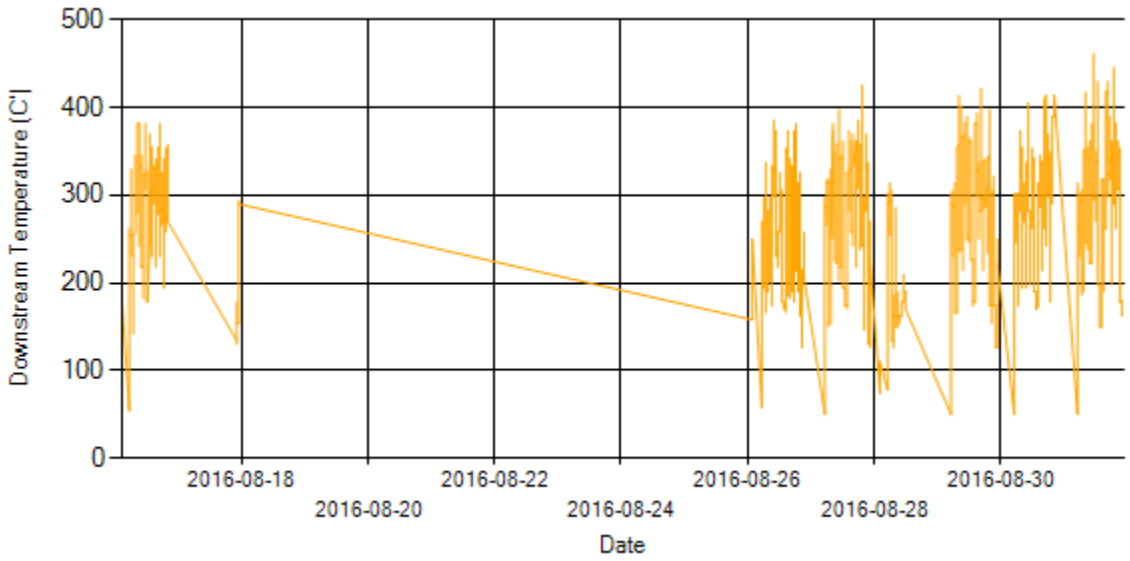


Figure 7- Temperature distribution over the period

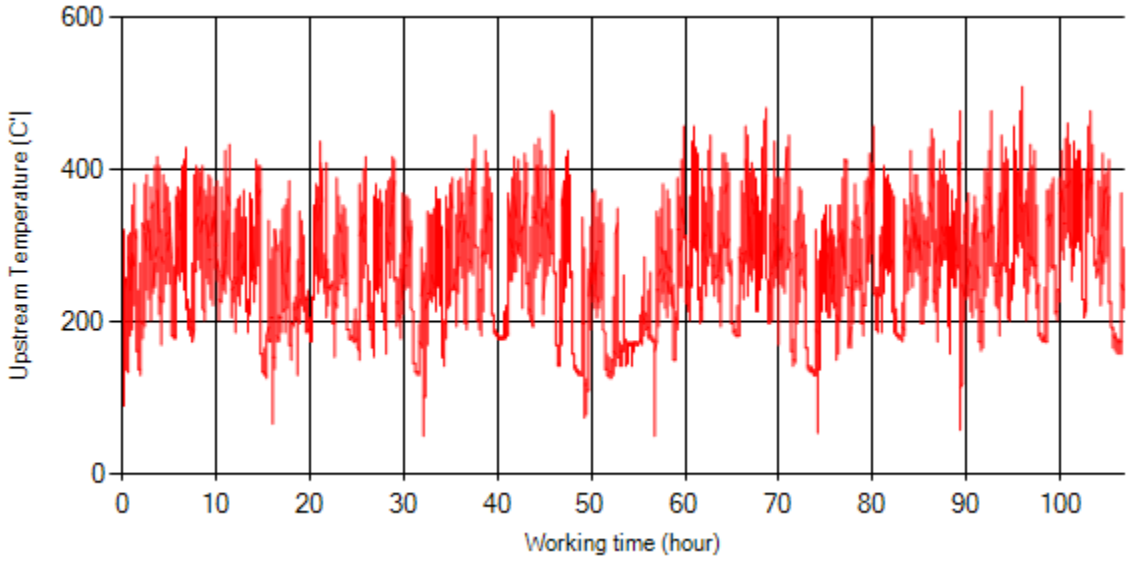


Figure 8- Temperature vs. working hours

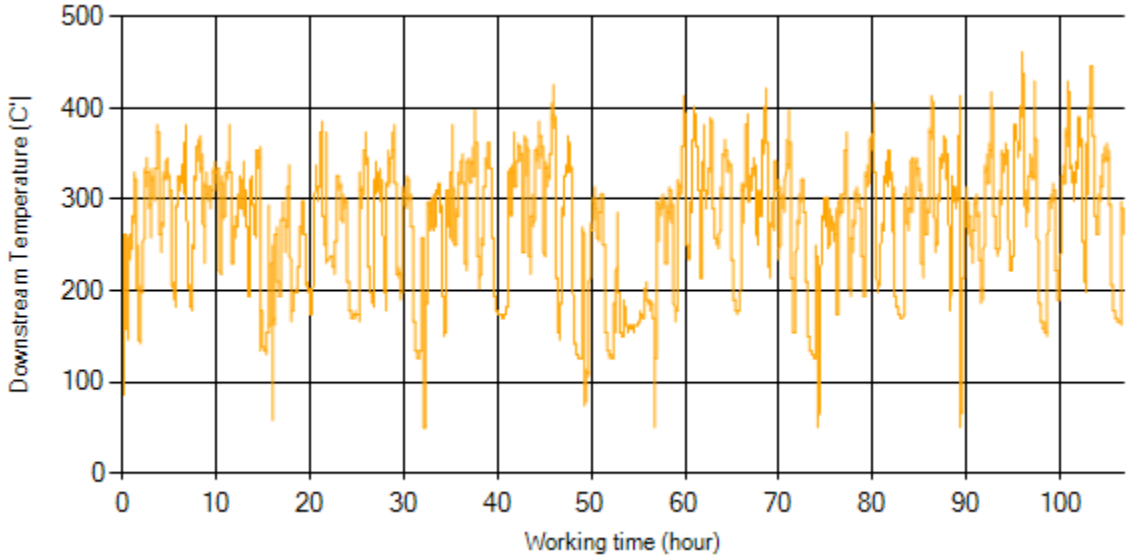


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

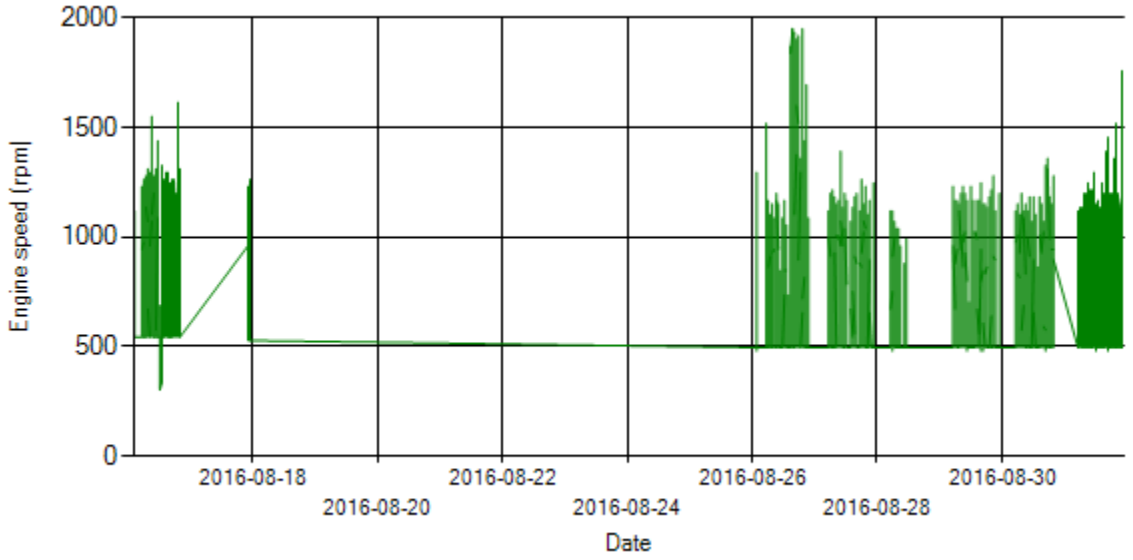


Figure 10- Engine speed distribution over the period

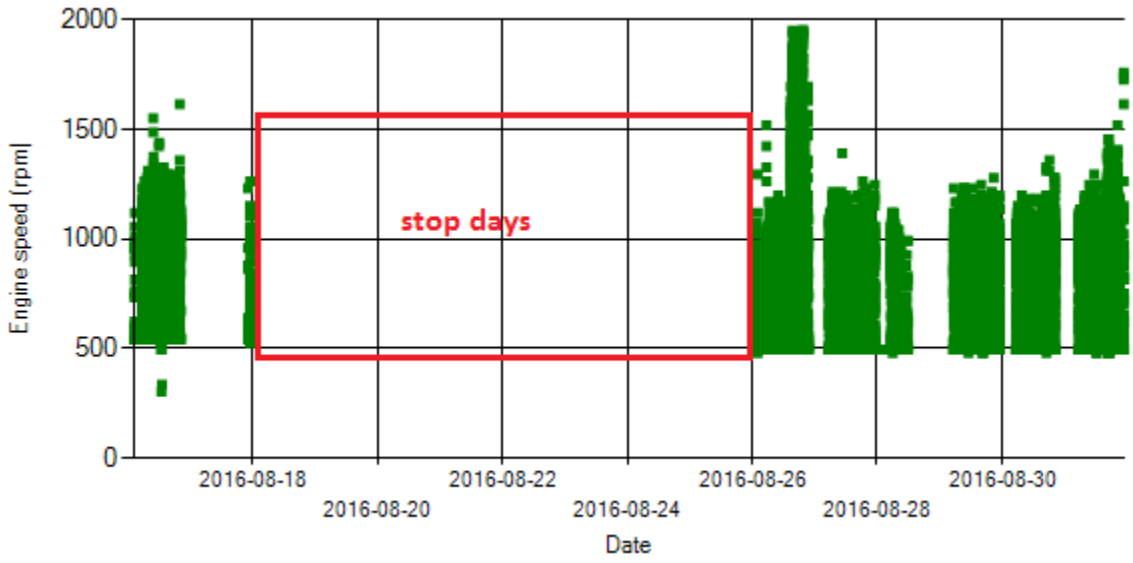


Figure 11- Engine speed diagram for calculating CPK's working days

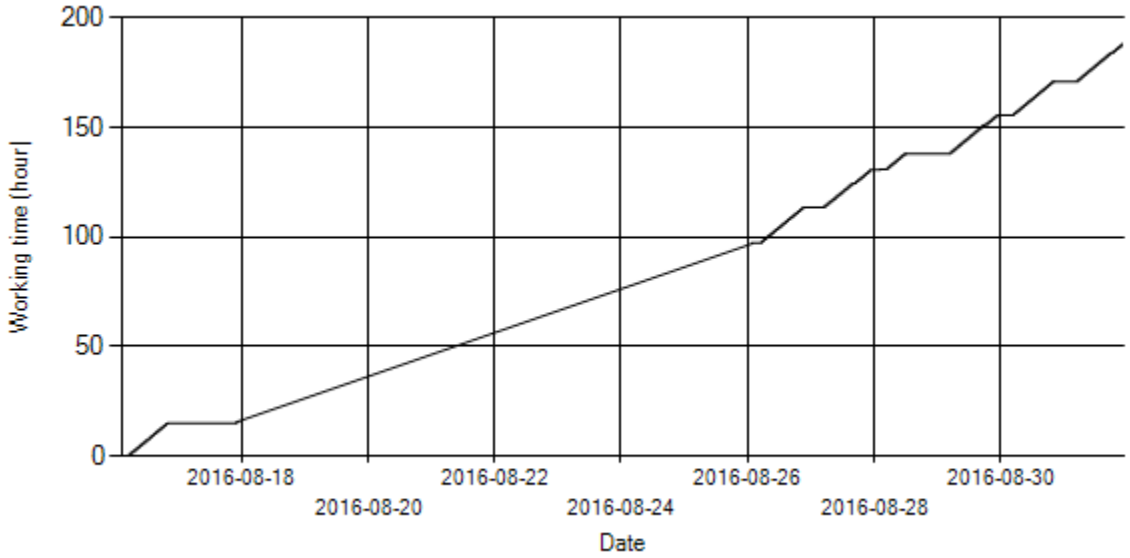


Figure 12- Time diagram for calculating CPK's working days

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 system was stationary for 8 days.

Pressure-Engine Speed diagrams

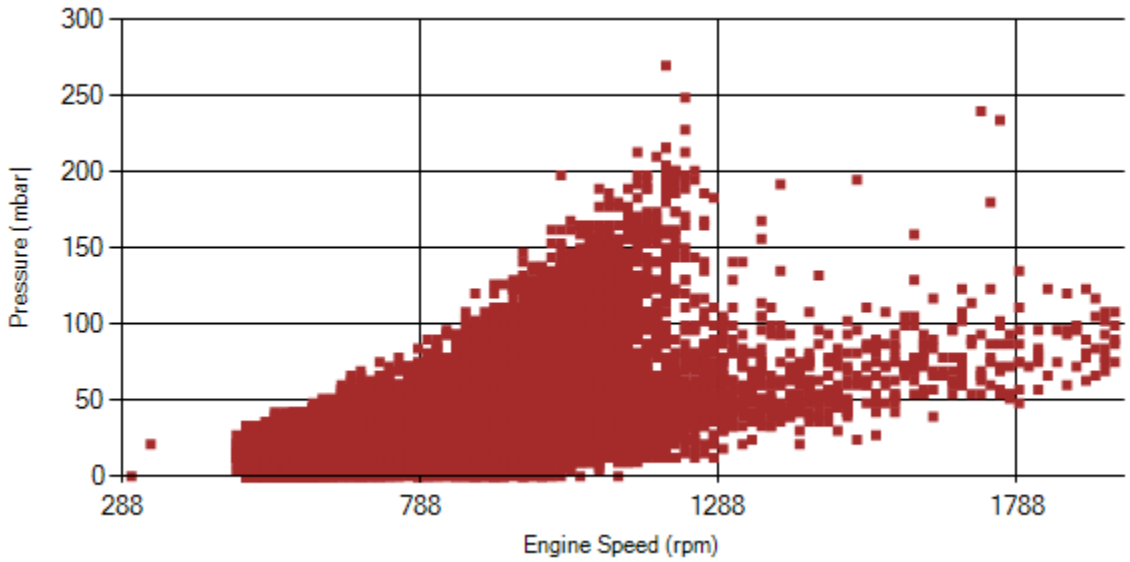


Figure 13- Pressure against engine speed

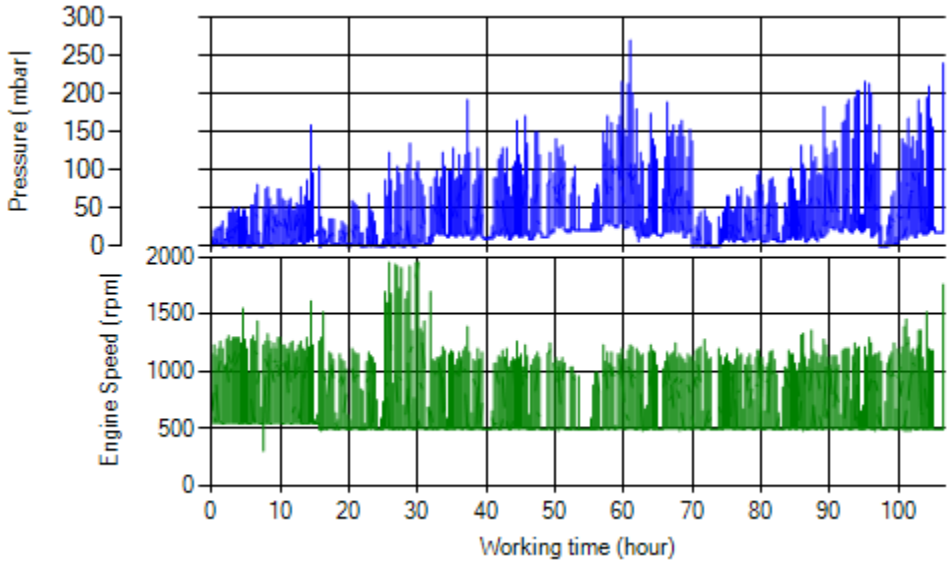


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

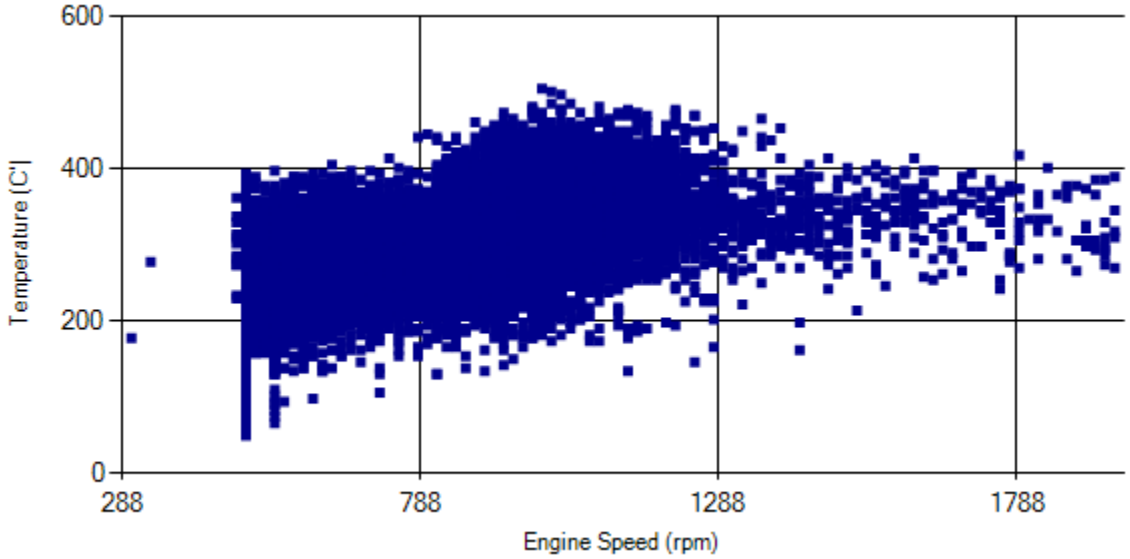


Figure 15- Temperature against engine speed

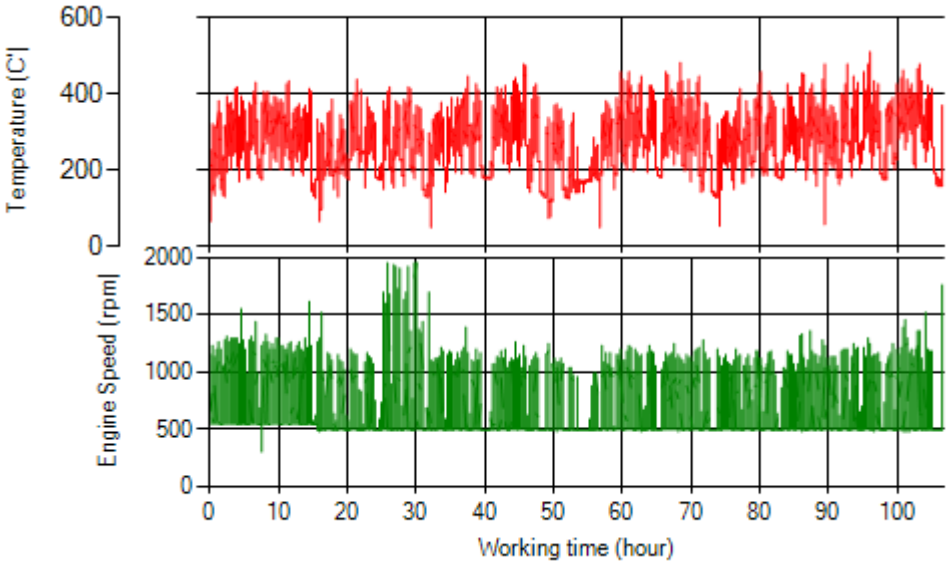


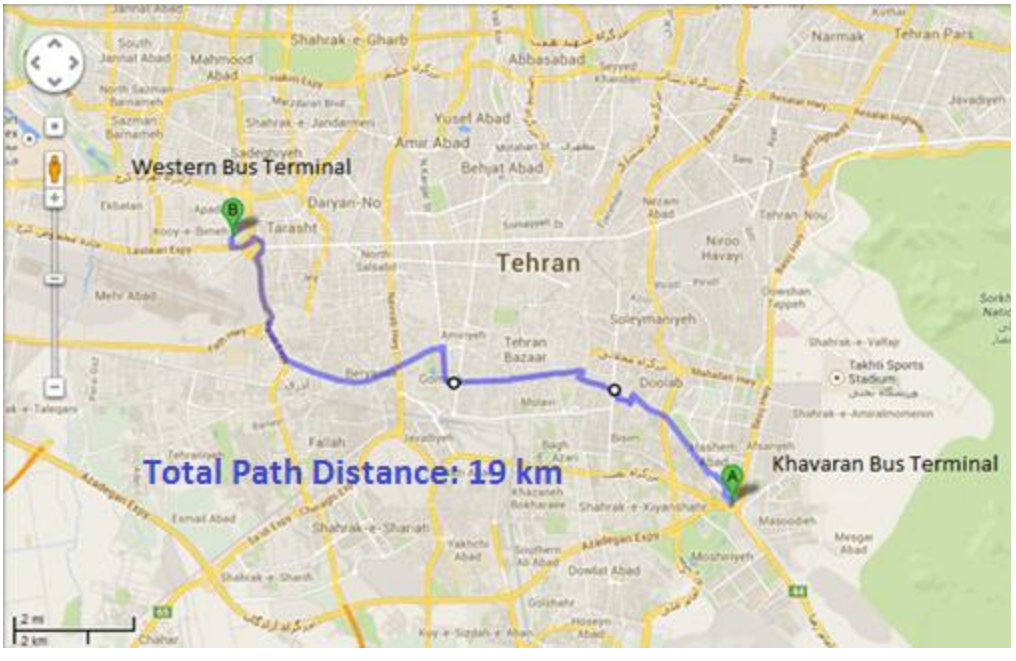
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 0.04% of total working time pressure is above 200 mbar and 0.35% above 150 mbar during this period.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed 11.9% of total working time temperature is above 350℃.

Filter operation status	Excellent ■ Good ☐ Maintenance required ☐ Failed ☐

Vehicle plate number	33592 (32441)
Bus line	Number 2 (west to east bus line)
DPF producer company	Tehag_02 (CDPF)



Overall Information

Table1- Overall Information

Vehicle plate number	33592 (32441)
CPK data logger number	LN: 001506, DN: 1927
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	Tehag_02 (Catalyzed DPF)
Installation date	25/Jan/2016
Report period	01/Aug/2016 - 15/Aug/2016 (fifteen days)
K value - DPF upstream	1.80 [1/m]
K value – DPF downstream	0.02 [1/m]

Table 2- DPF Maintenance History

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

Table 3- Fuel and Additive Consumption Information

Bus mileage (from DPF installation date)	12431 km
Bus mileage over the period	788 km
Working days over the period	7 days
Stop days	8 days
Data logger working days	7 days
Working hours over the period	55 hours 18 minutes
Average working hours per day (including stop days)	3 hours 41 minutes
Bus average speed	14.2 km/hr
idle speed time to all working time ration	59.68 %
Total Bus fuel consumption over the period	473 lit
Fuel consumption per hour	8.53 lit/hr
Average fuel consumption	0.60 lit/km

Temperature, Pressure and Engine Speed Overview

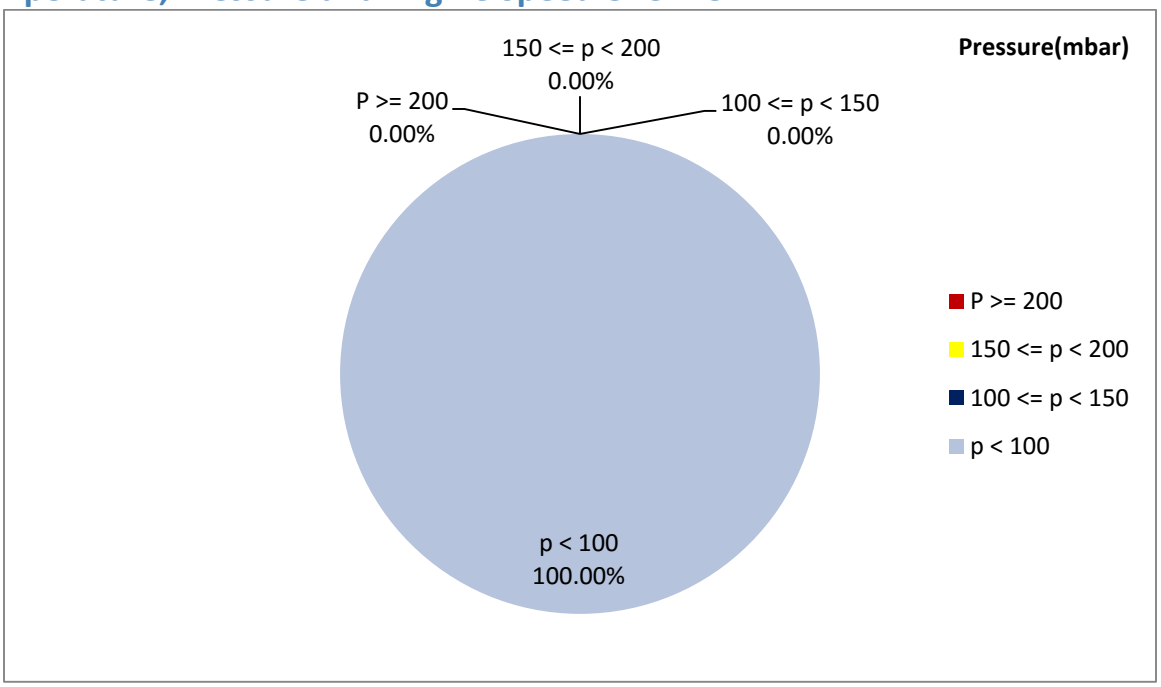


Figure 1- Pressure distribution over the working hours

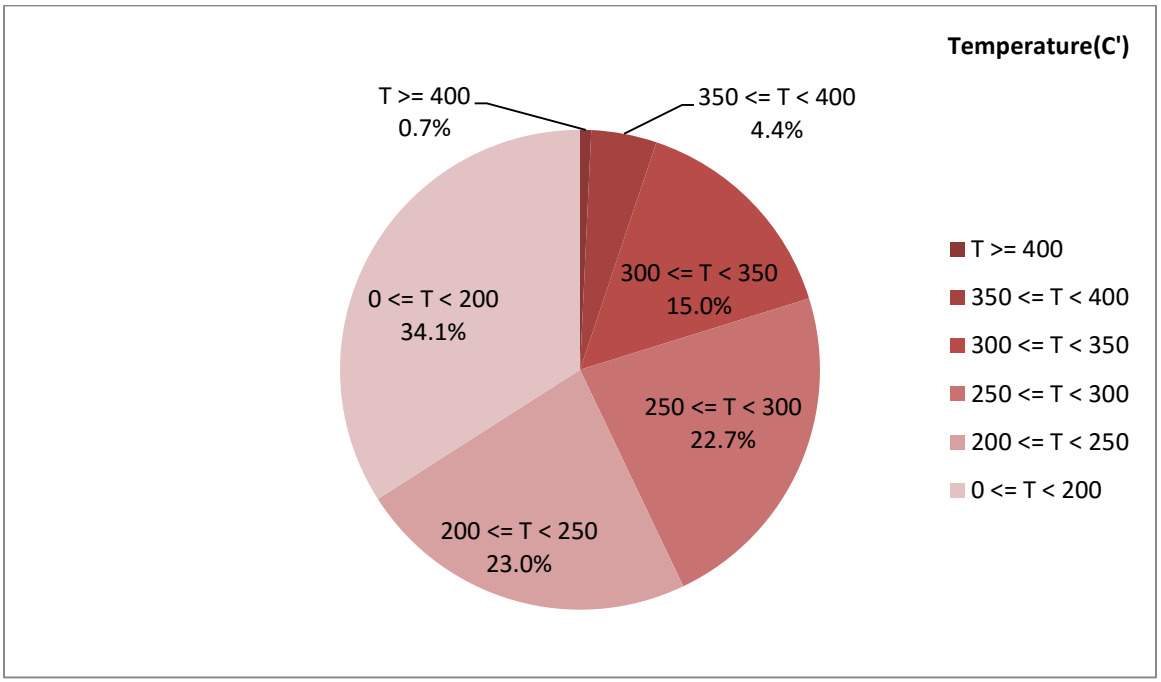


Figure 2-Temperature distribution over the working hours

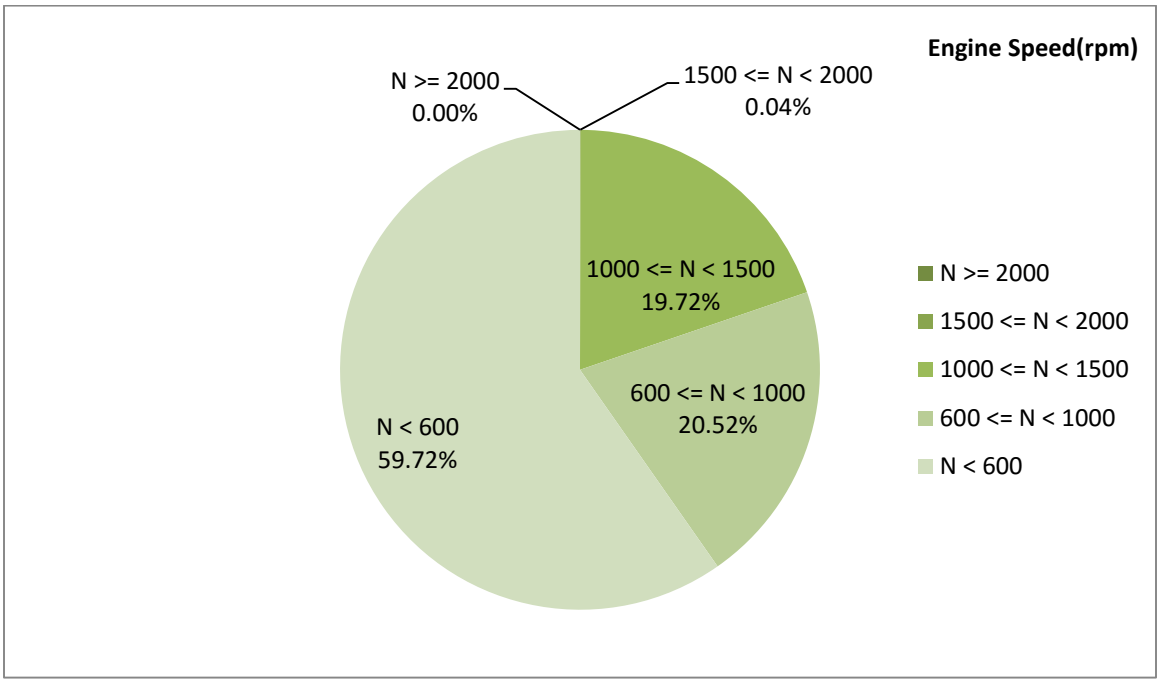


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
236.03	0.64	716

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
292.02	1.59	969

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
450-62	27-0	1696-272

Detailed Pressure Analysis

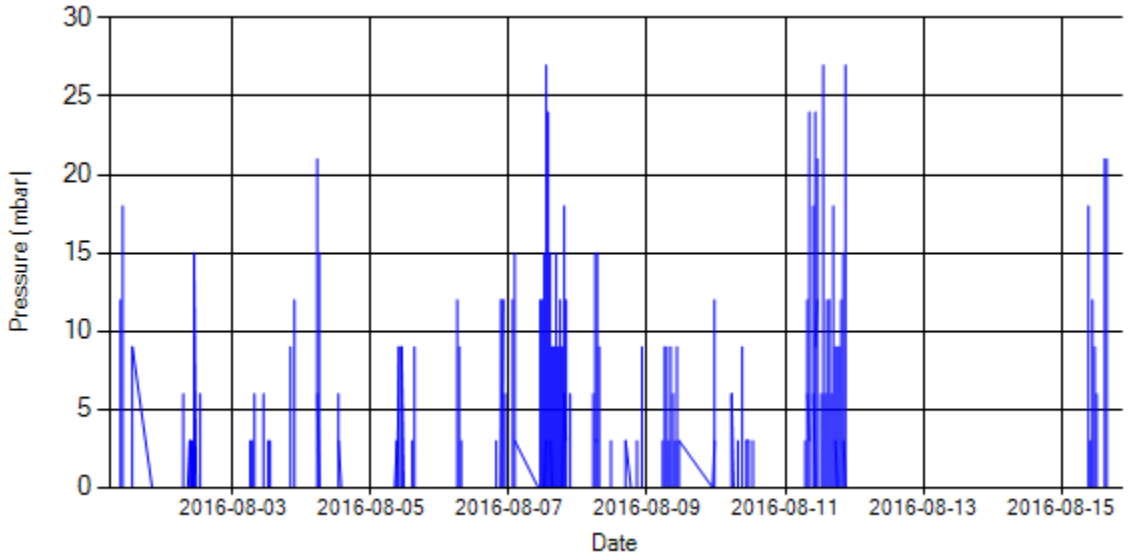


Figure 4- Pressure distribution over the period

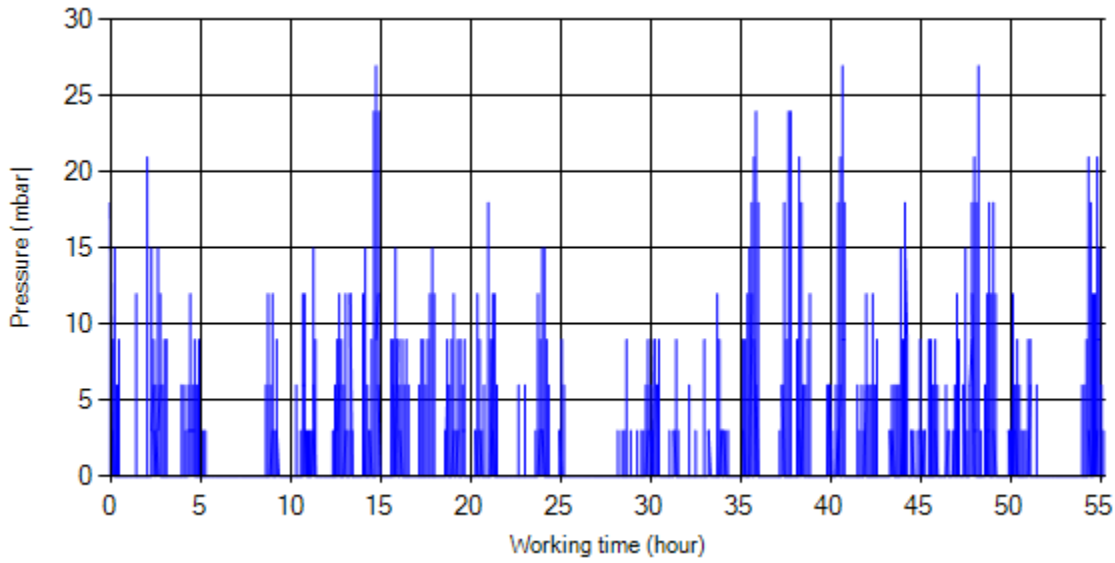


Figure 5- Pressure vs. working hours

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

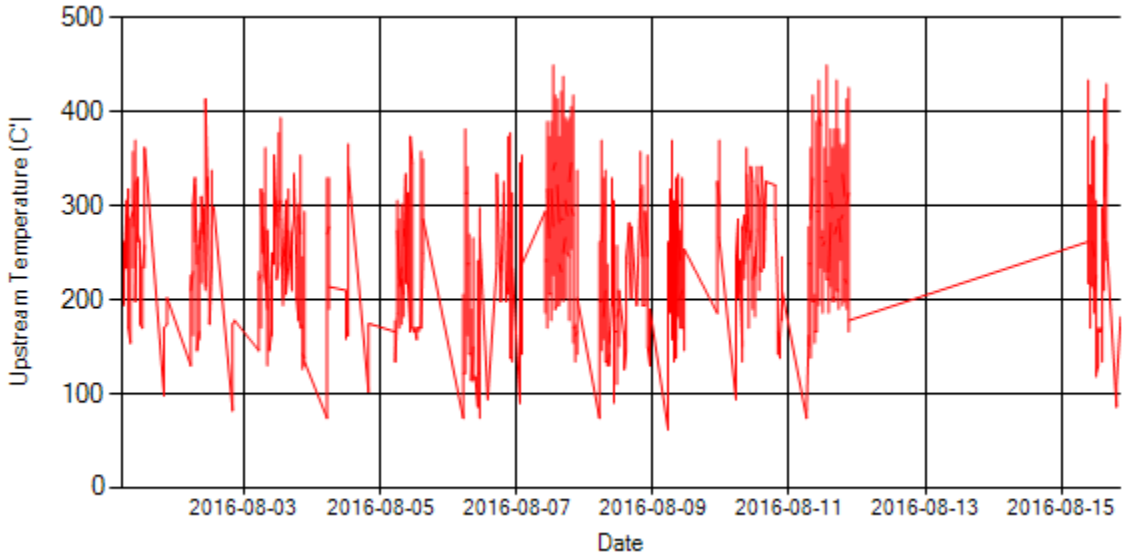


Figure 6- Temperature distribution over the period

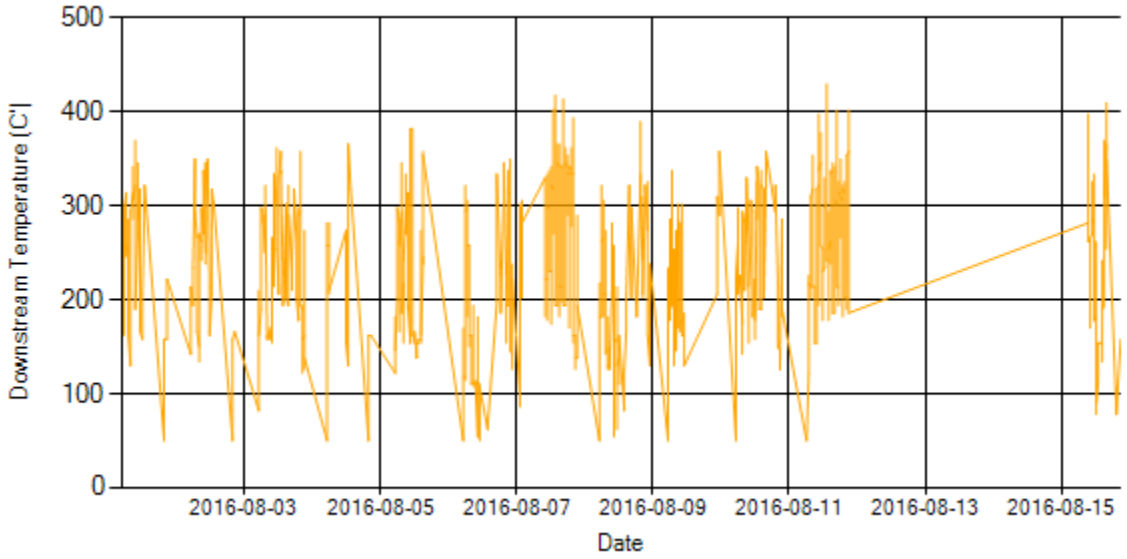


Figure 7- Temperature distribution over the period

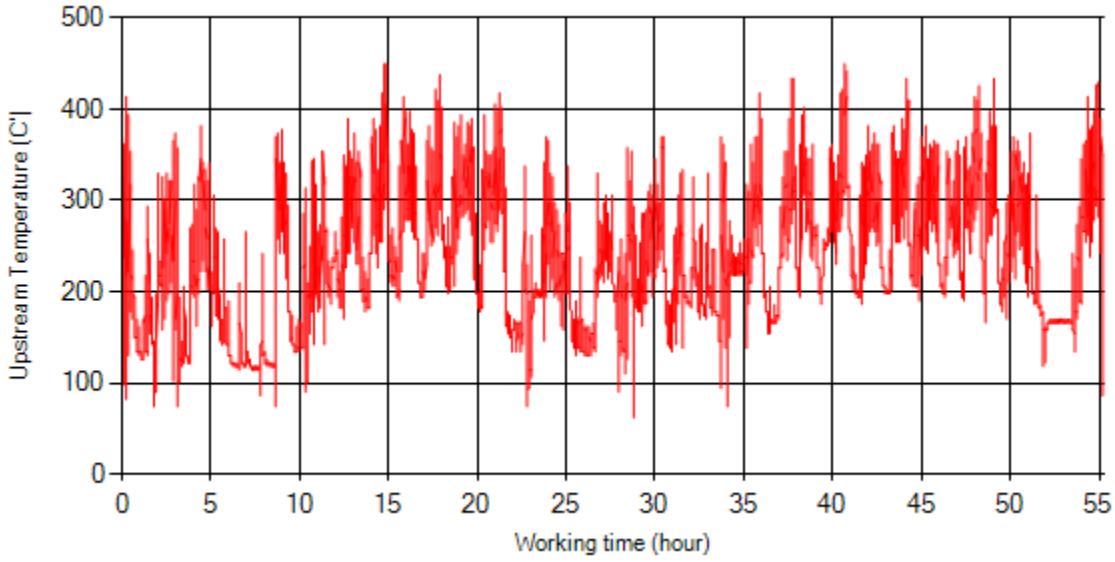


Figure 8- Temperature vs. working hours

Figure 9- Temperature vs. working hours

Engine Speed Diagrams

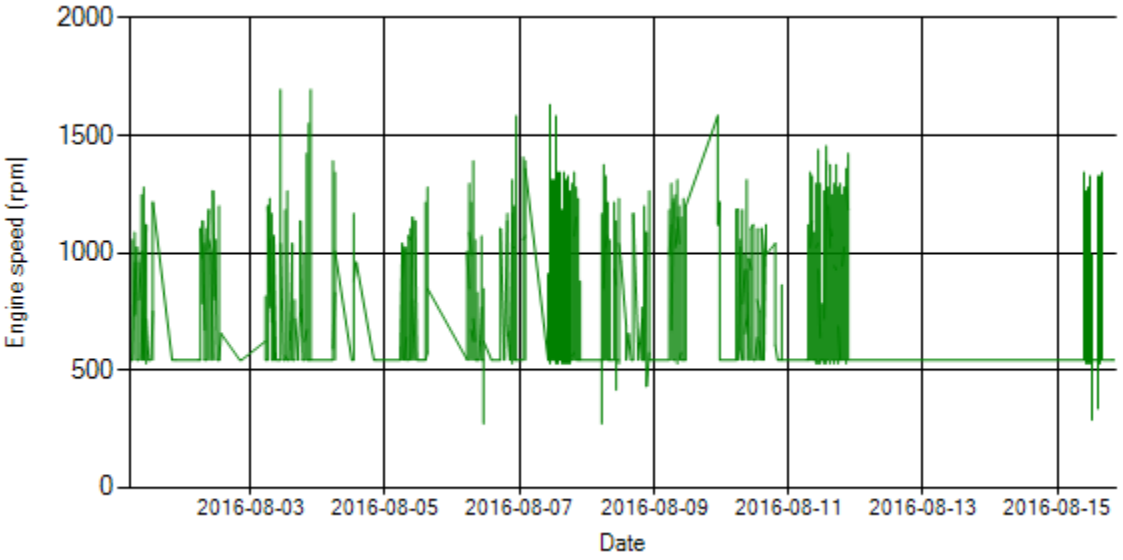


Figure 10- Engine speed distribution over the period

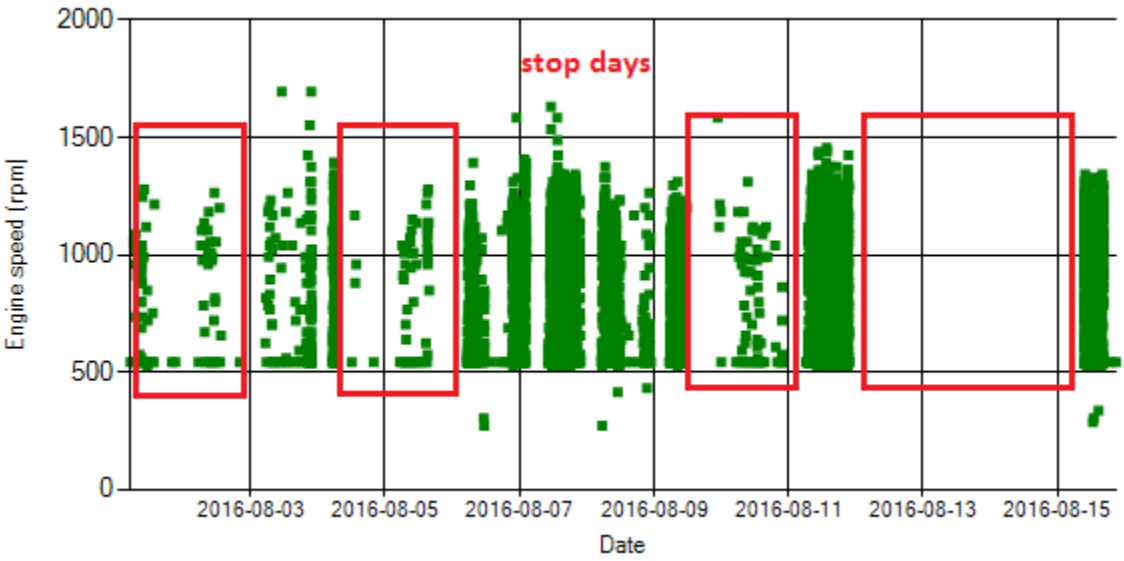


Figure 11- Engine speed diagram for calculating CPK's working days

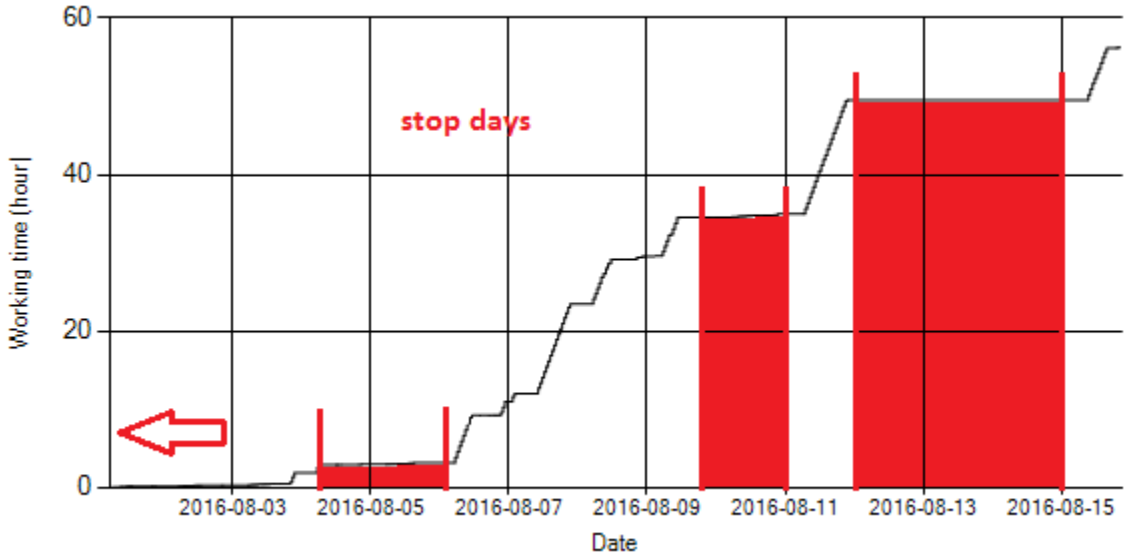


Figure 12- Time diagram for calculating CPK's working days

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 system was stationary for 8 days.

Pressure-Engine Speed diagrams

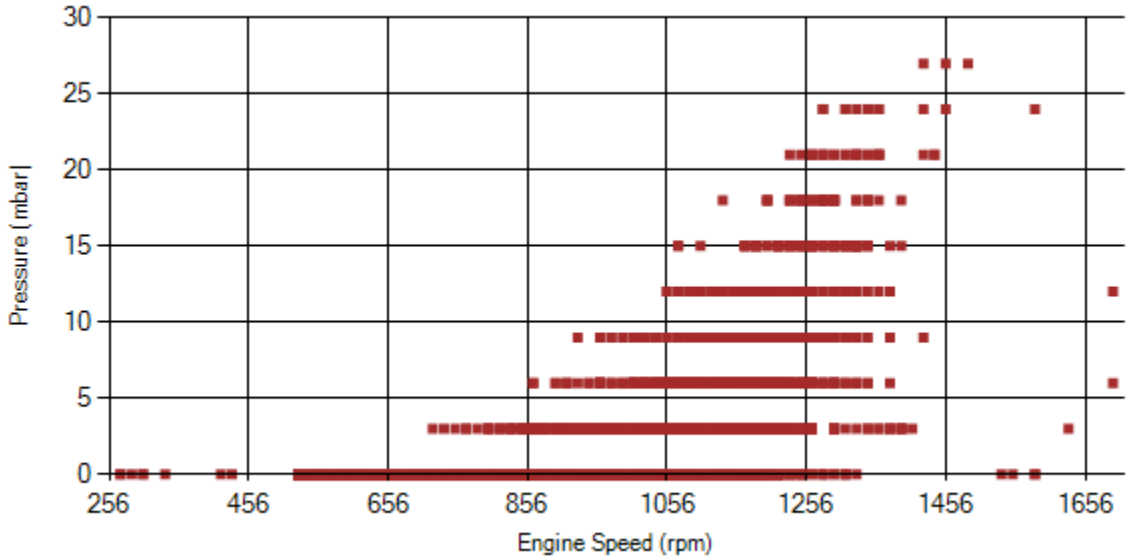


Figure 13- Pressure against engine speed

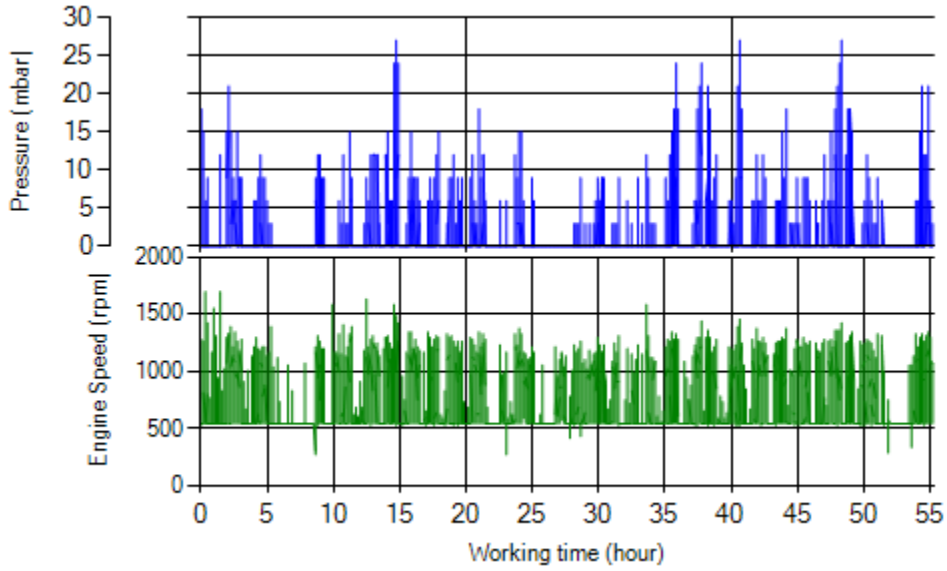


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

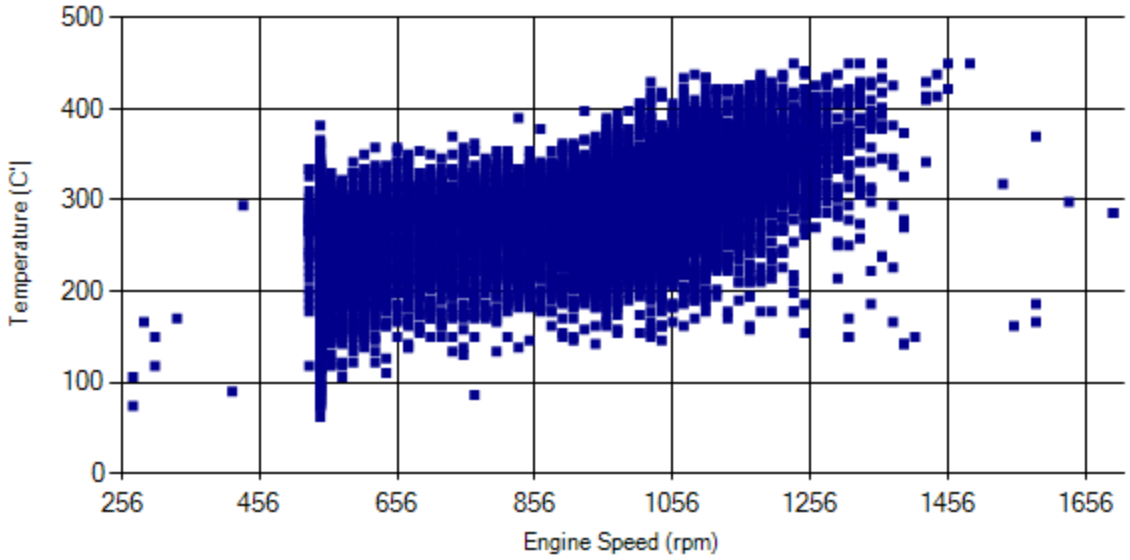


Figure 15- Temperature against engine speed

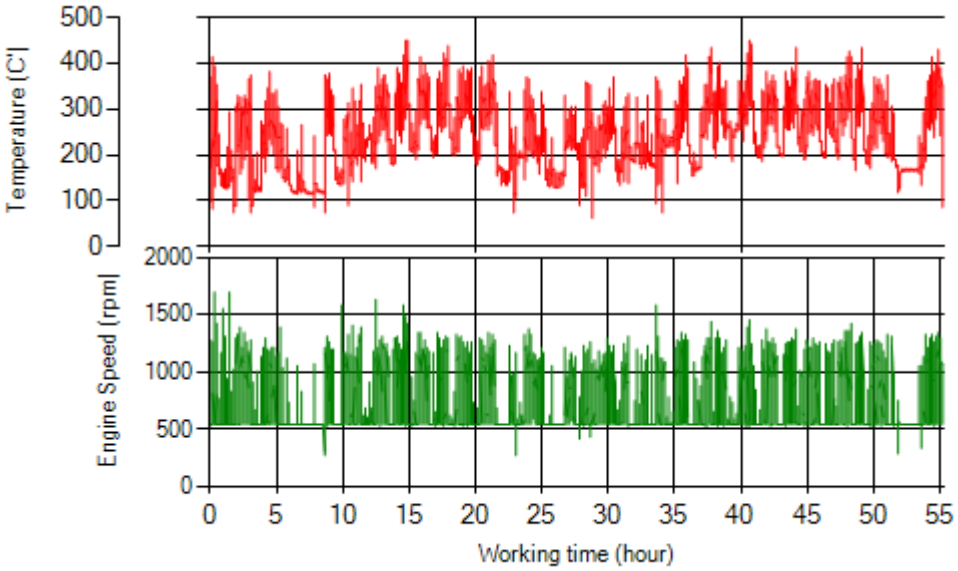


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, all of working time pressure was below 100 mbar during this period.
- Figure 2 display flow temperature distribution for DPF's upstream. It can be obviously observed that 5.1% of total working-time temperature is above 350 ℃ and 42.8% above 250℃.

Filter operation status	Excellent ■	Good ☐
	Maintenance required ☐	Failed☐

Overall Information

Table1- Overall Information

Vehicle plate number	33592 (32441)
CPK data logger number	LN: 001506, DN: 1927
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	Tehag_02 (Catalyzed DPF)
Installation date	25/Jan/2016
Report period	16/Aug/2016 - 31/Aug/2016 (sixteen days)
K value - DPF upstream	1.80 [1/m]
K value – DPF downstream	0.02 [1/m]

Table 2- DPF Maintenance History

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

Table 3- Fuel and Additive Consumption Information

Bus mileage (from DPF installation date)	13489 km
Bus mileage over the period	1058 km
Working days over the period	9 days
Stop days	7 days
Data logger working days	9 days
Working hours over the period	71 hours 55 minutes
Average working hours per day (including stop days)	4 hours 30 minutes
Bus average speed	14.7 km/hr
idle speed time to all working time ration	54.34 %
Total Bus fuel consumption over the period	614 lit
Fuel consumption per hour	8.52 lit/hr
Average fuel consumption	0.58 lit/km

Temperature, Pressure and Engine Speed Overview

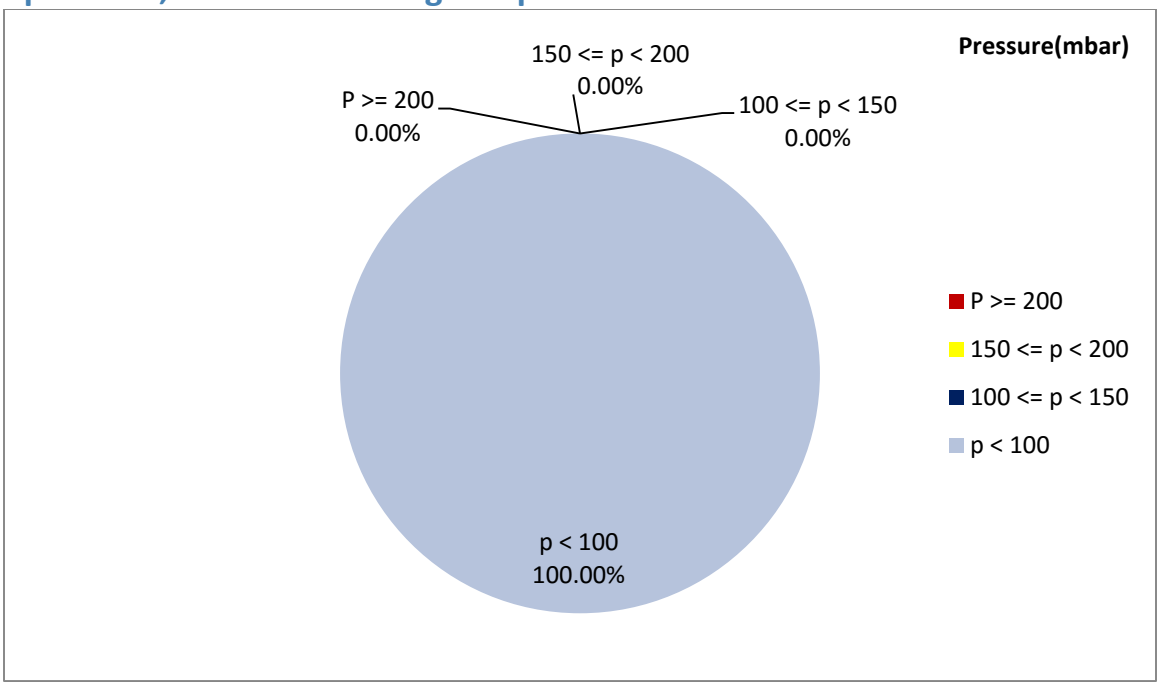


Figure 1- Pressure distribution over the working hours

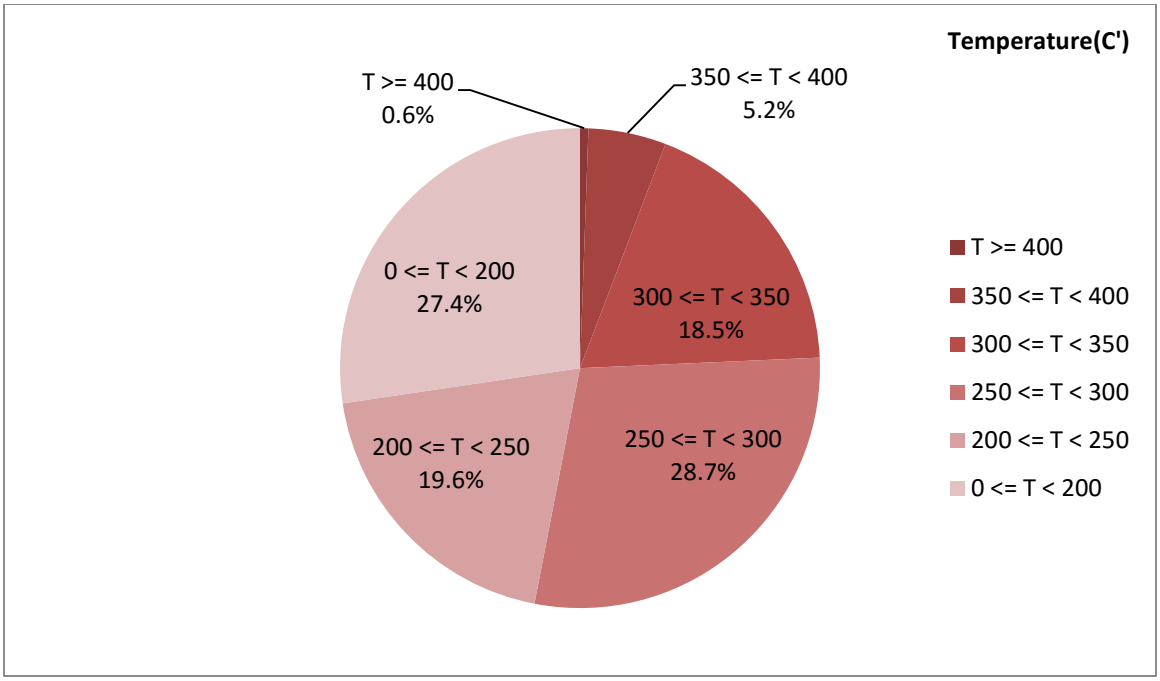


Figure 2-Temperature distribution over the working hours

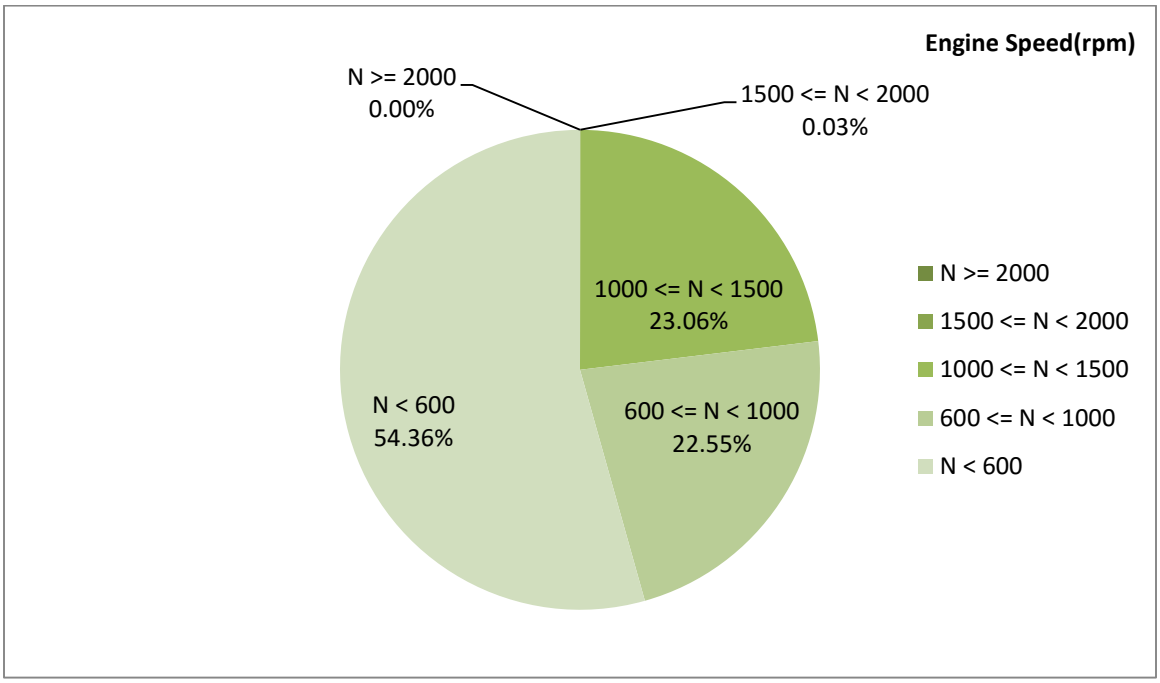


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
248.75	0.76	742

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
298.08	1.67	976

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
458-50	33-0	1856-256

Detailed Pressure Analysis

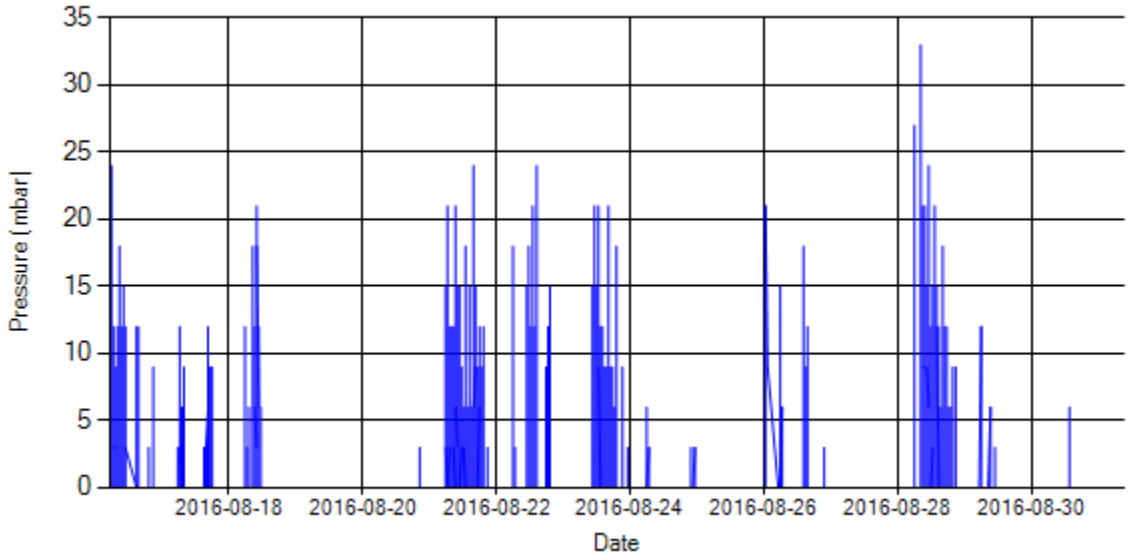


Figure 4- Pressure distribution over the period

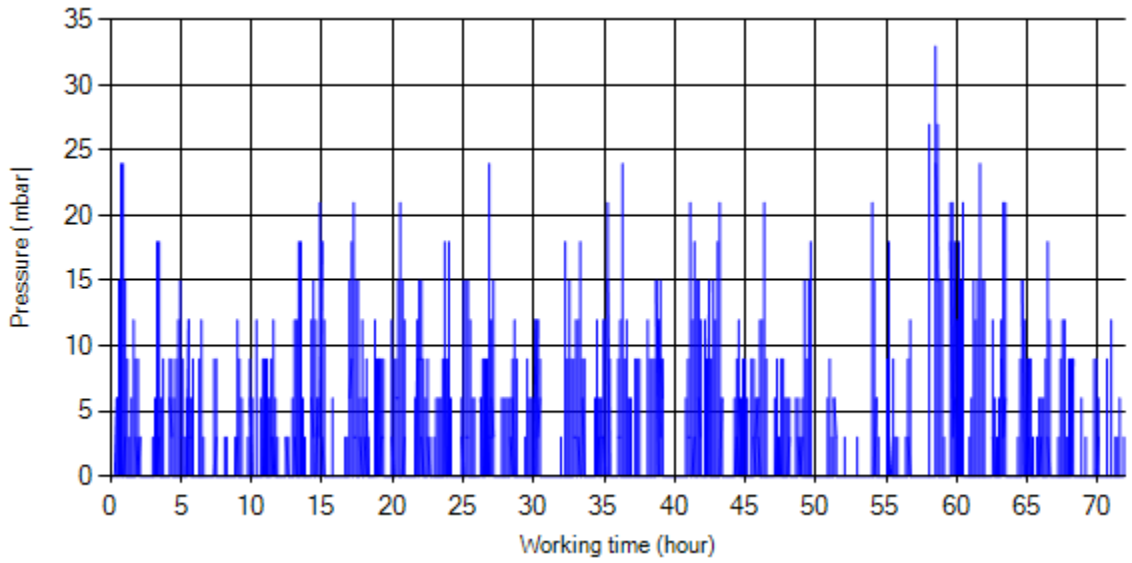


Figure 5- Pressure vs. working hours

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

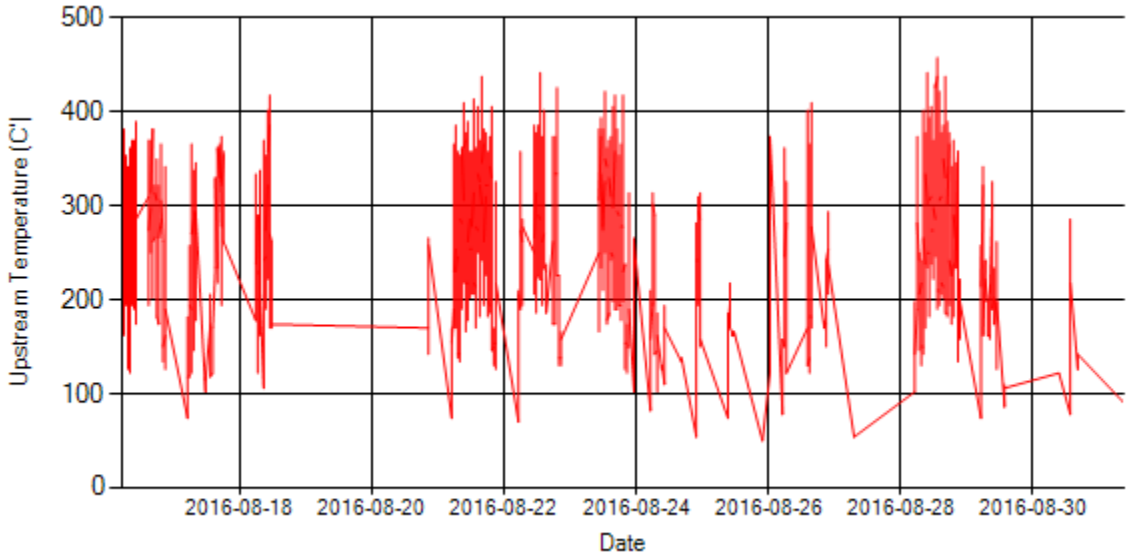


Figure 6- Temperature distribution over the period

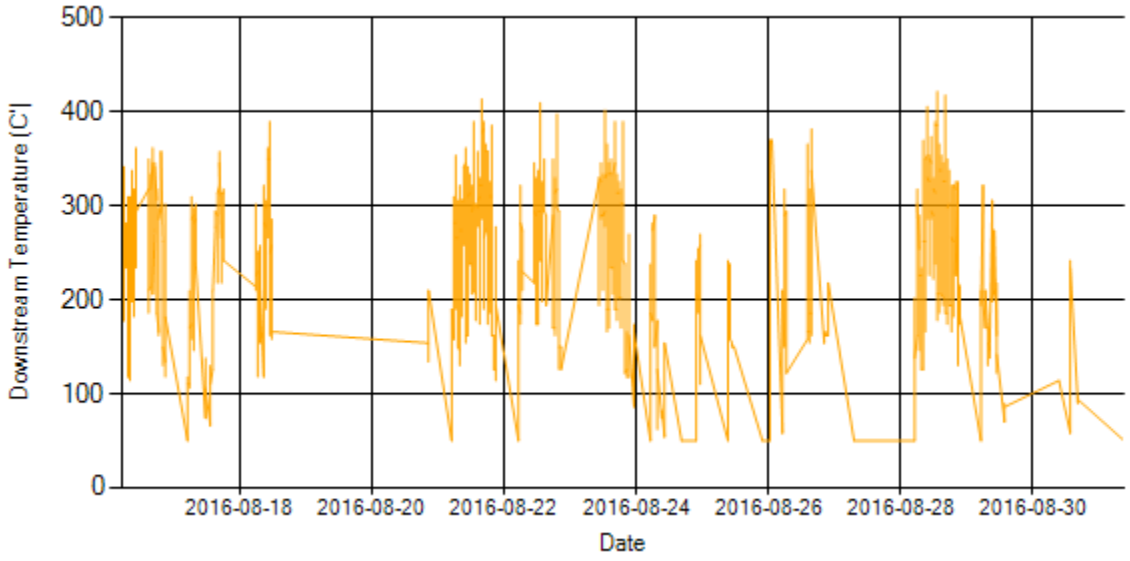


Figure 7- Temperature distribution over the period

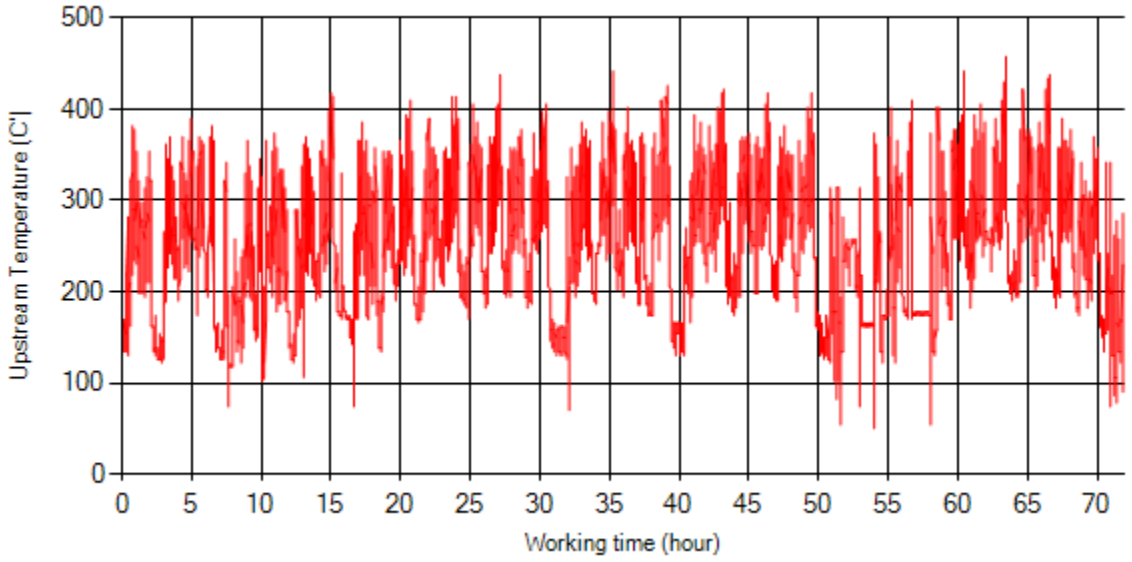


Figure 8- Temperature vs. working hours

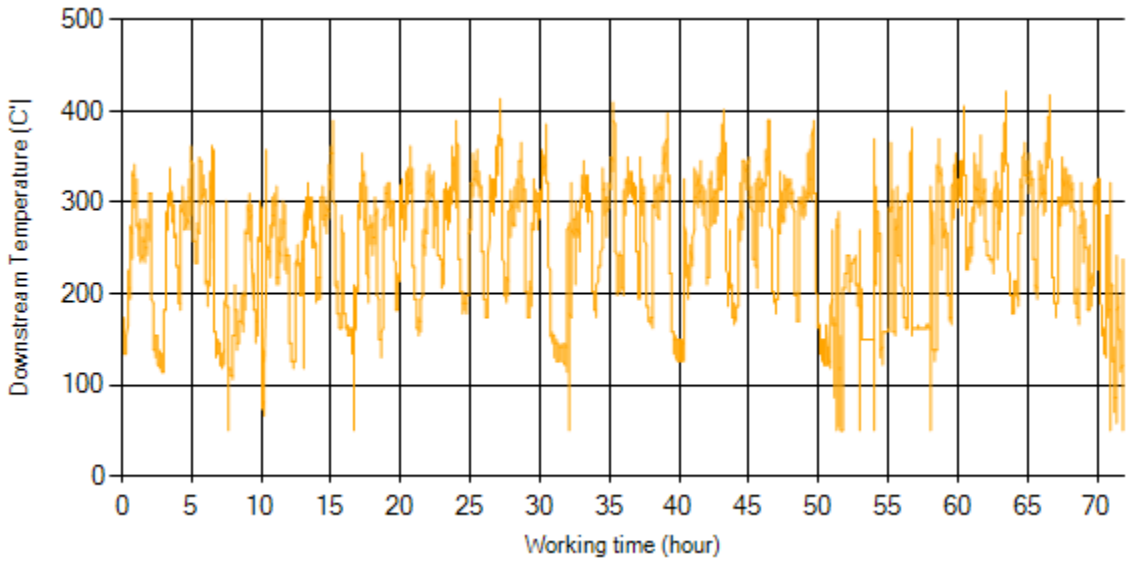


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

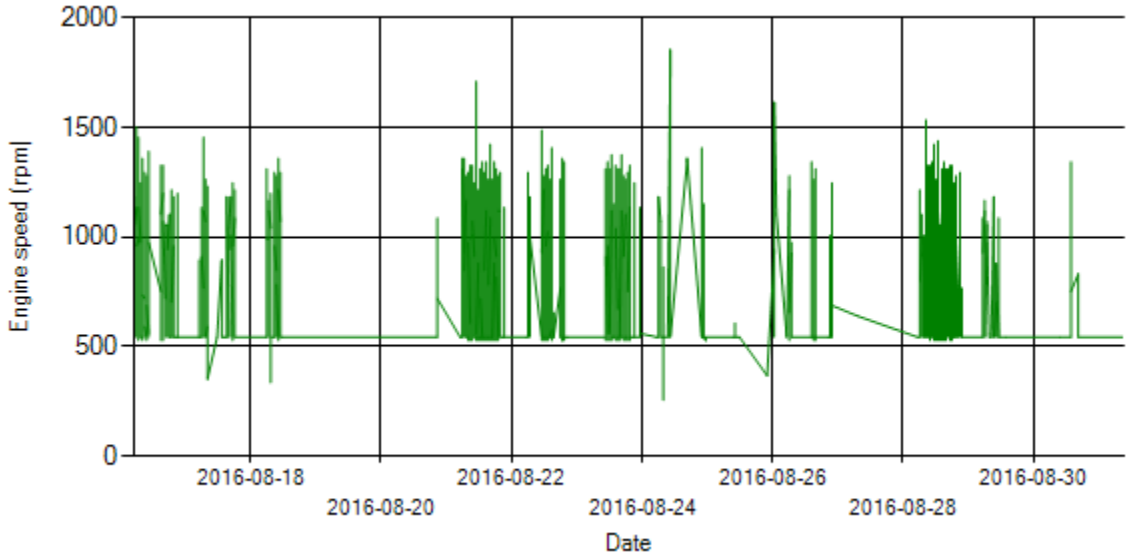


Figure 10- Engine speed distribution over the period

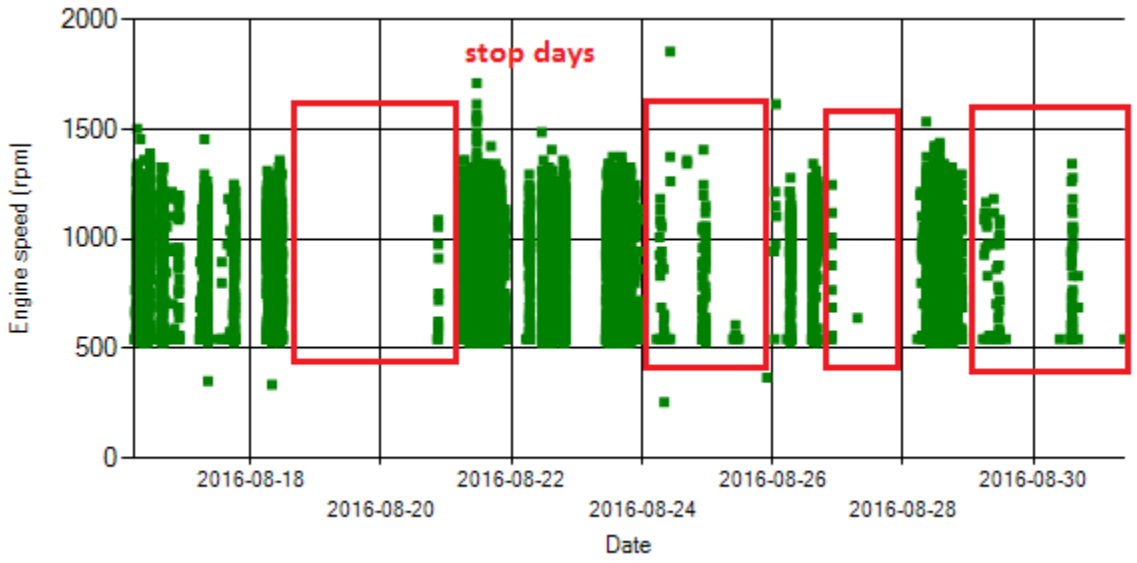


Figure 11- Engine speed diagram for calculating CPK's working days

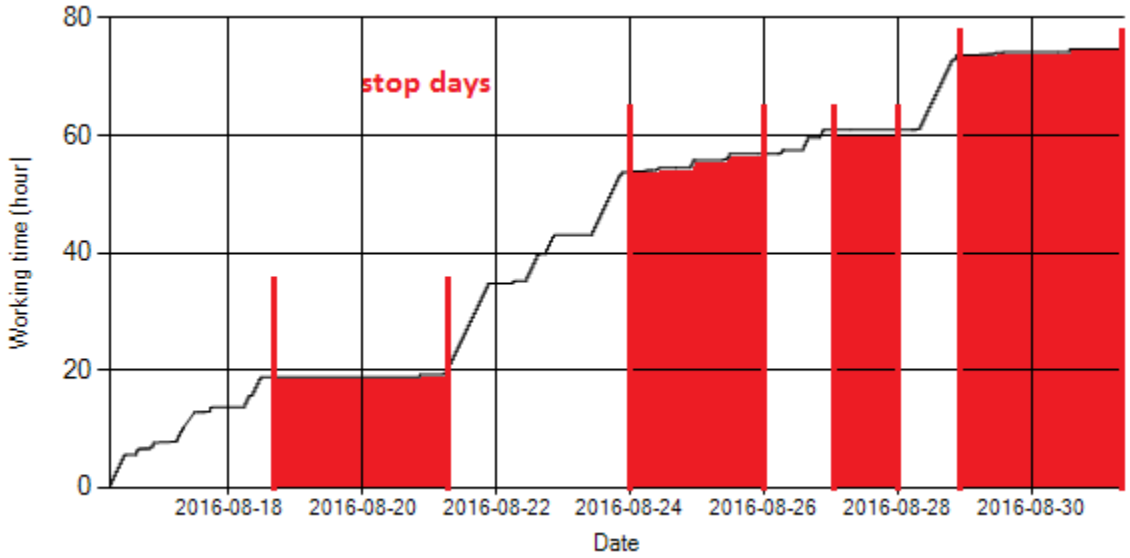


Figure 12- Time diagram for calculating CPK's working days

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 system was stationary for 7 days.

Pressure-Engine Speed diagrams

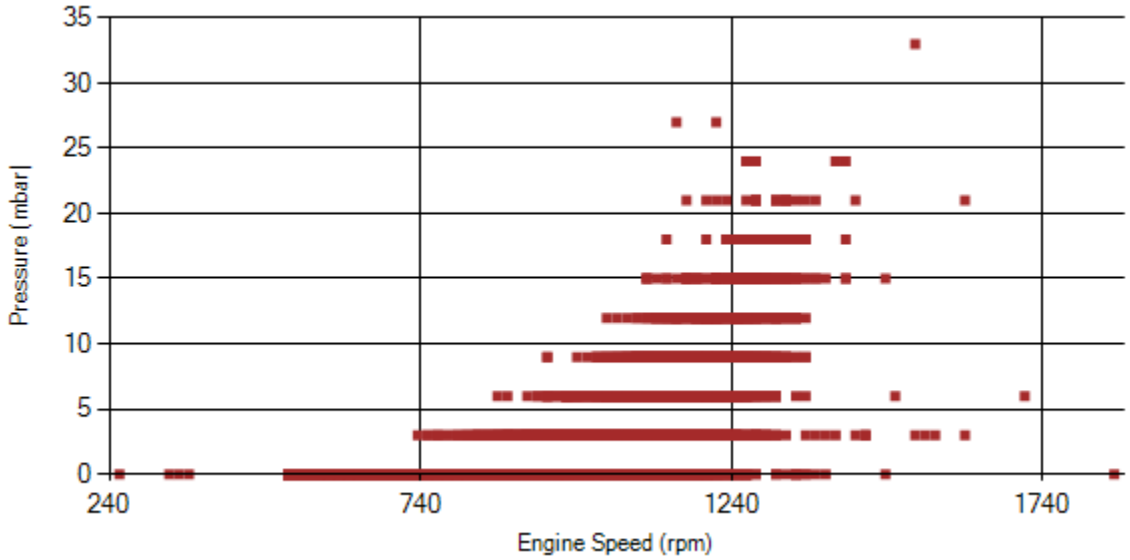


Figure 13- Pressure against engine speed

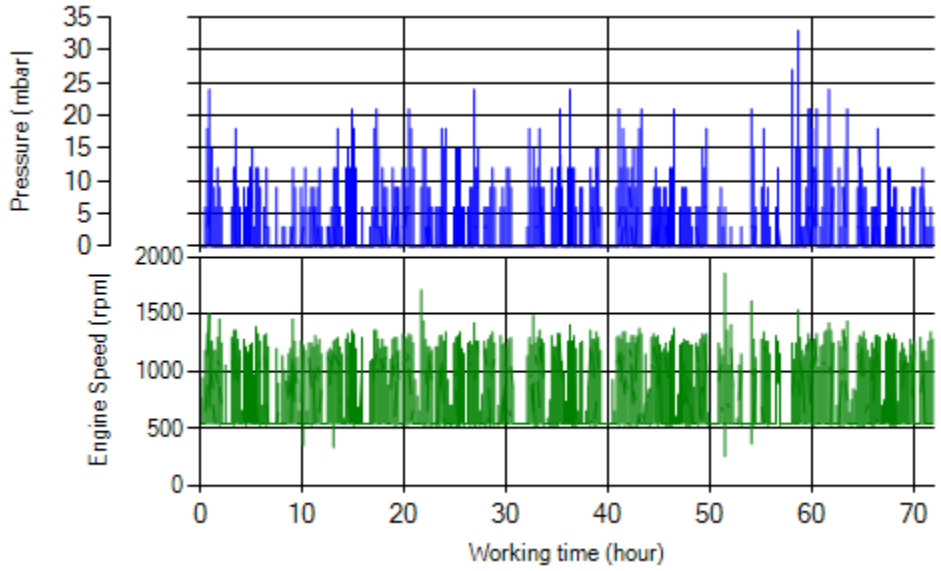


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

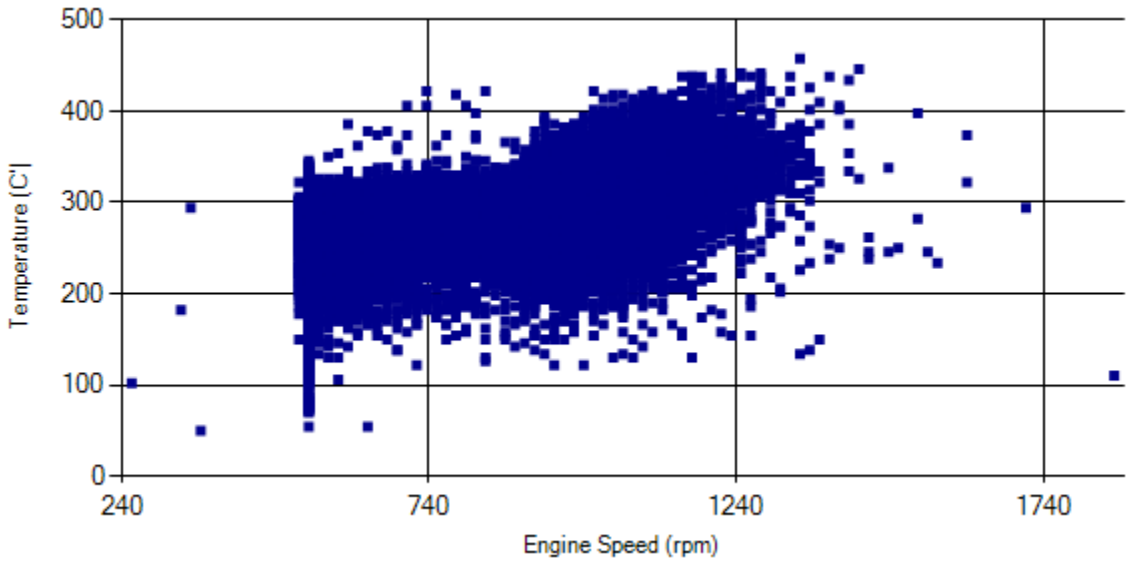


Figure 15- Temperature against engine speed

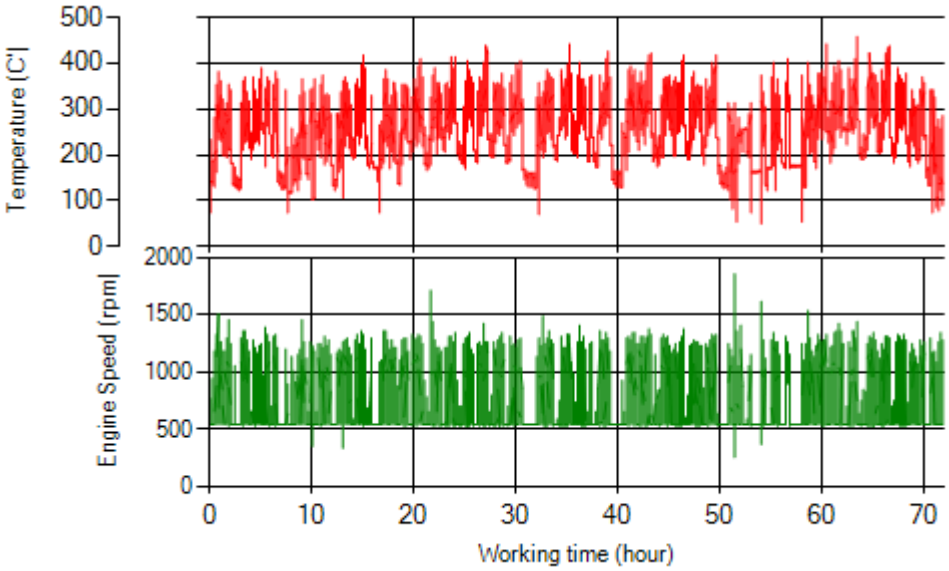


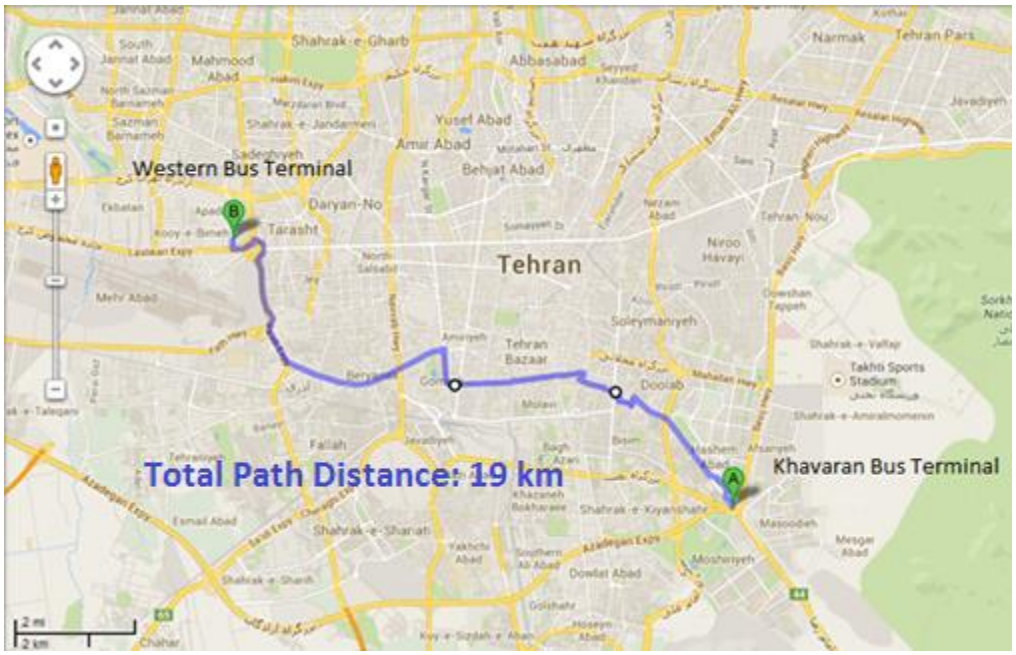
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, all of working time pressure was below 100 mbar during this period.
- Figure 2 display flow temperature distribution for DPF's upstream. It can be obviously observed that 5.8% of total working-time temperature is above 350 ℃ and 53% above 250℃.

Filter operation status	Excellent ■	Good ☐
	Maintenance required ☐	Failed☐

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



AZMOON SANAT ARVIN	Document Number: DPF2016081/1 Date: 20/Aug/2016

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/Aug/2016 – 15/Aug/2016 (fifteen days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF has been removed after two weeks working on Jun 17th. After receiving cleaning machine DPF was cleaned on Aug 10th and was 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 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	4292 km
Working days over the period	15 days
Stop days	0 days
Data logger working days	15 days
Working hours over the period	253 hours 50 minutes
Average working hours per day (including stop days)	16 hours 55 minutes
Bus average speed	16.9 km/hr
idle speed time to all working time ration	21.41 %
Total Bus fuel consumption over the period	2231 lit
Fuel consumption per hour	8.7 lit/hr
Average fuel consumption	0.52 lit/km

Temperature, Pressure and Engine Speed Overview

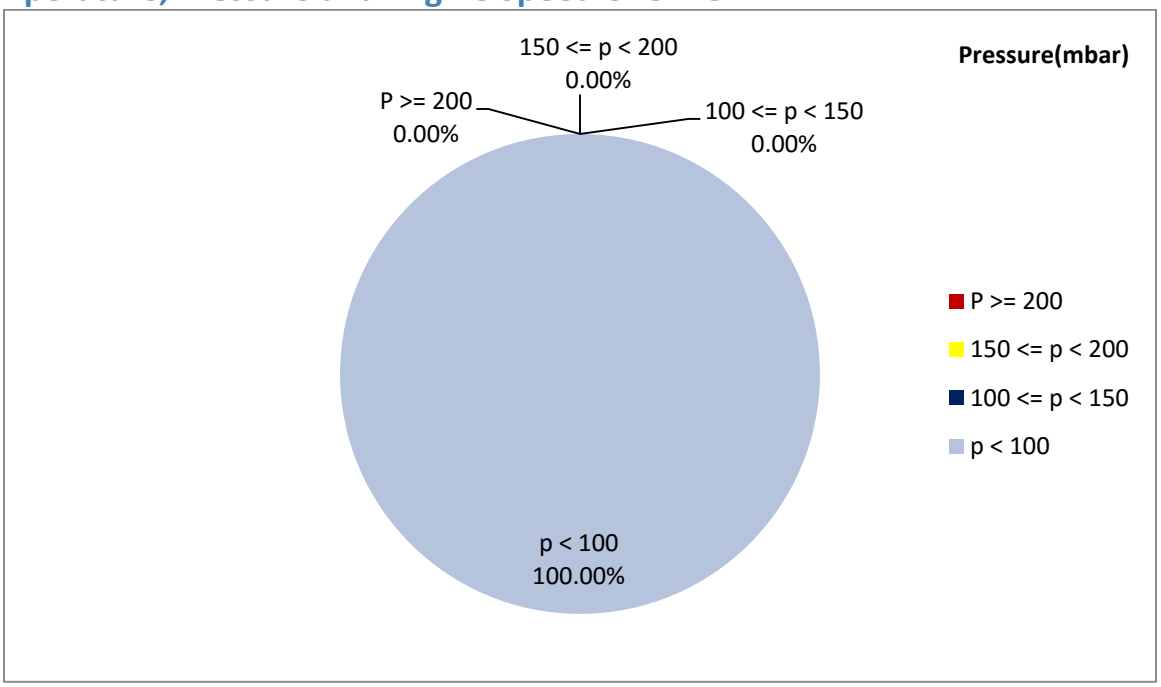


Figure 1- Pressure distribution over the working hours

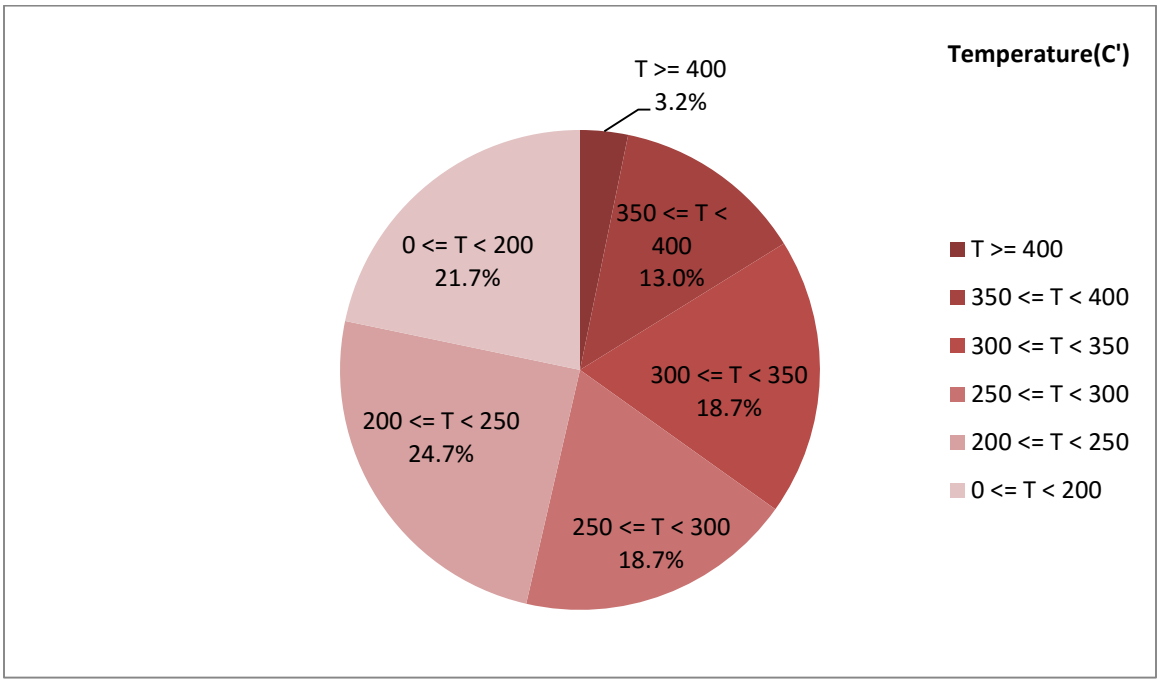


Figure 2-Temperature distribution over the working hours

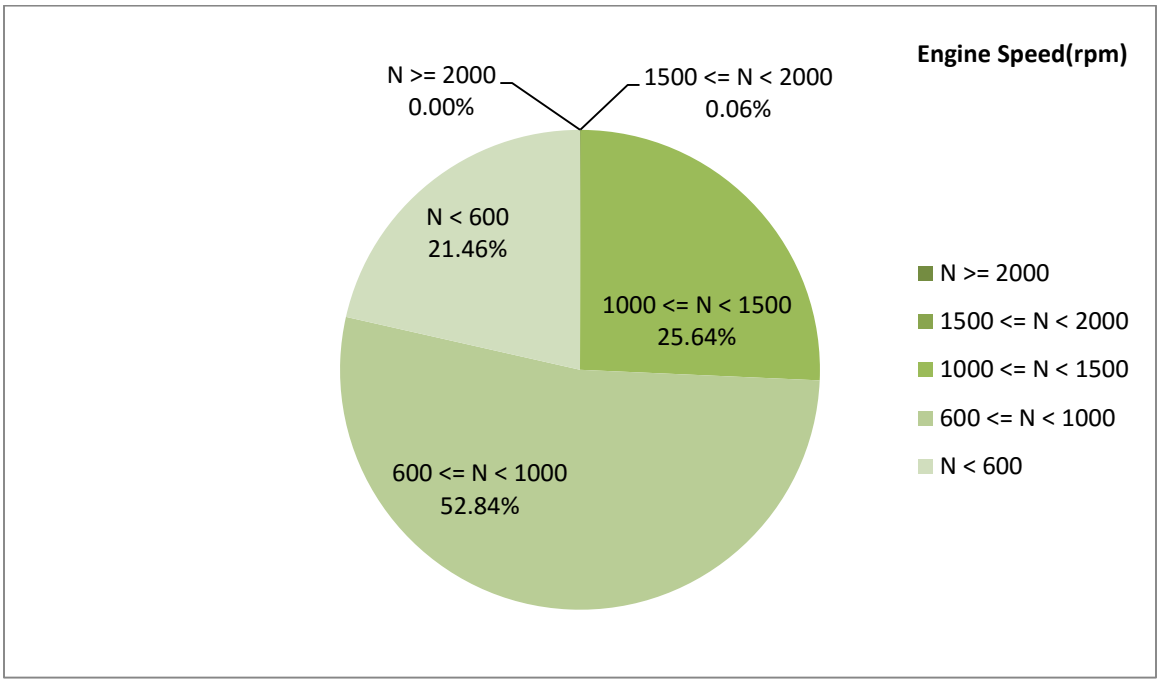


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
263.51	1.71	834

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
281.56	2.17	912

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
478-50	51-0	2144-256

Detailed Pressure Analysis

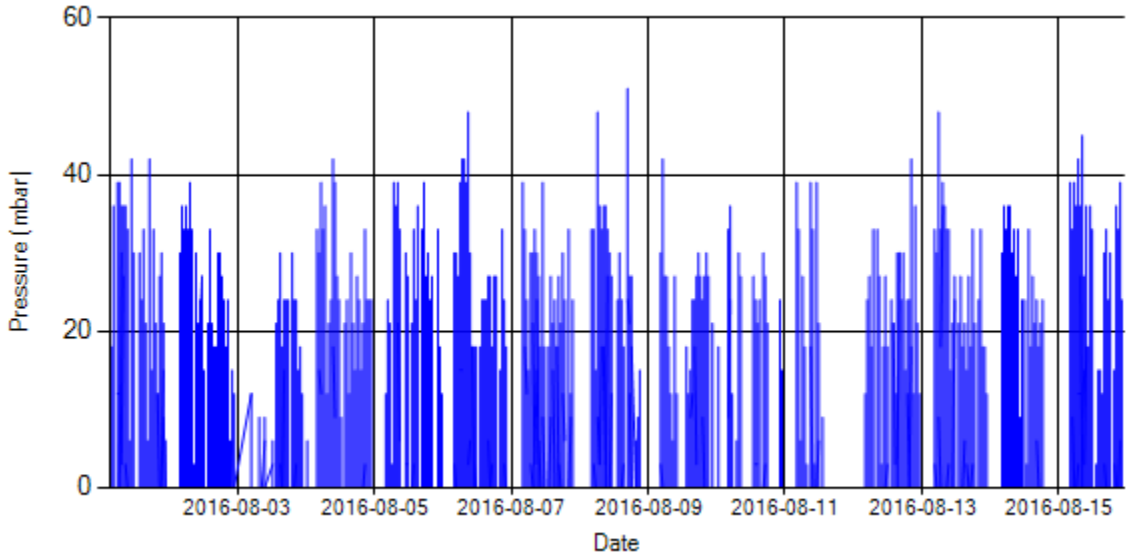


Figure 4- Pressure distribution over the period

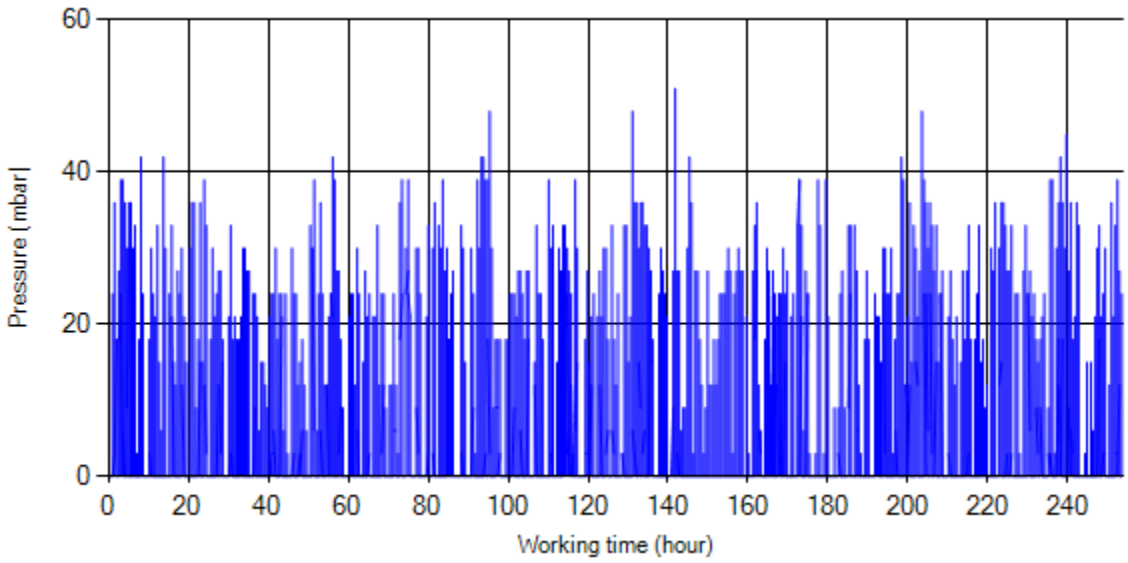


Figure 5- Pressure vs. working hours

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

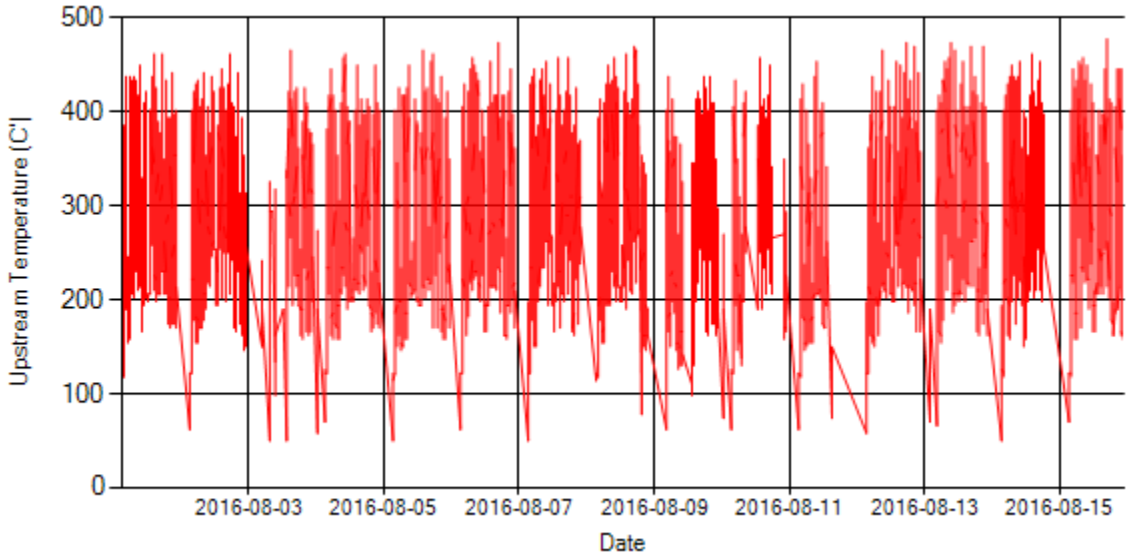


Figure 6- Temperature distribution over the period

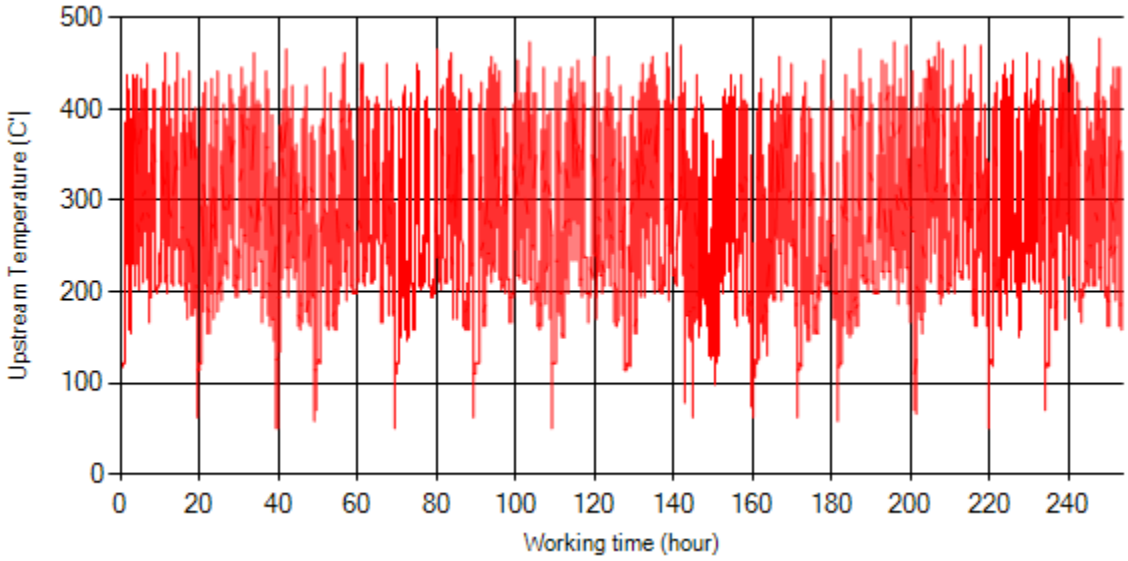


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

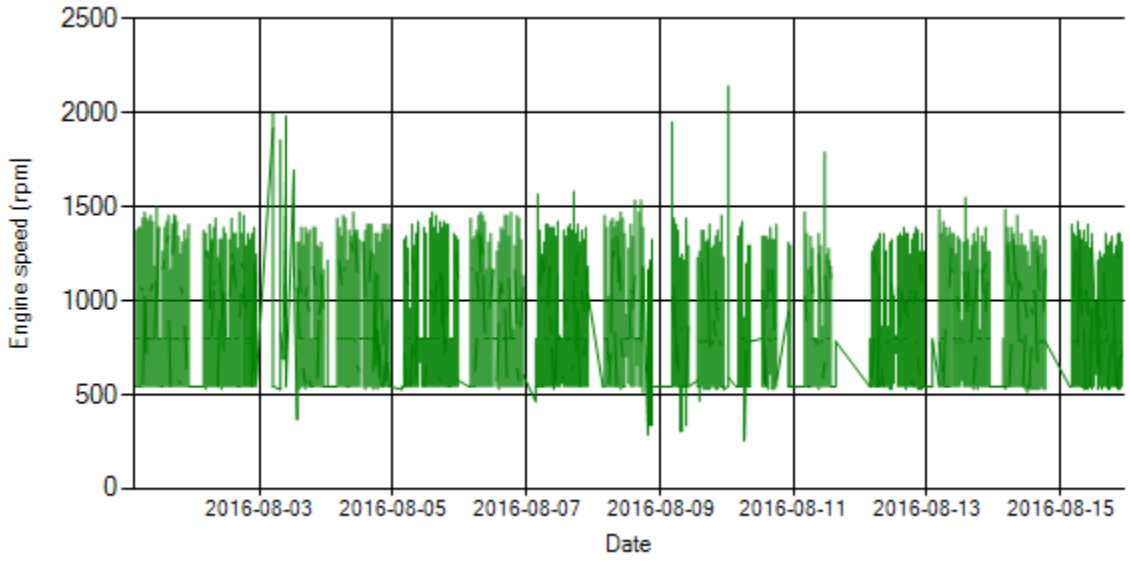


Figure 8- Engine speed distribution over the period

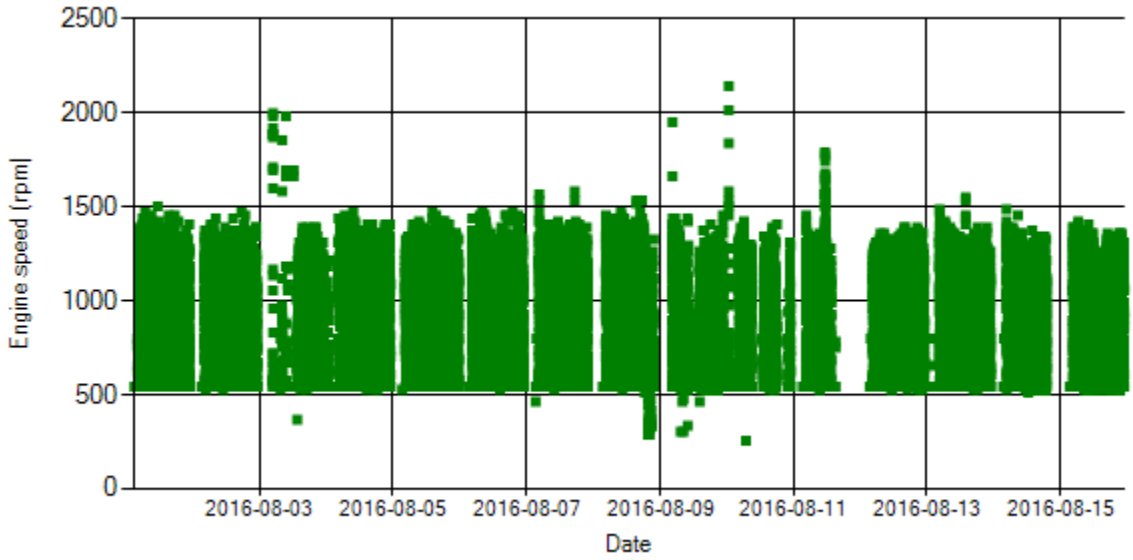


Figure 9- Engine speed diagram for calculating CPK's working days

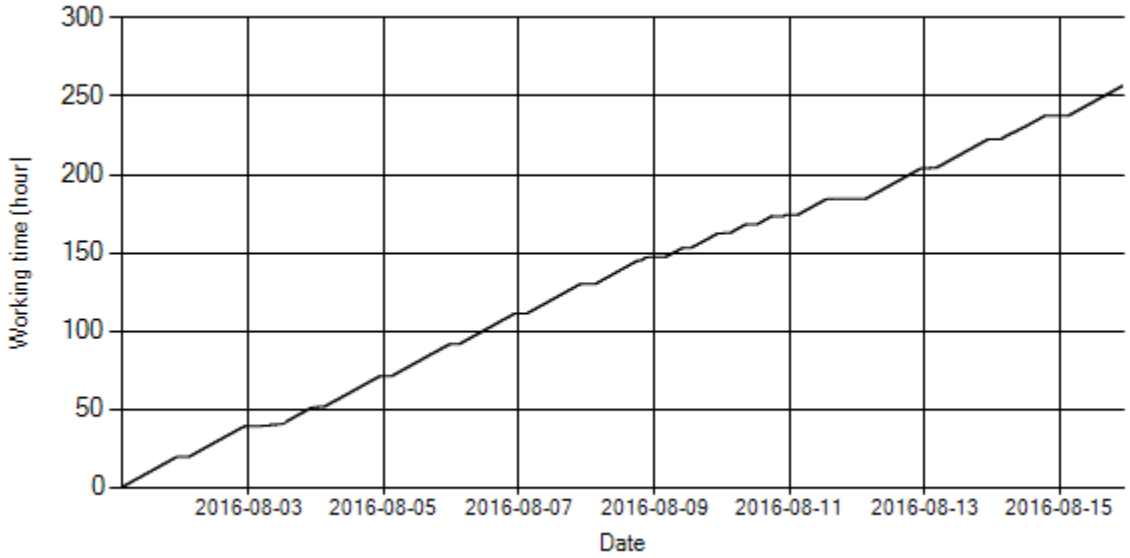


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 10. The lines parallel with Date axis show days without data logger data. As depicted in Figure 10 system was working all days of the period.

Pressure-Engine Speed diagrams

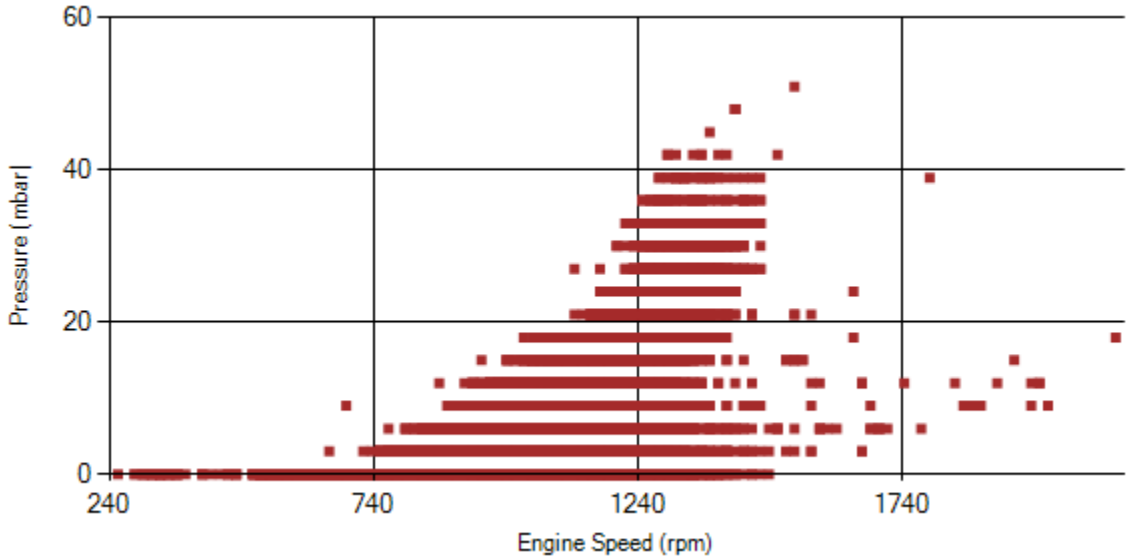


Figure 11- Pressure against engine speed

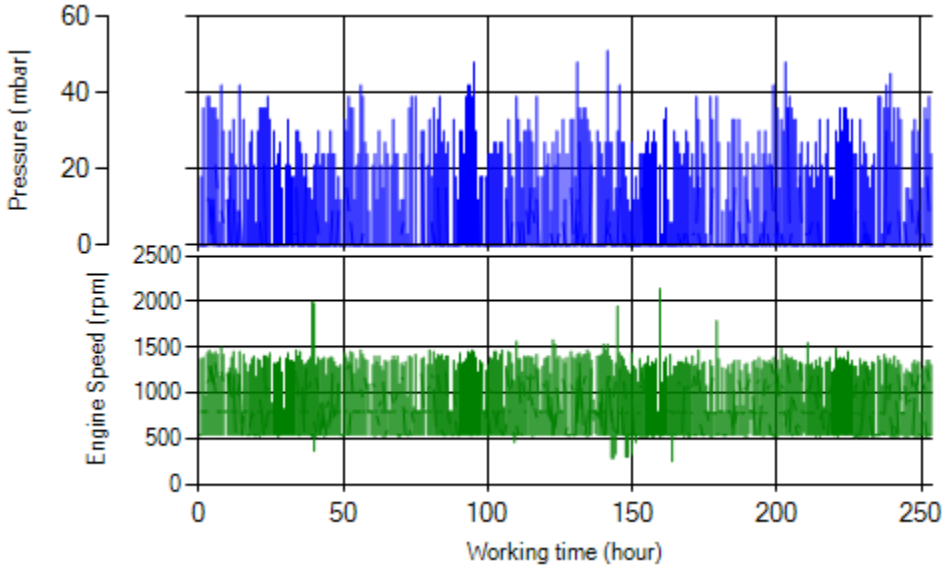


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

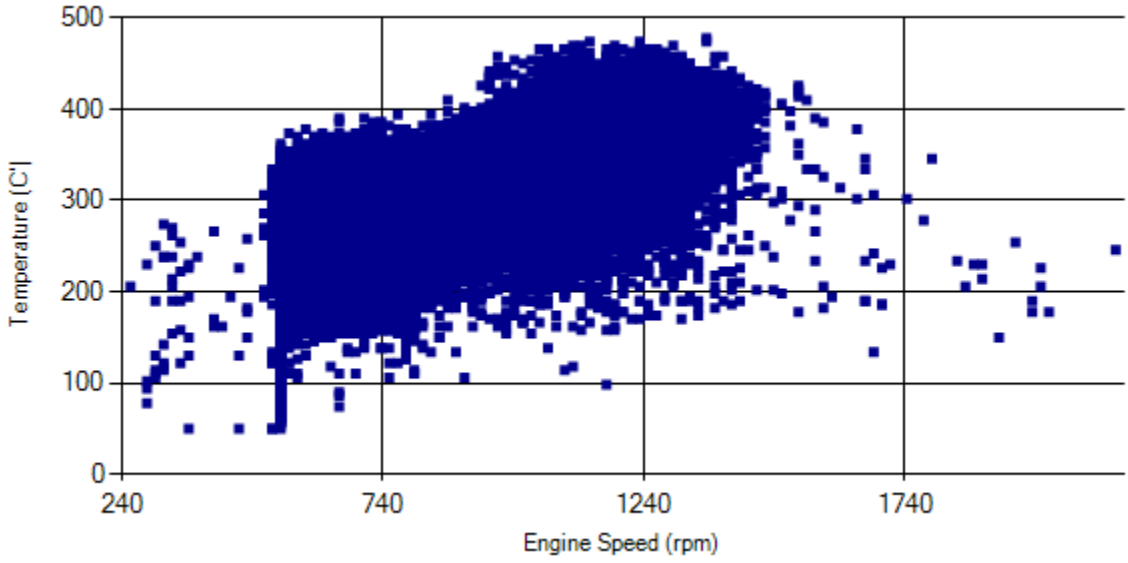


Figure 13- Temperature against engine speed

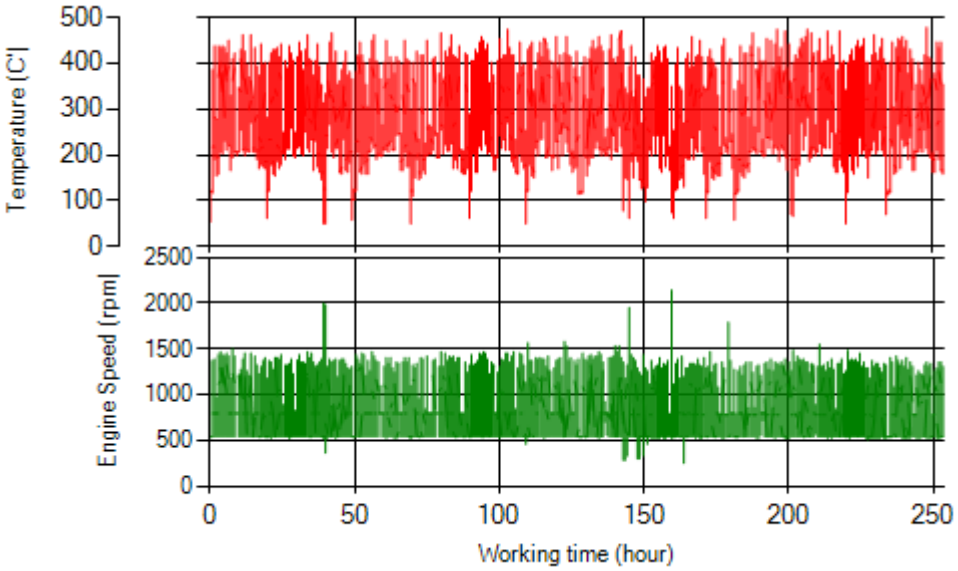


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

Notice: System was working without DPF over the period.

AZMOON SANAT ARVIN	Document Number: DPF2016082/1 Date: 05/Sep/2016

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/Aug/2016 – 31/Aug/2016 (sixteen days)
K value – DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF has been removed after two weeks working on Jun 17th. After receiving cleaning machine DPF was cleaned on Aug 10th and was 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 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	3675 km
Working days over the period	15 days
Stop days	1 days
Data logger working days	15 days
Working hours over the period	218 hours 40 minutes
Average working hours per day (including stop days)	13 hours 40 minutes
Bus average speed	16.8 km/hr
idle speed time to all working time ration	22.35 %
Total Bus fuel consumption over the period	1985 lit
Fuel consumption per hour	9.07 lit/hr
Average fuel consumption	0.54 lit/km

Temperature, Pressure and Engine Speed Overview

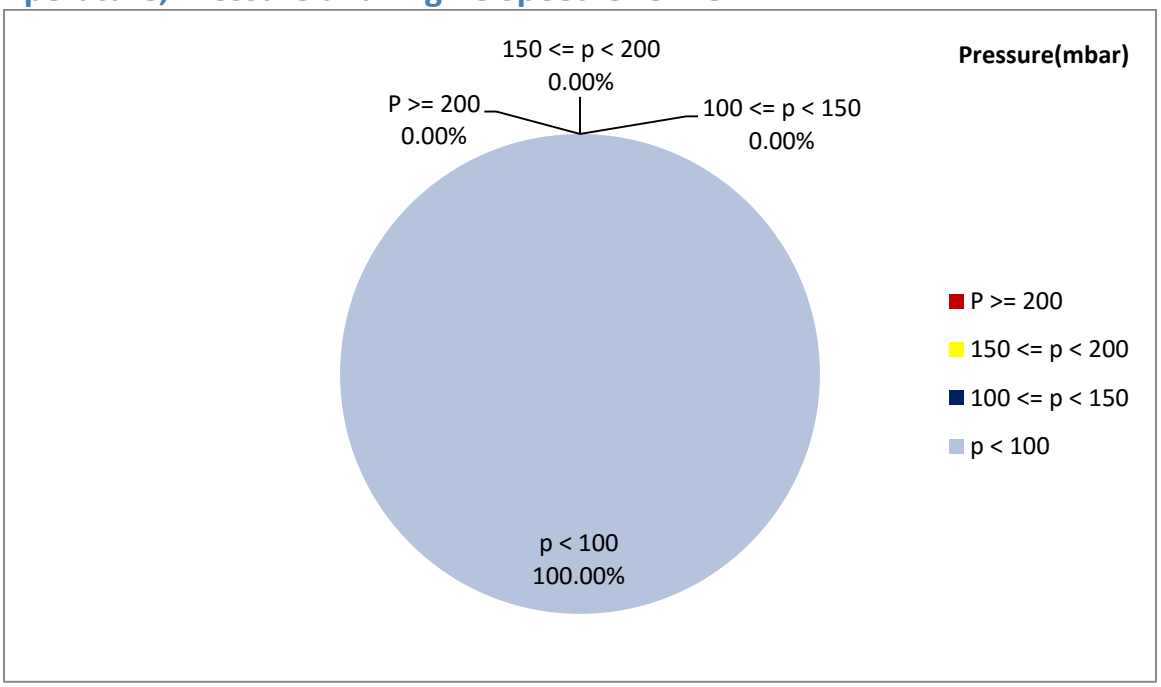


Figure 1- Pressure distribution over the working hours

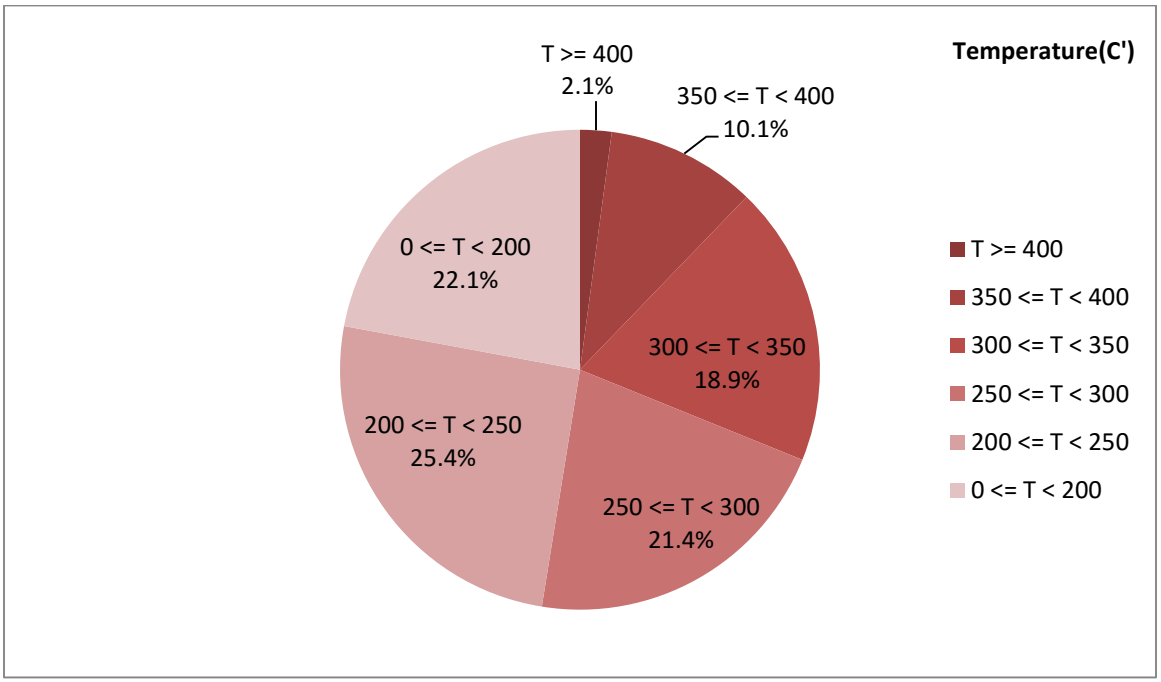


Figure 2-Temperature distribution over the working hours

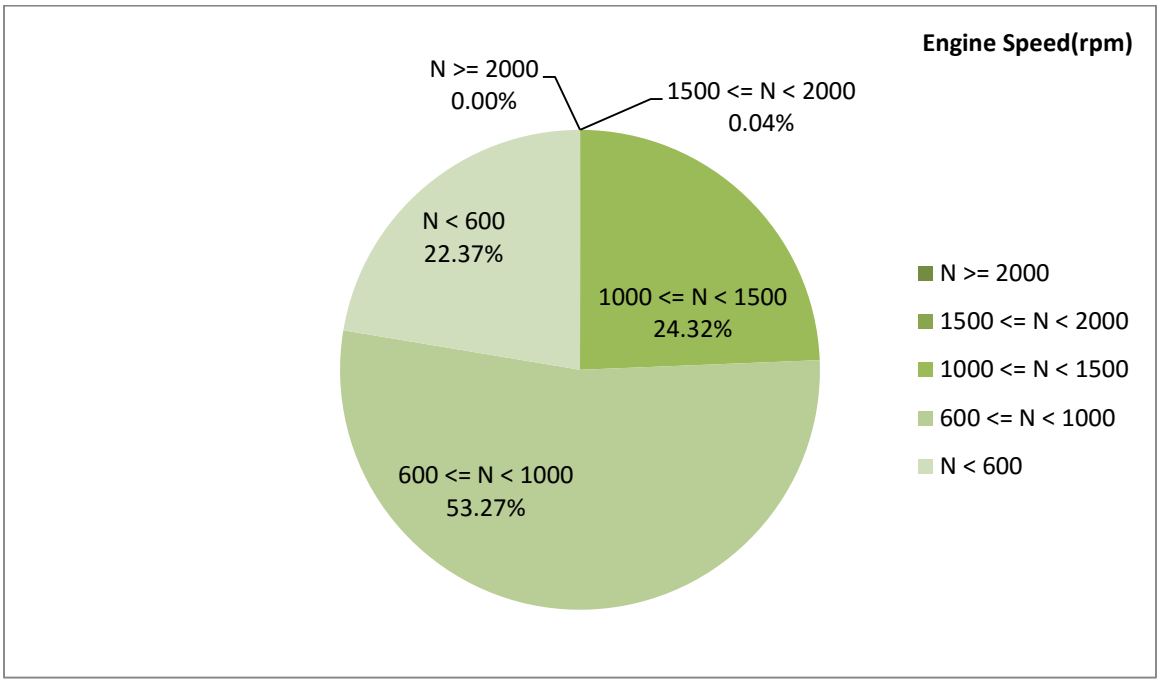


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
260.41	1.15	822

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
275.14	1.48	901

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
486-50	42-0	1952-256

Detailed Pressure Analysis

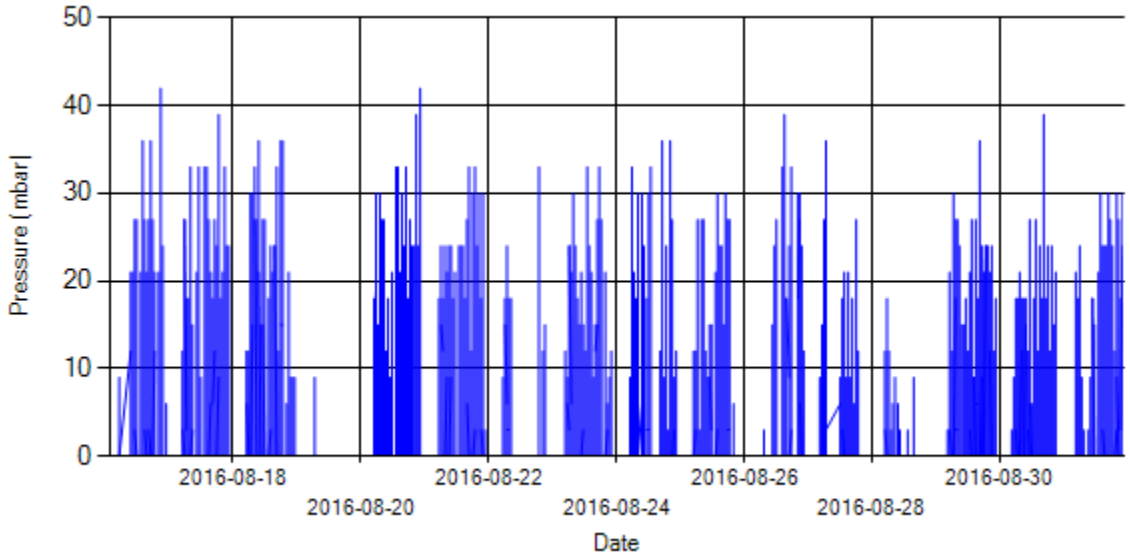


Figure 4- Pressure distribution over the period

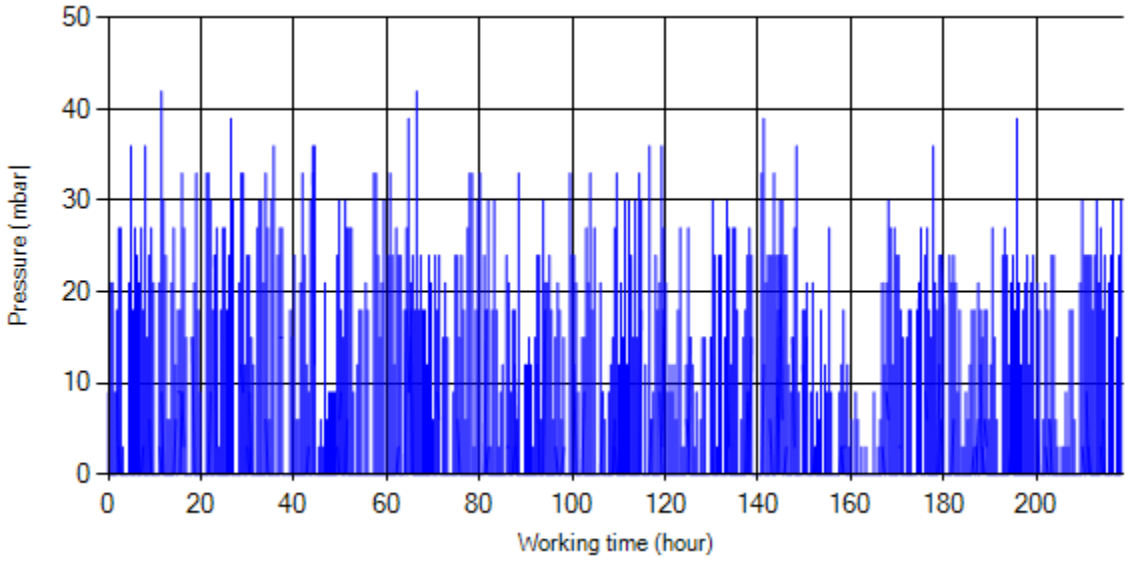


Figure 5- Pressure vs. working hours

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

Detailed Temperature Analysis

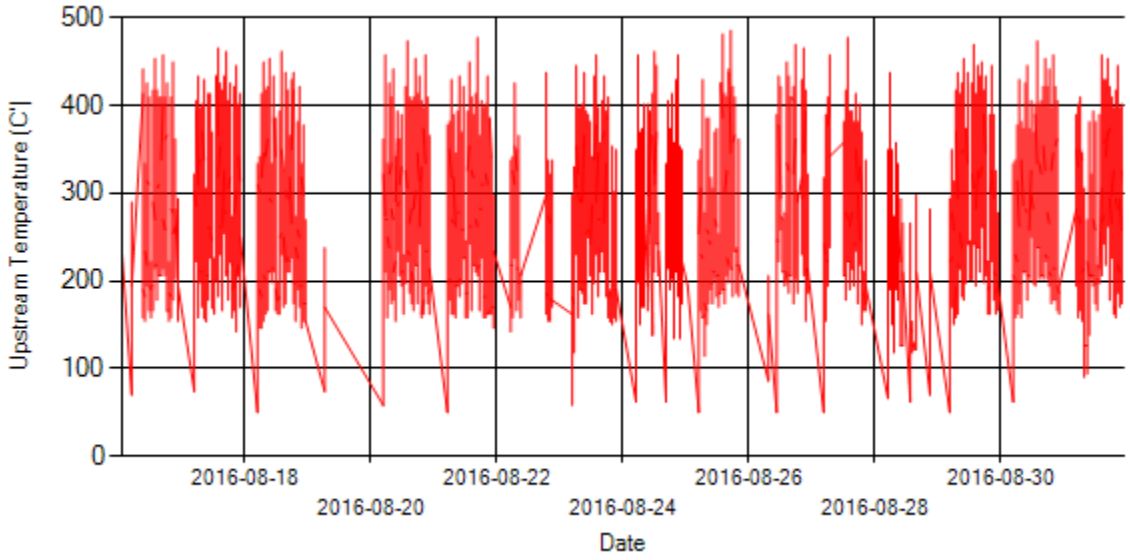


Figure 6- Temperature distribution over the period

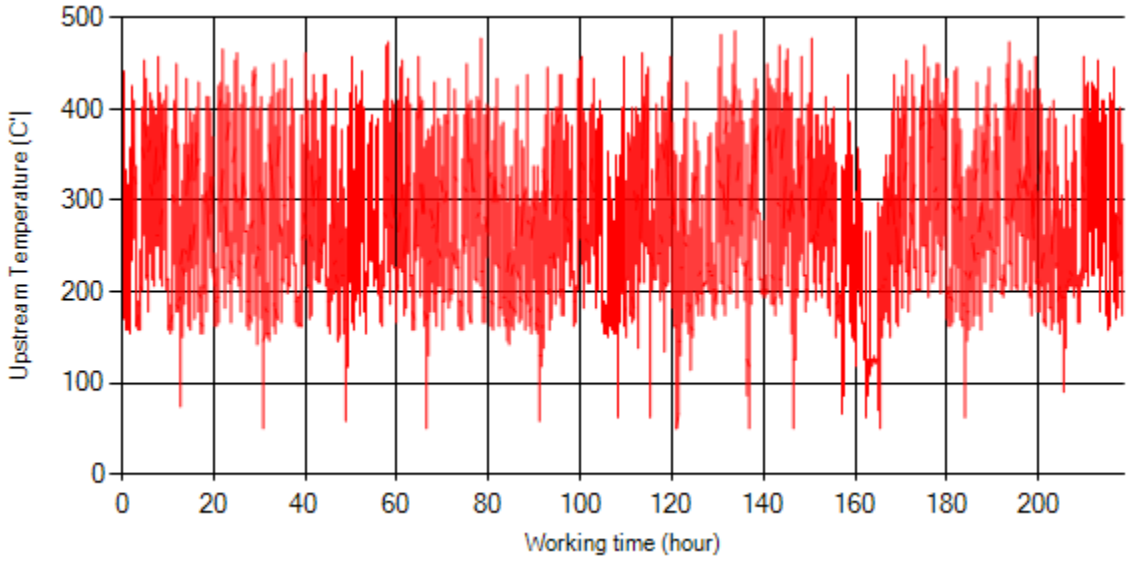


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

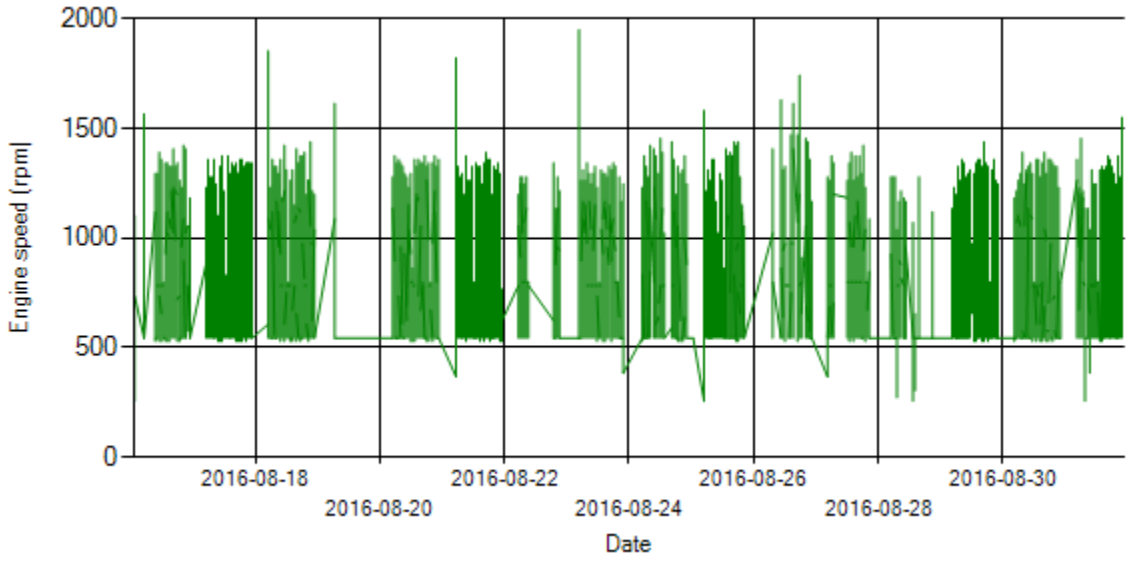


Figure 8- Engine speed distribution over the period

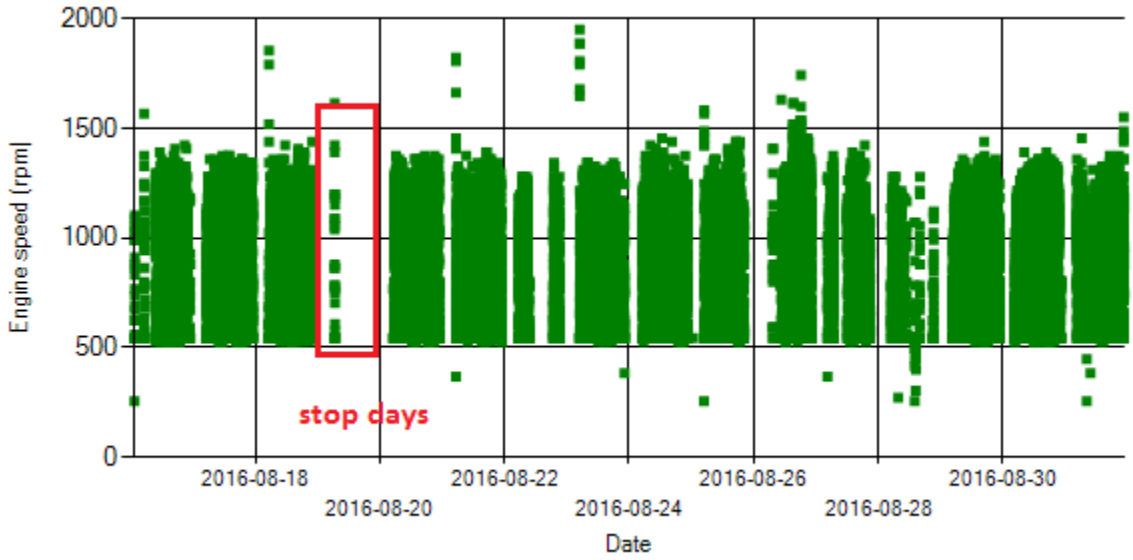


Figure 9- Engine speed diagram for calculating CPK's working days

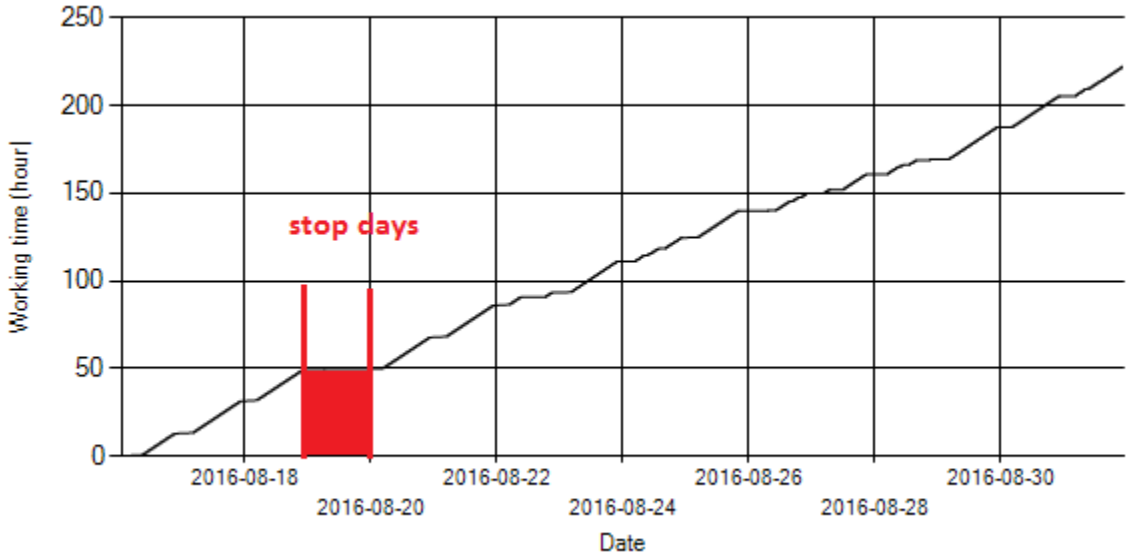


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 10. The lines parallel with Date axis show days without data logger data. As depicted in Figure 10 system was stopped for 1 day.

Pressure-Engine Speed diagrams

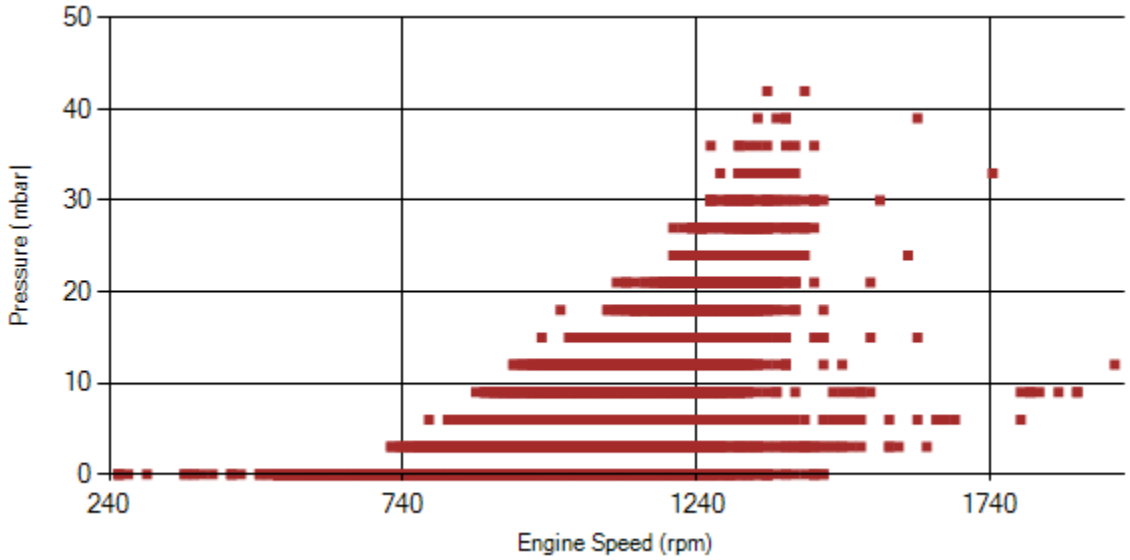


Figure 11- Pressure against engine speed

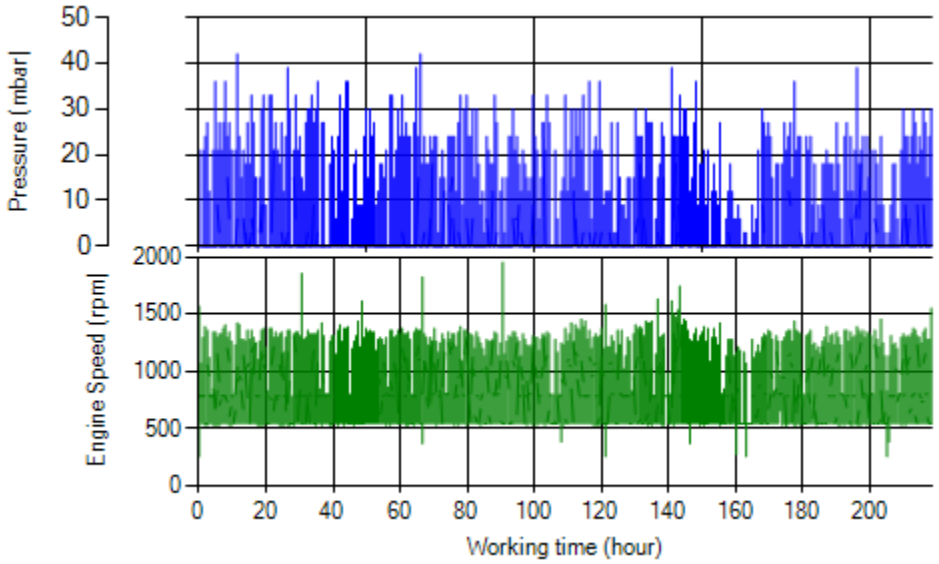


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

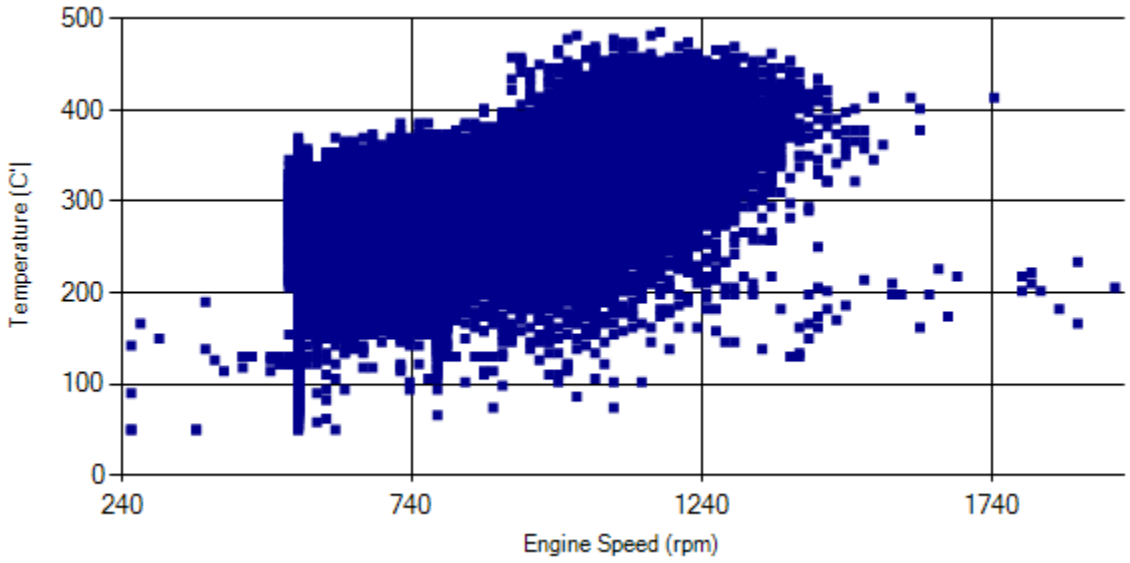


Figure 13- Temperature against engine speed

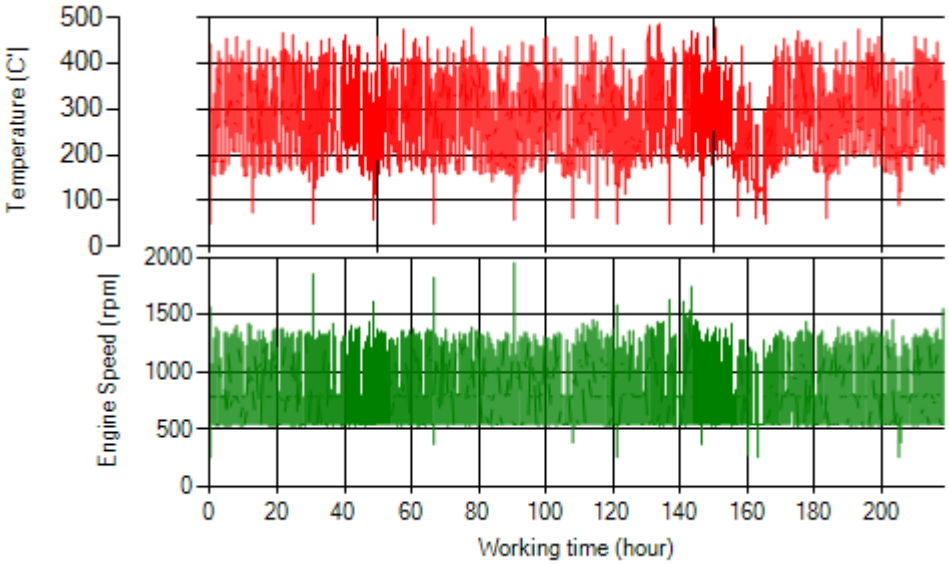
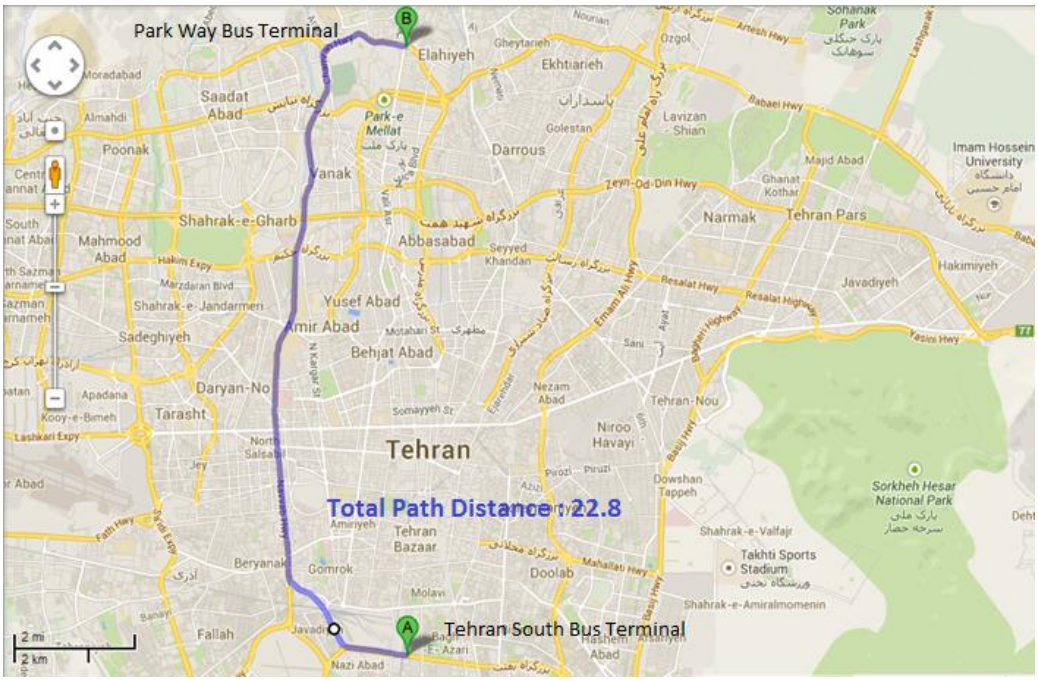


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

Notice: System was working without DPF over the period.

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



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/Aug/2016 – 15/Aug/2016 (fifteen days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF core was cleaned on 2015/Jun/13 for the first time. The second cleaning was done on 2016/Jul/11. Due to some wiring problems, the DPF core was replaced with muffler on Jul 13th.
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)	87864 km
Bus mileage over the period	3313 km
Working days over the period	14 days
Stop days	1 day
Data logger working days	14 days
Working hours over the period	204 hours 34 minutes
Average working hours per day (including stop days)	13 hours 38 minutes
Bus average speed	16.2 km/hr
idle speed time to all working time ration	23.66 %
Total Bus fuel consumption over the period	1723 lit
Fuel consumption per hour	8.42 lit/hr
Average fuel consumption	0.52 lit/km

Temperature, Pressure and Engine Speed Overview

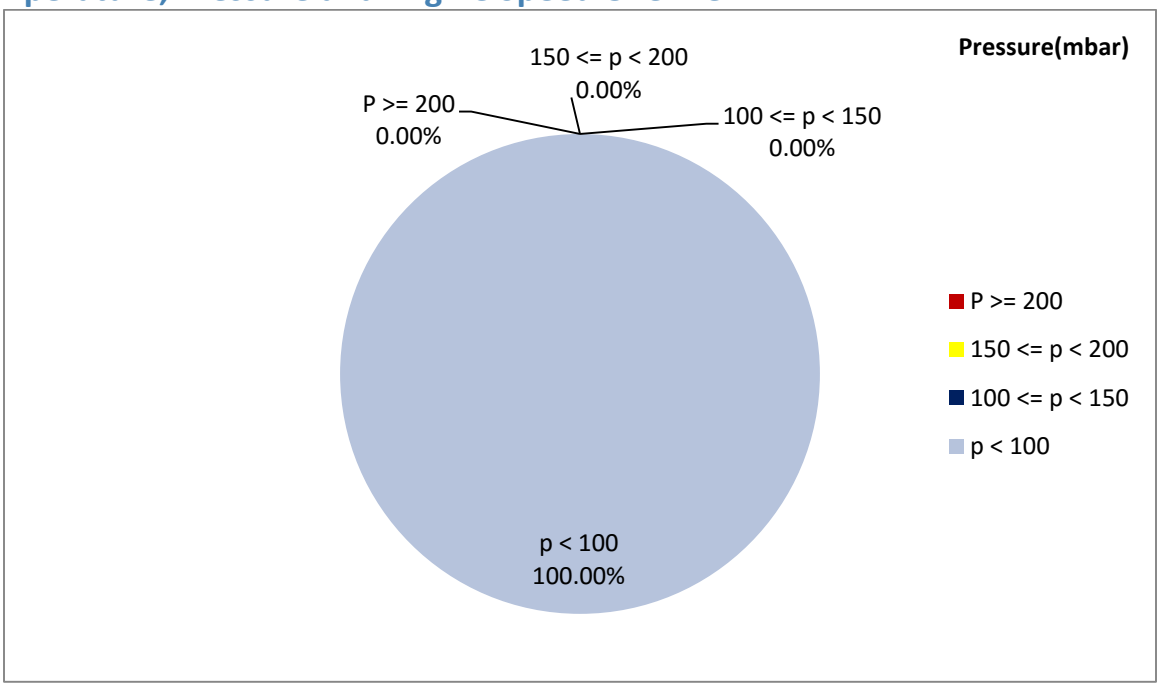


Figure 1- Pressure distribution over the working hours

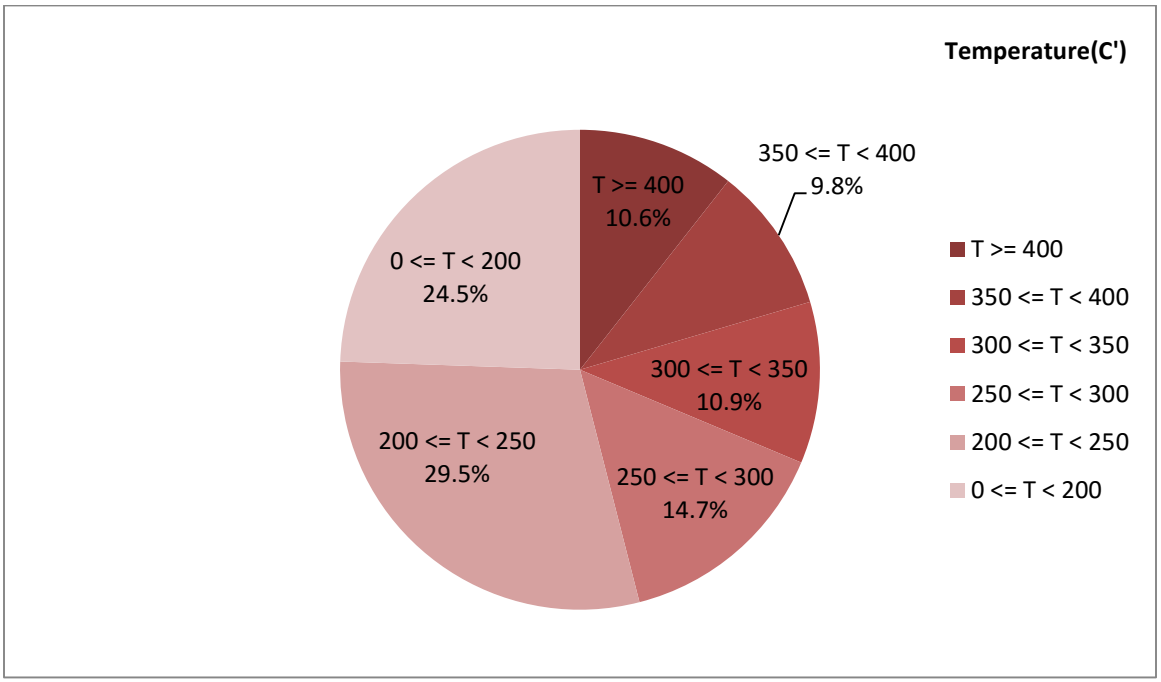


Figure 2-Temperature distribution over the working hours

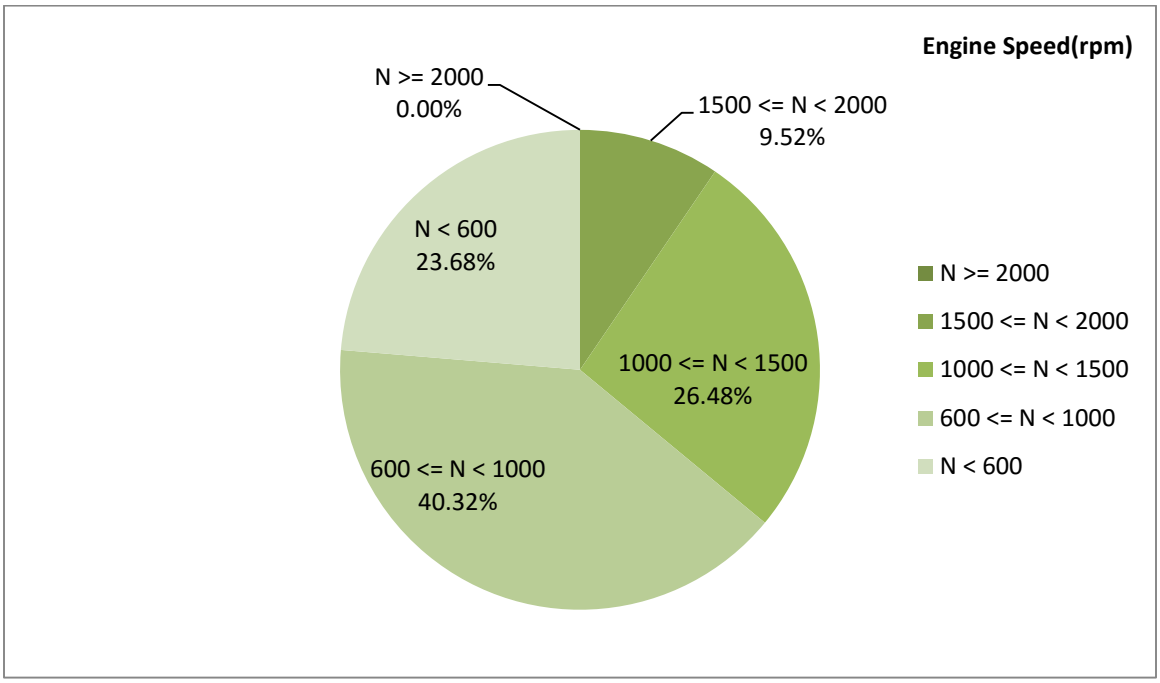


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
262.55	3.71	932

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
280.68	4.86	1051

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
538-50	72-0	2144-304

Detailed Pressure Analysis

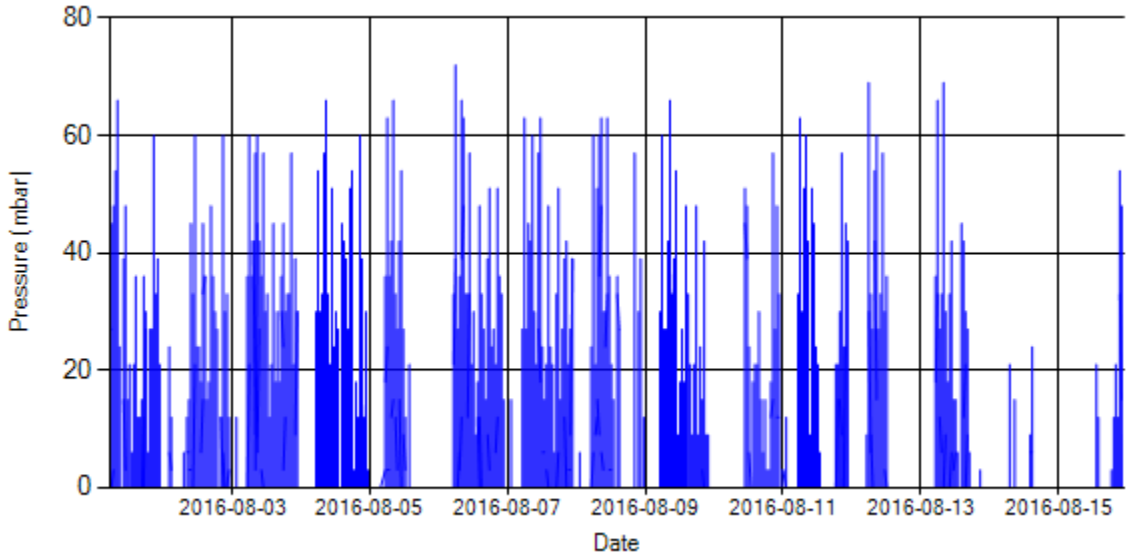


Figure 4- Pressure distribution over the period

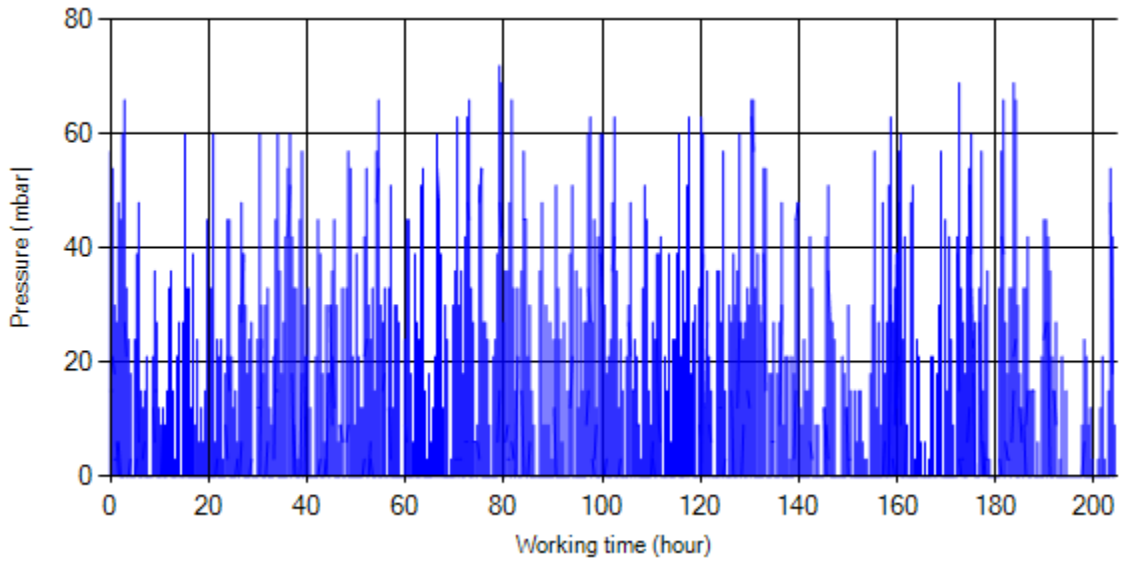


Figure 5- Pressure vs. working hours

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

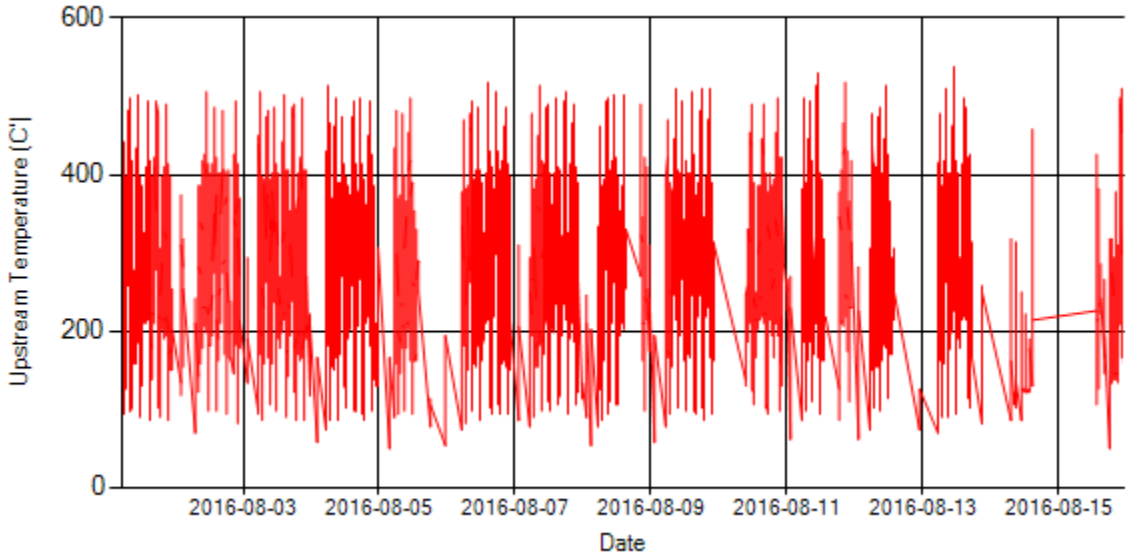


Figure 6- Temperature distribution over the period

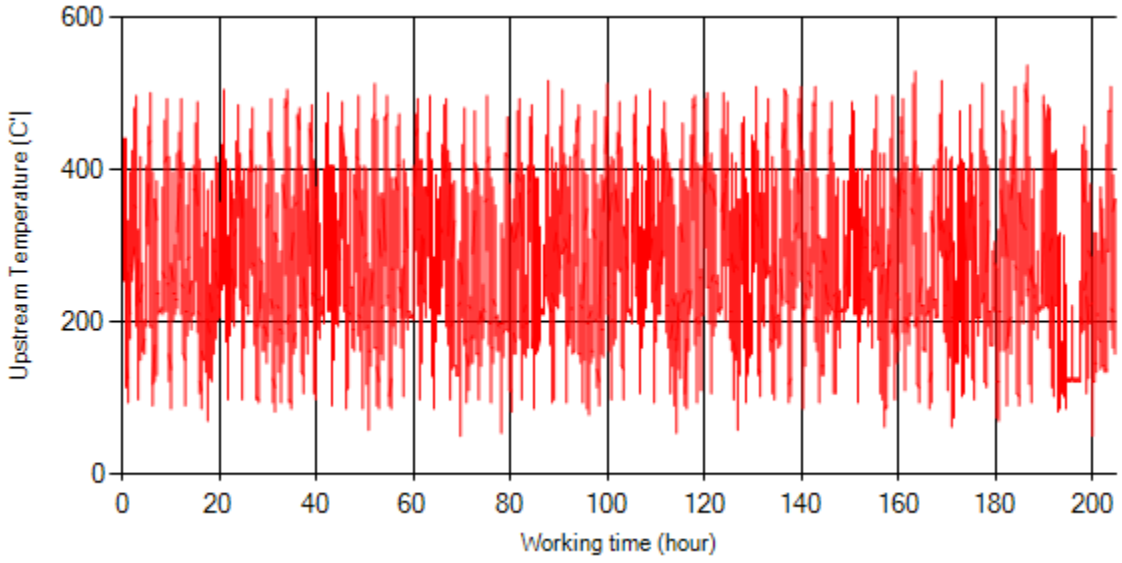


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

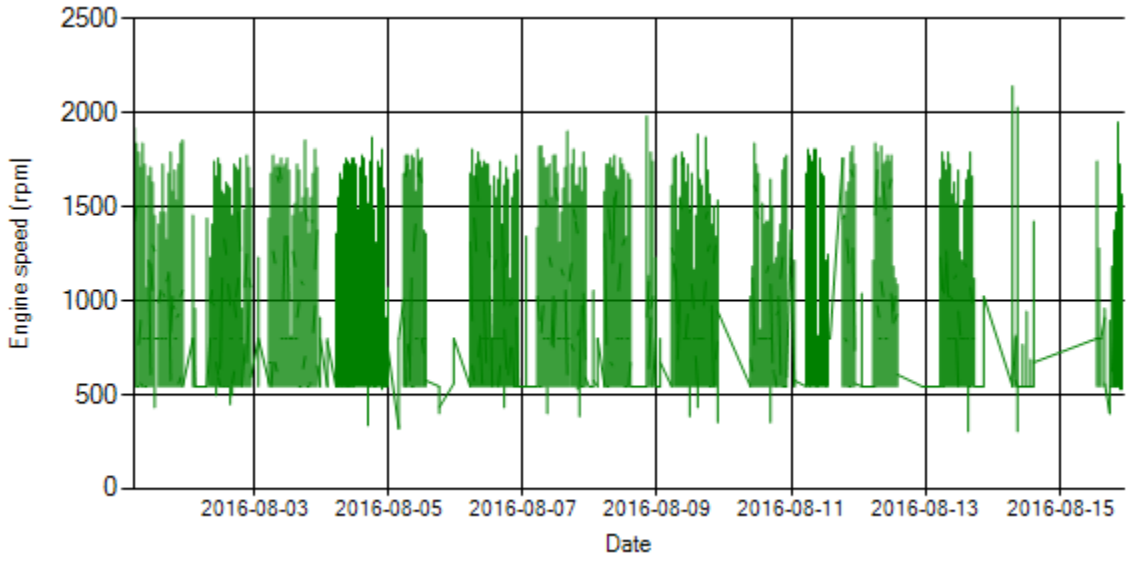


Figure 8- Engine speed distribution over the period

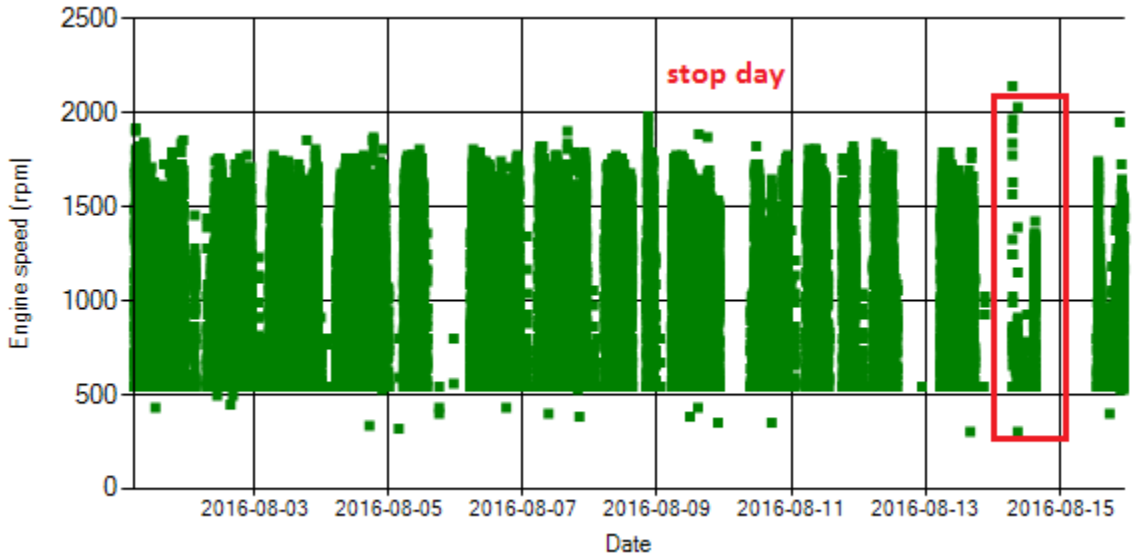


Figure 9- Engine speed diagram for calculating CPK's working days

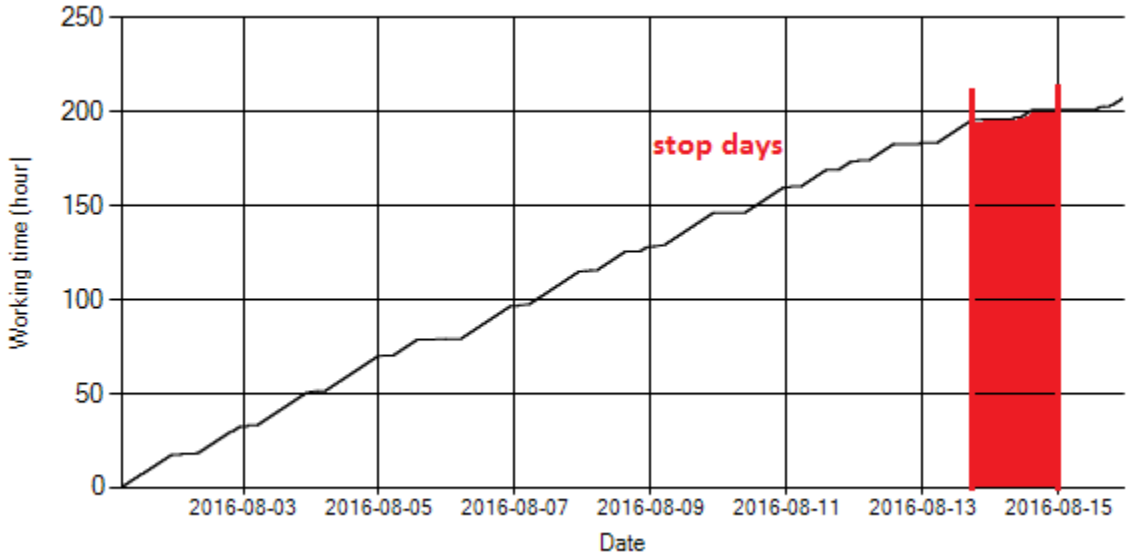


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 10. The lines parallel with Date axis show days without data logger data. As depicted in Figure 10 system was stationary for 1 day.

Pressure-Engine Speed diagrams

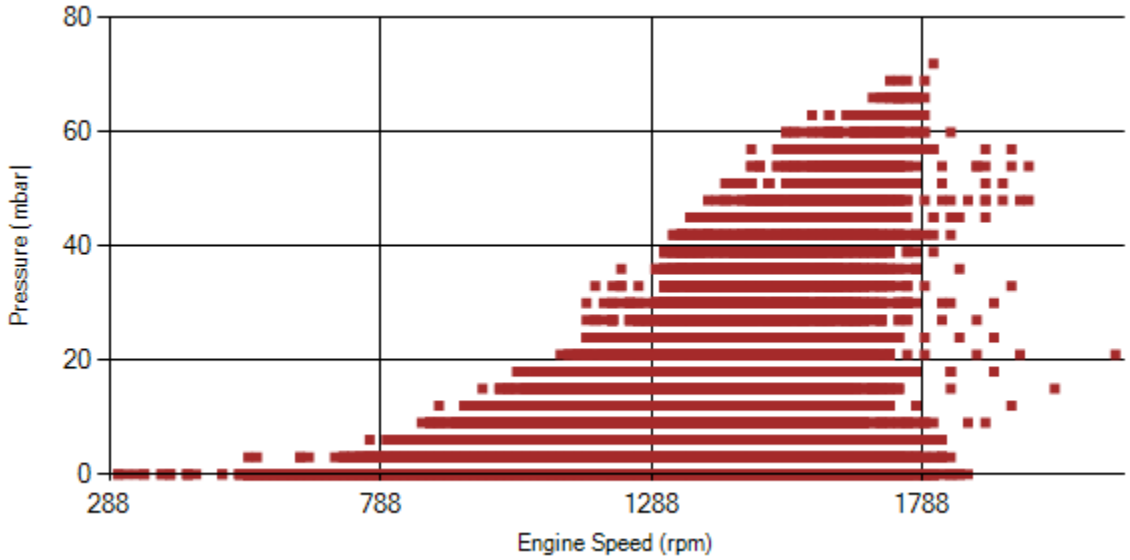


Figure 11- Pressure against engine speed

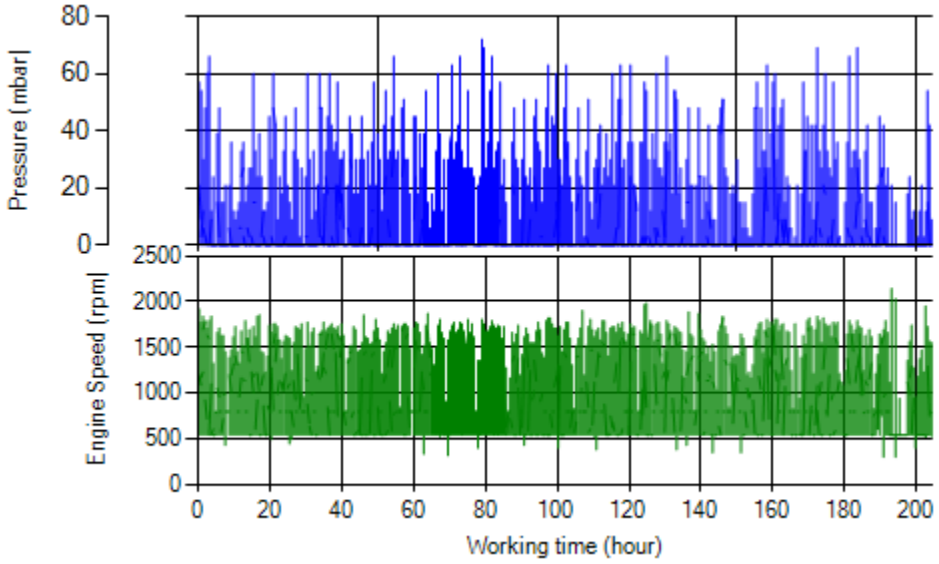


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

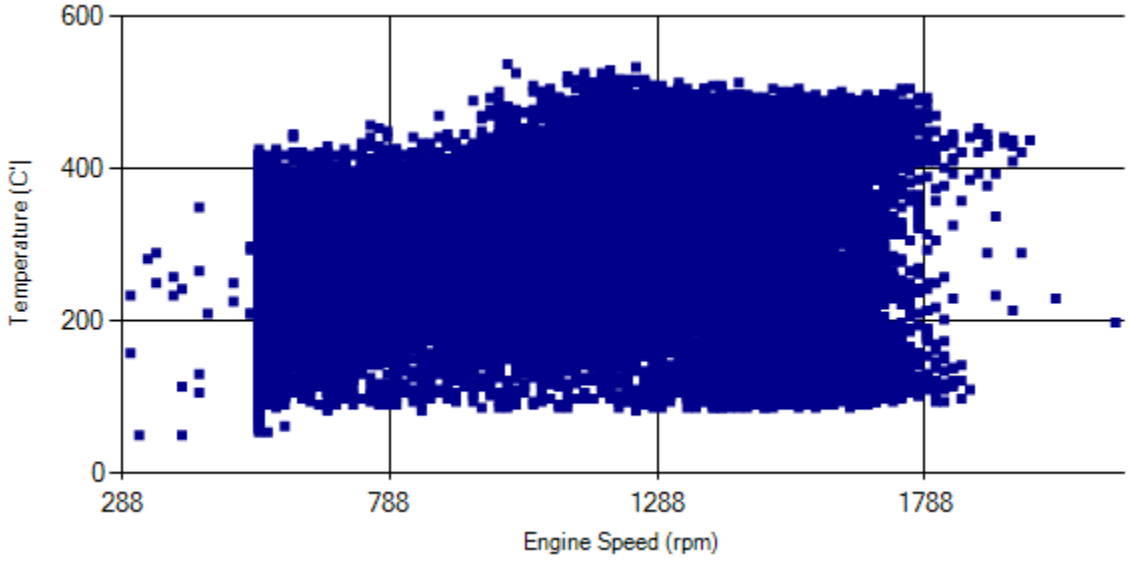


Figure 13- Temperature against engine speed

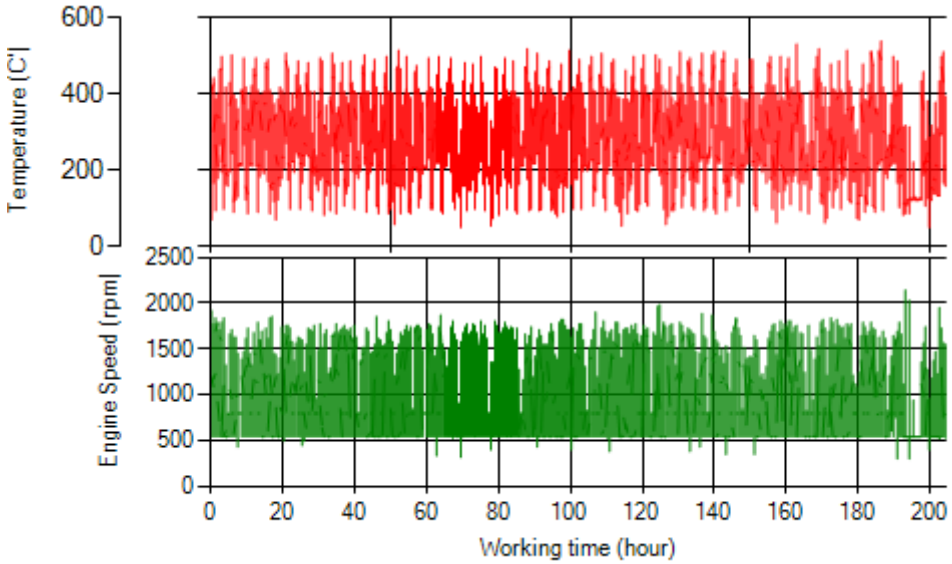


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

NOTE: System was working without DPF core in this period.

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/Aug/2016 – 31/Aug/2016 (sixteen days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF core was cleaned on 2015/Jun/13 for the first time. The second cleaning was done on 2016/Jul/11. Due to some wiring problems, the DPF core was replaced with muffler on Jul 13th.
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)	91208 km
Bus mileage over the period	3344 km
Working days over the period	14 days
Stop days	2 days
Data logger working days	14 days
Working hours over the period	180 hours 45 minutes
Average working hours per day (including stop days)	11 hours 18 minutes
Bus average speed	15.8 km/hr
idle speed time to all working time ration	28.23 %
Total Bus fuel consumption over the period	1739 lit
Fuel consumption per hour	9.62 lit/hr
Average fuel consumption	0.52 lit/km

Temperature, Pressure and Engine Speed Overview

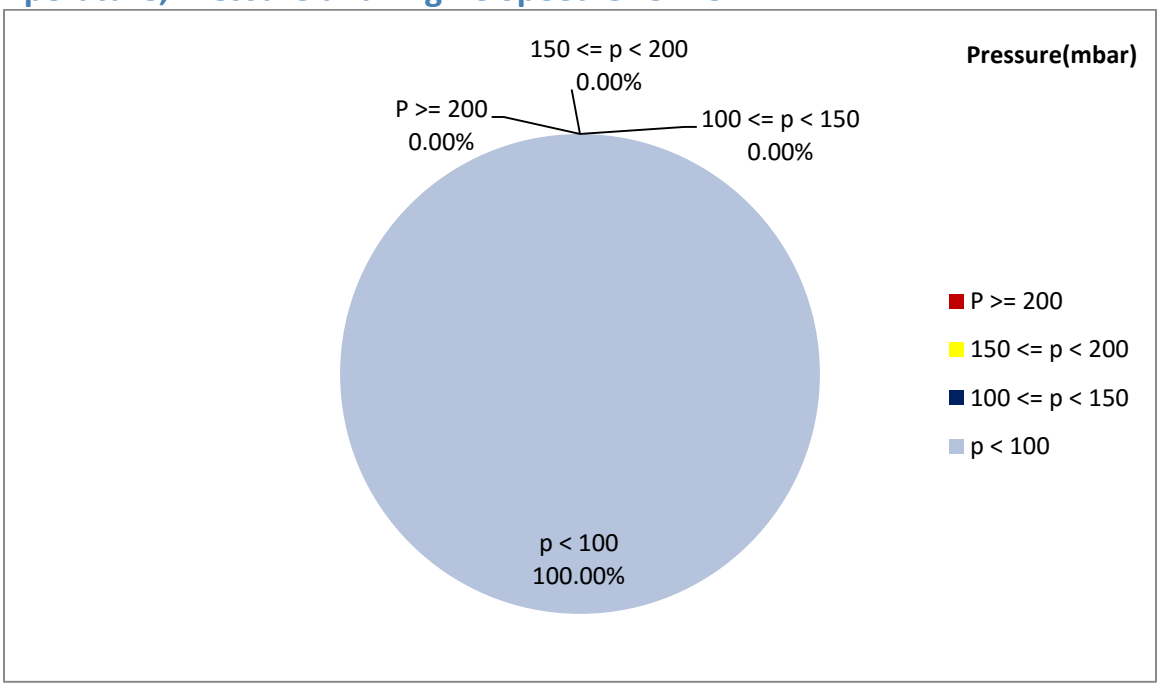


Figure 1- Pressure distribution over the working hours

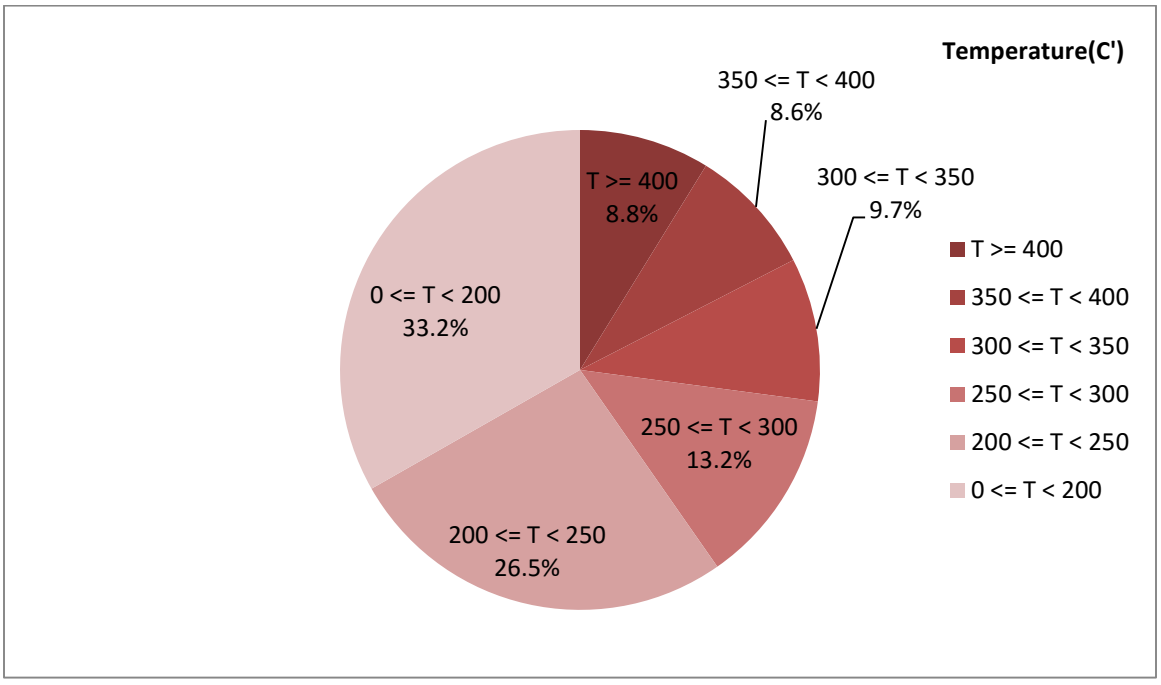


Figure 2-Temperature distribution over the working hours

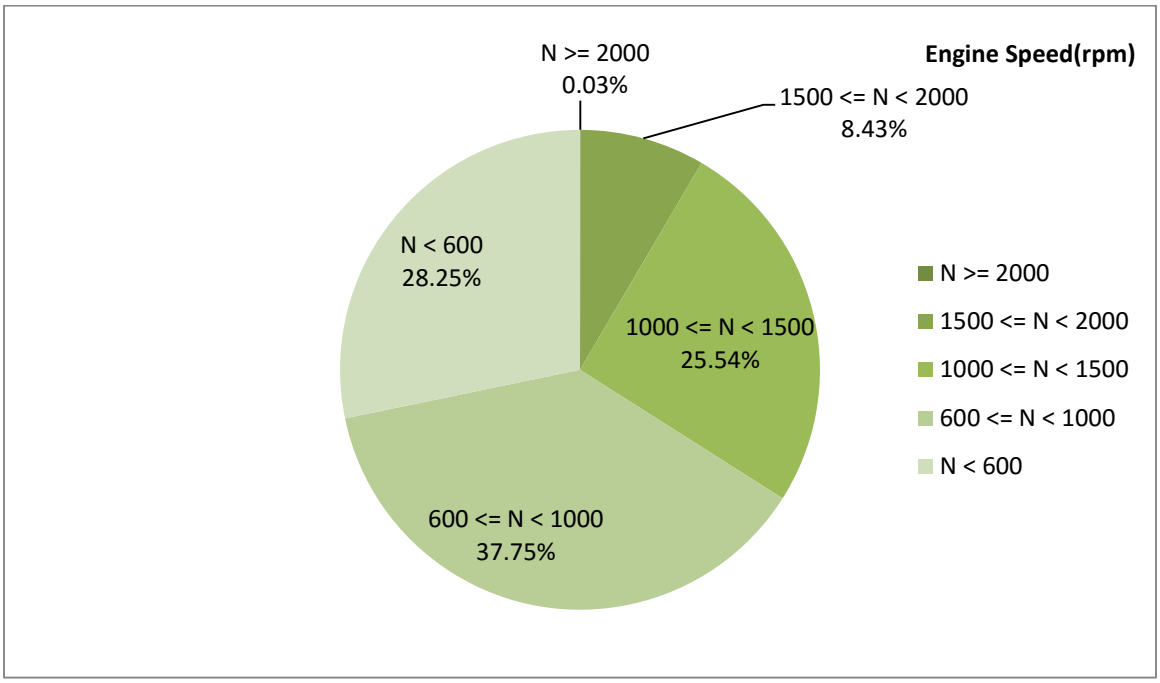


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
247.62	3.14	908

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
272.34	4.36	1049

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
534-50	66-0	2160-272

Detailed Pressure Analysis

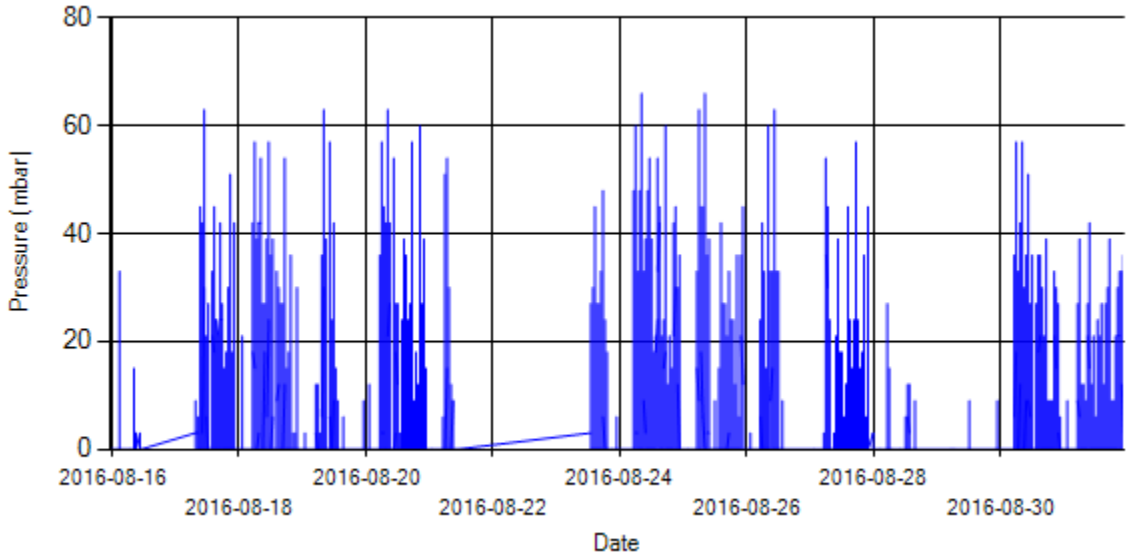


Figure 4- Pressure distribution over the period

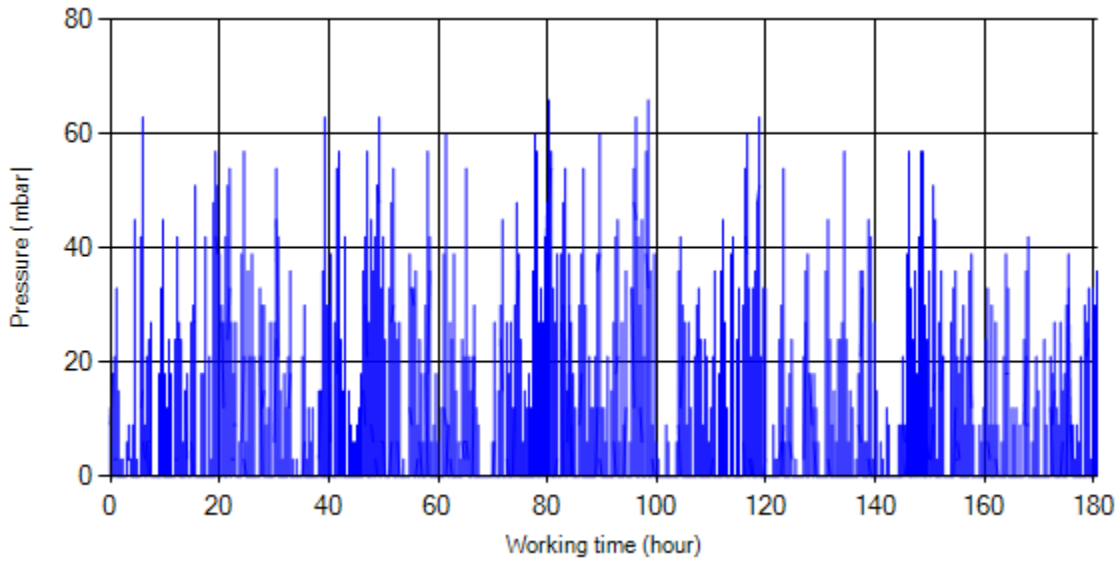


Figure 5- Pressure vs. working hours

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

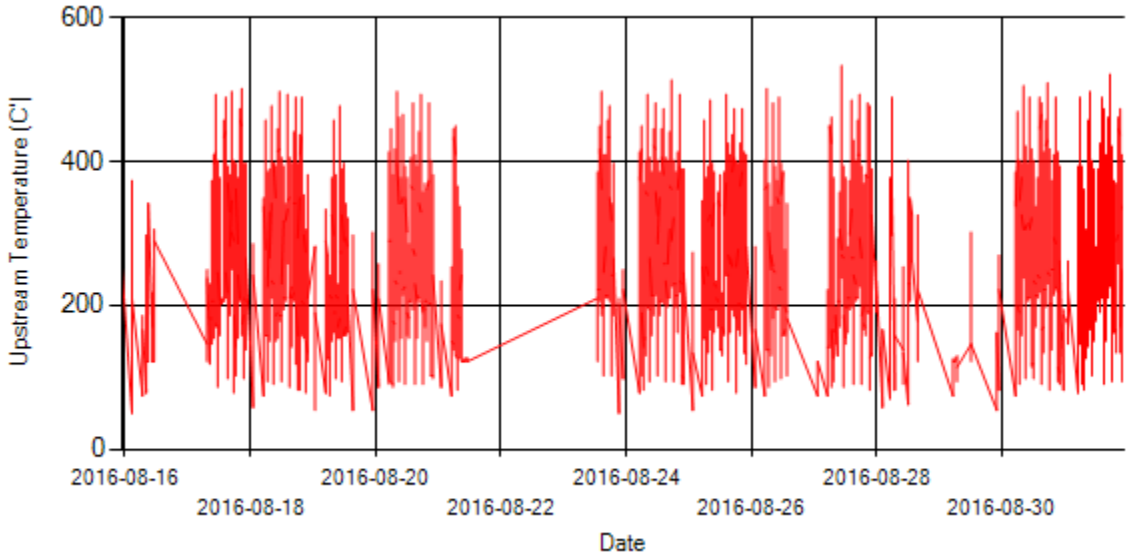


Figure 6- Temperature distribution over the period

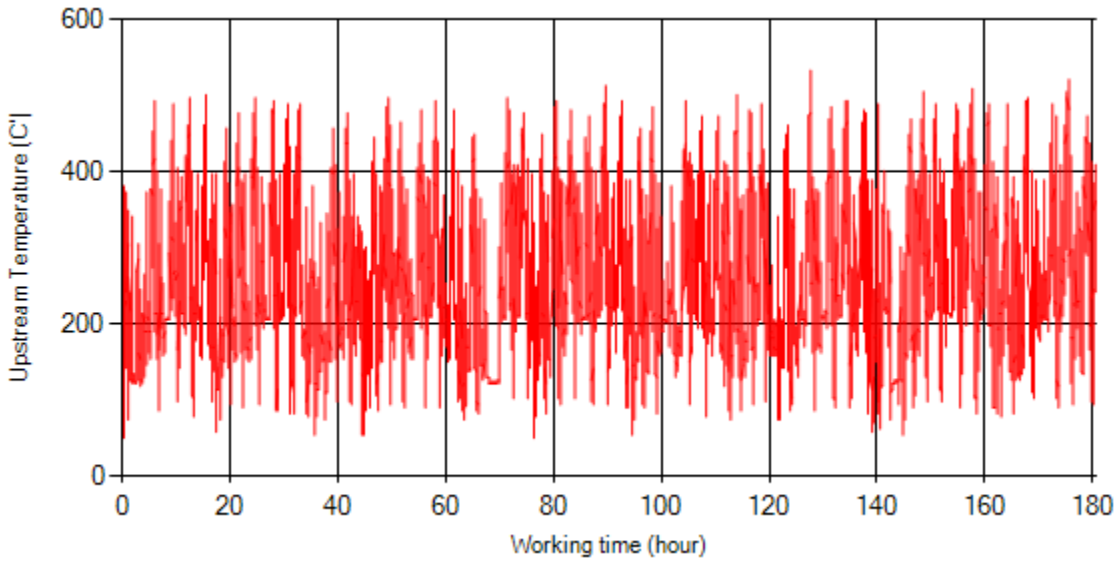


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

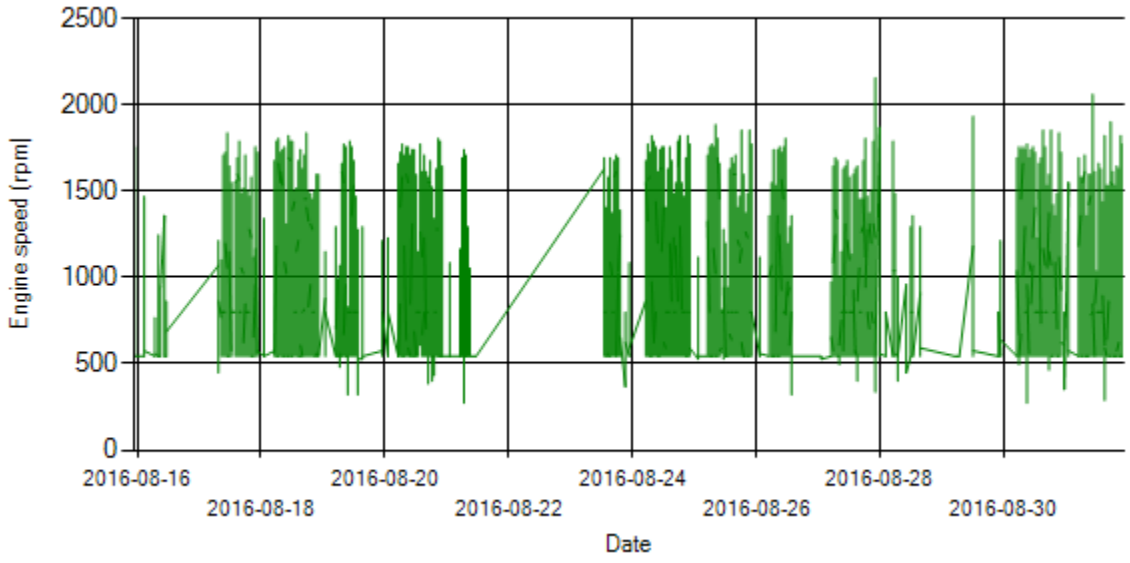


Figure 8- Engine speed distribution over the period

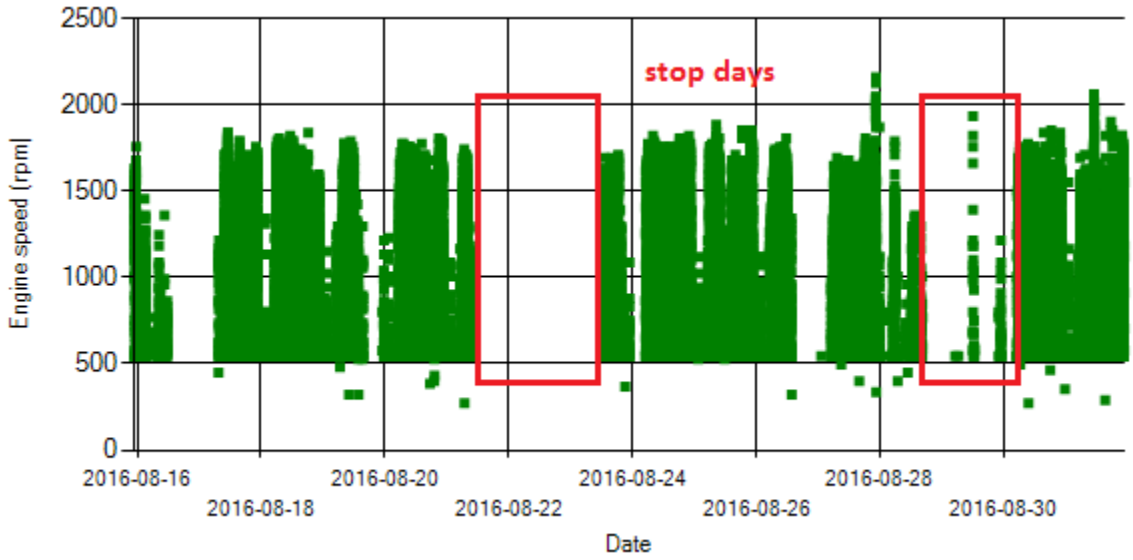


Figure 9- Engine speed diagram for calculating CPK's working days

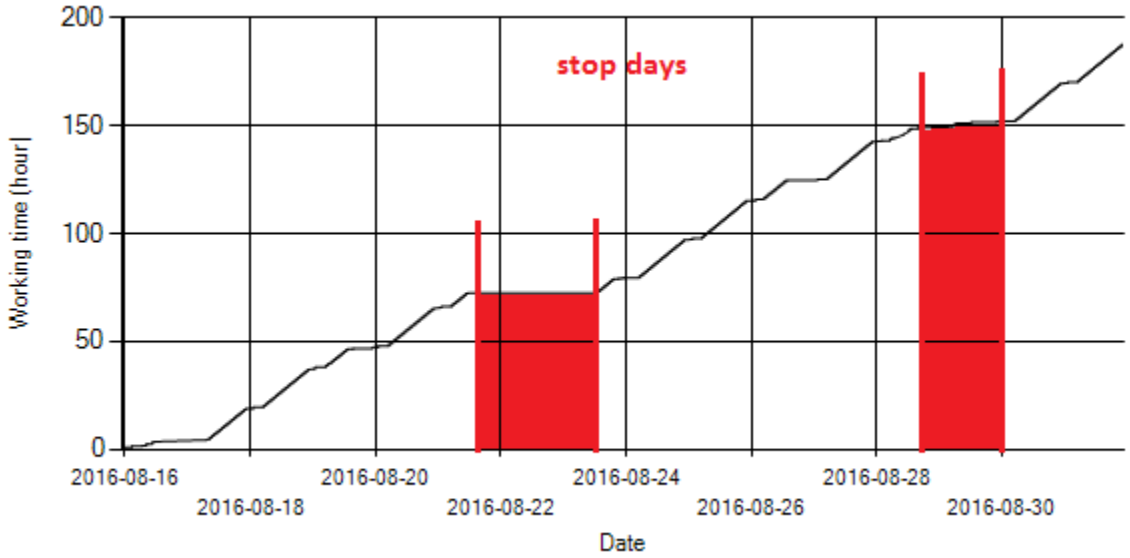


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 10. The lines parallel with Date axis show days without data logger data. As depicted in Figure 10 system was stopped for 2 days.

Pressure-Engine Speed diagrams

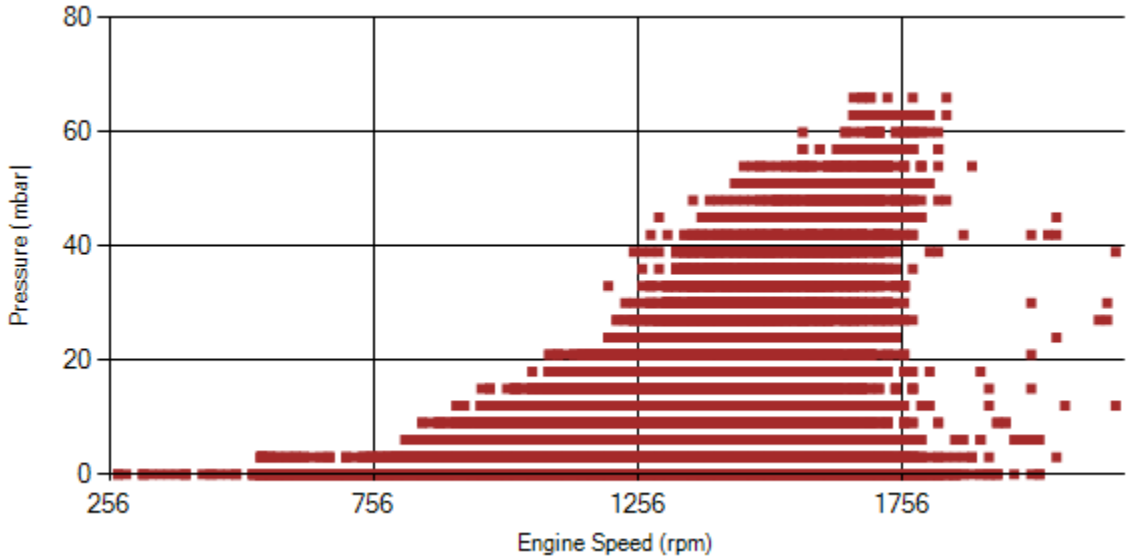


Figure 11- Pressure against engine speed

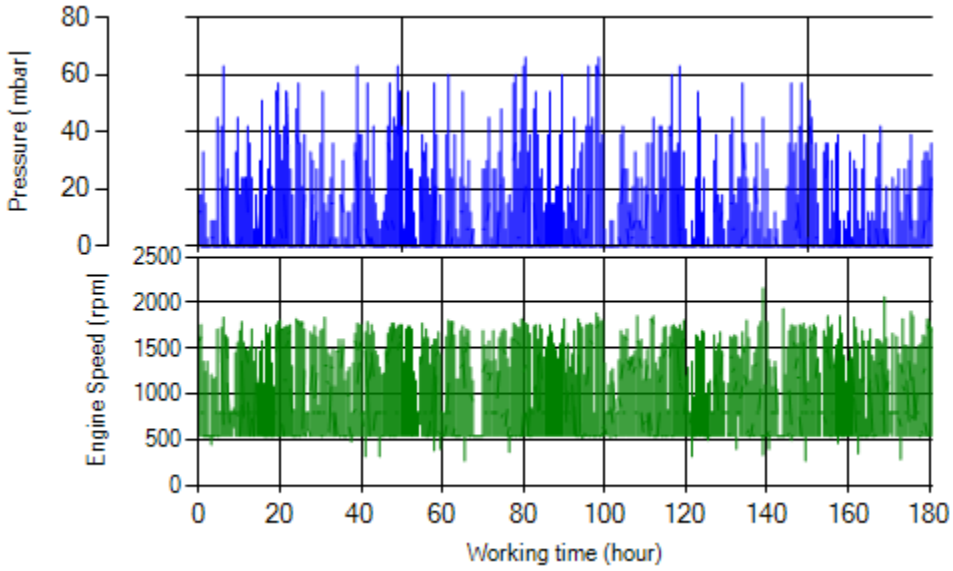


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

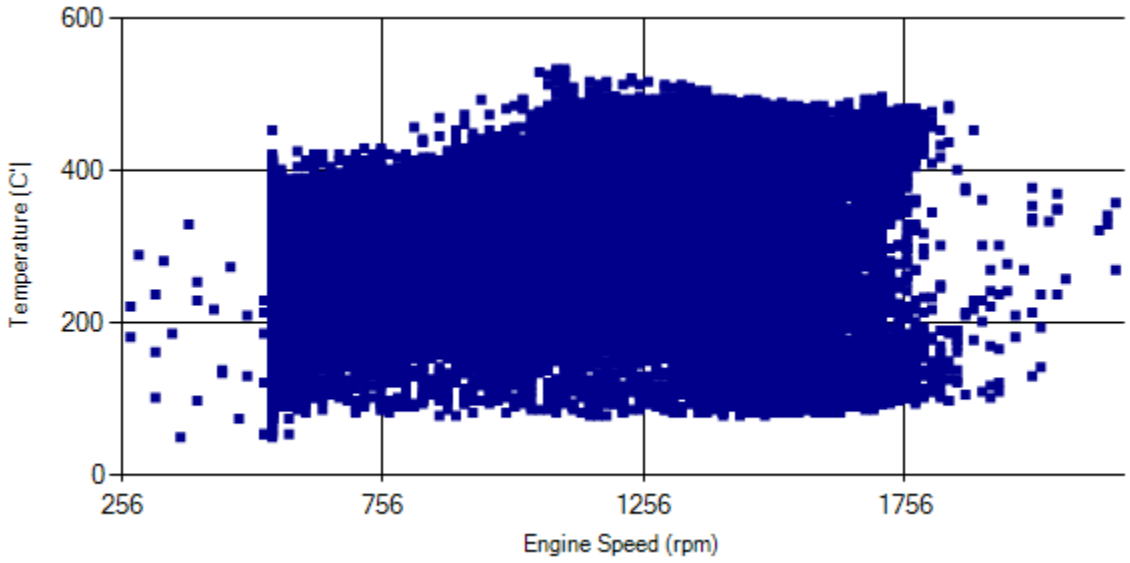


Figure 13- Temperature against engine speed

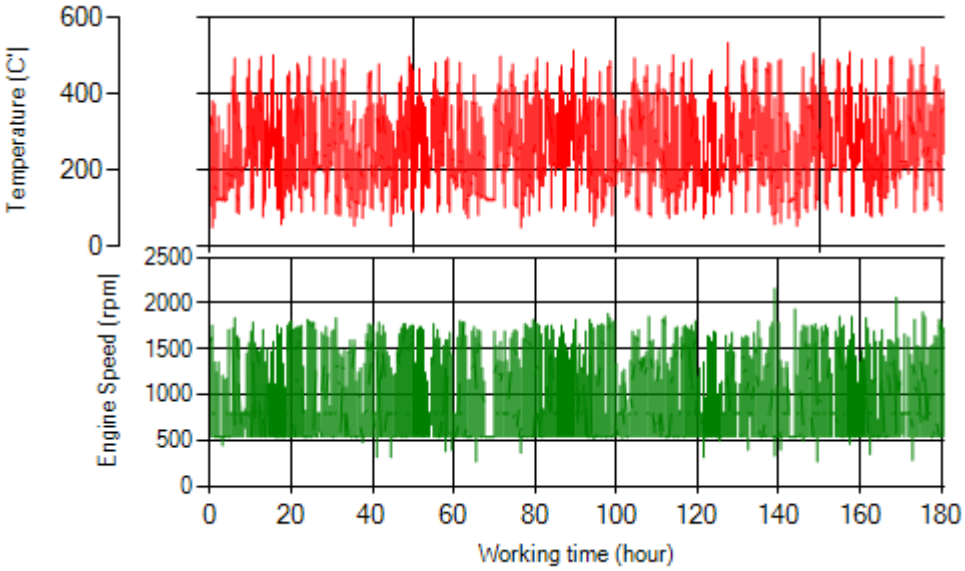
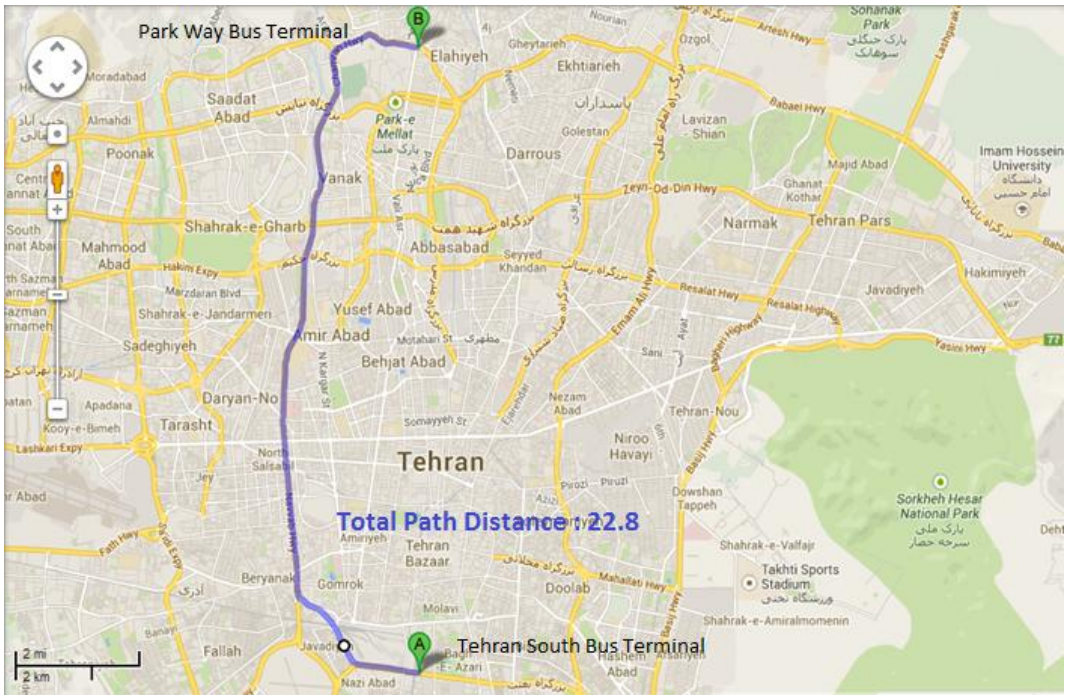


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

NOTE: System was working without DPF core in this period.

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



Overall Information

Table1- Overall Information

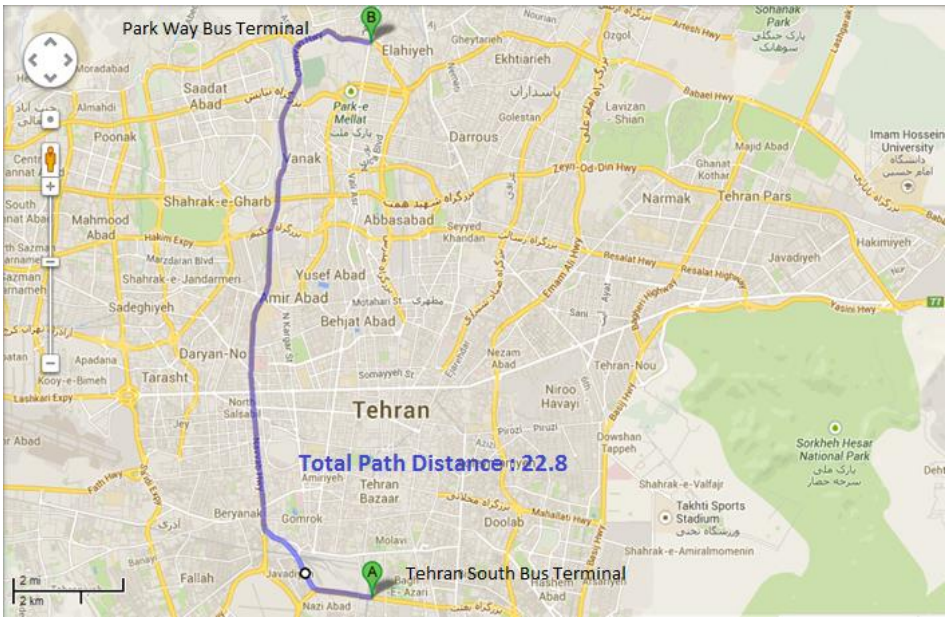
Vehicle plate number	78515
CPK data logger number	LN: 001490, DN: 1954, Sim Number +98000000000
Bus line	Number 4 (south to north bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	Dinex_01 (passive system with FBC)
Installation date	22/Oct/2014
Report period	01/Aug/2016 – 31/Aug/2016 (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 15th. (Secondary value/Initial value=0.3)

Notice: The bus has been stopped from 2015 Sep 18th until now due to technical problems (related to Bus Company).

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



ASA Azmoon Sanat Arvin	Document Number: DPF2016081/1 Date: 21/Aug/2016

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	PURItech (Passive system with FBC)
Installation date	28/Jan/2015
Report period	01/Aug/2016 – 15/Aug/2016 (fifteen days)
K value	-
K value	-

Table 2- DPF Maintenance History

Filter maintenance date	DPF core was removed on Jul 22nd and was cleaned on Aug 12th for the first time. Considering system relatively high backpressure, filter isolation defect and air filter's deformation, DPF core was removed on Sep 16th and installed on Nov 17th. The third cleaning was unavoidable after only 6 days working and was done on 29th Nov. System only worked for two days and DPF was replaced by muffler on Nov 30th. DPF was installed for the fourth time on Jan/19/2016 and was replaced by muffler after only three days working because of high backpressure. A new DPF core was installed on May/14/2016 and was cleaned on Jun/25/2016. The DPF core was replaced by muffler on Jul/10/2016 due to high backpressure.
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)	102548 km
Bus mileage over the period	3014 km
Working days over the period	14 days
Stop days	1 day
Data logger working days	14 days
Working hours over the period	180 hours 24 minutes
Average working hours per day (including stop days)	12 hours 53 minutes
Bus average speed	16.7 km/hr
idle speed time to all working time ration	22.07 %
Total Bus fuel consumption over the period	1778 lit
Fuel consumption per hour	9.85 lit/hr
Average fuel consumption	0.59 lit/km

Temperature, Pressure and Engine Speed Overview

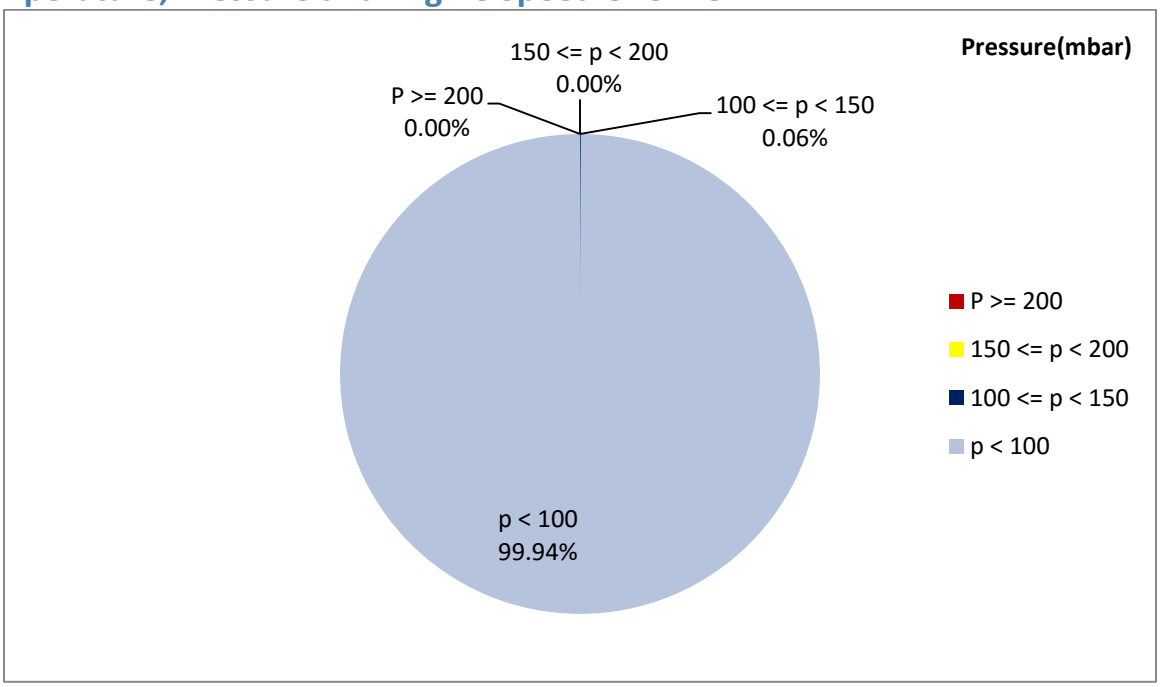


Figure 1- Pressure distribution over the working hours

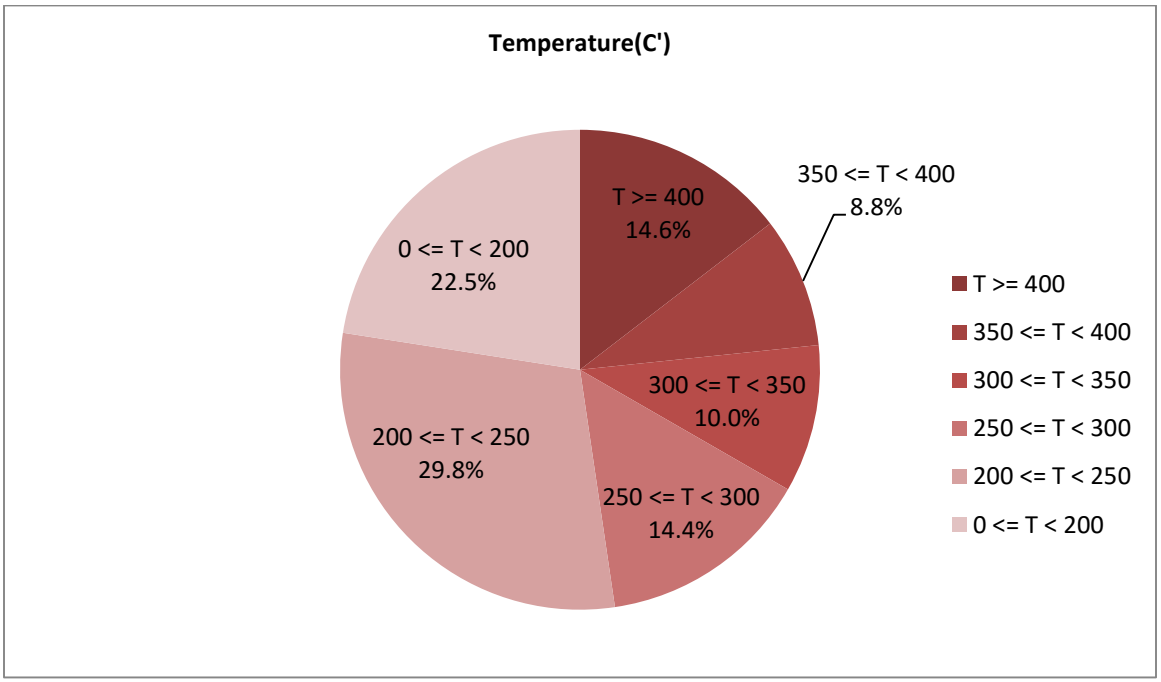


Figure 2-Temperature distribution over the working hours

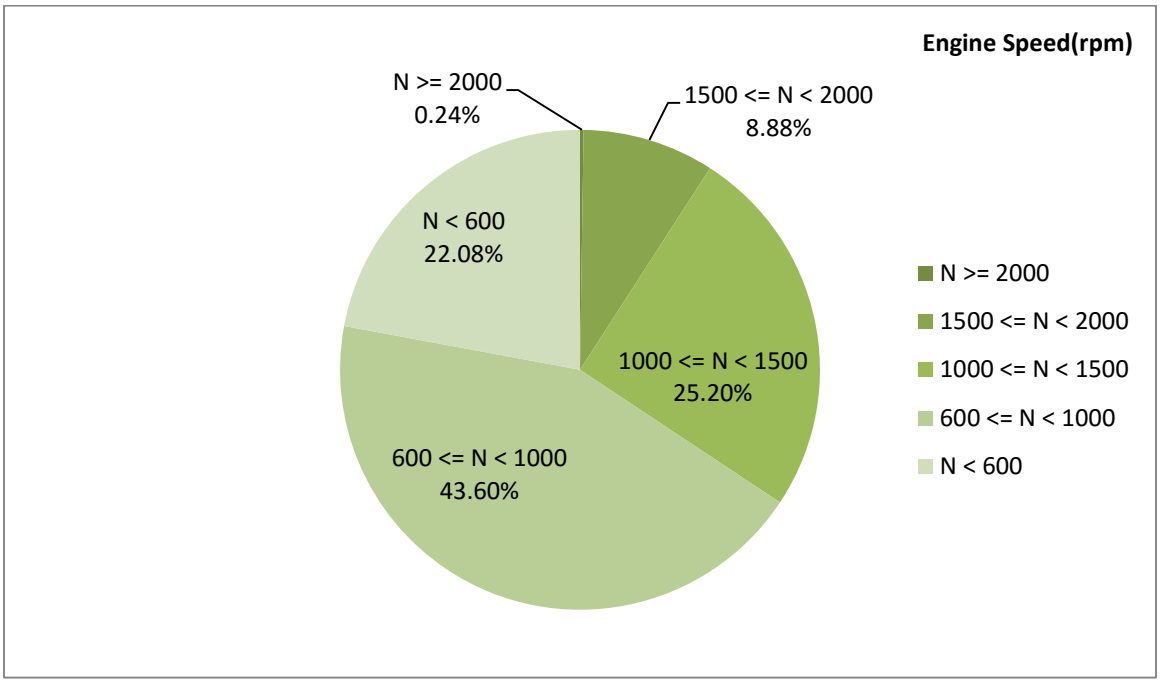


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
275.09	6.2	930

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
292.07	7.96	1038

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
610-50	111-0	2400-256

Detailed Pressure Analysis

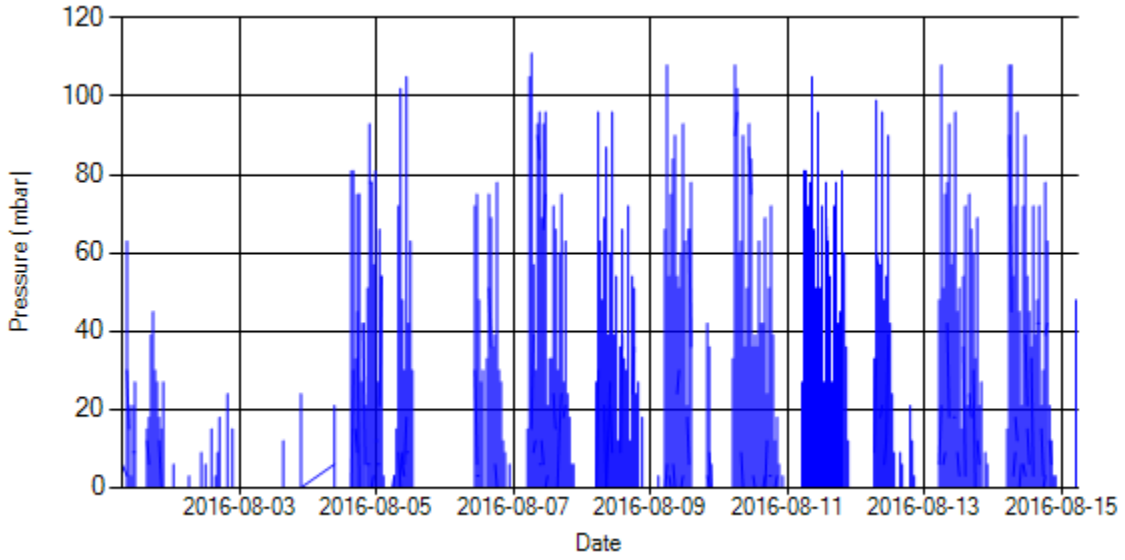


Figure 4- Pressure distribution over the period

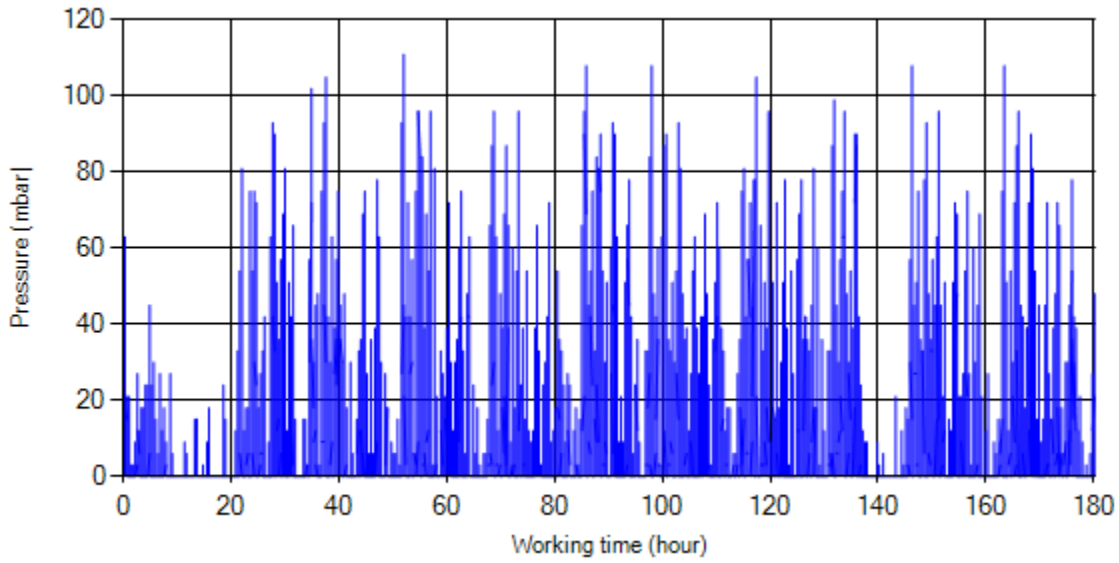


Figure 5- Pressure vs. working hours

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

Detailed Temperature Analysis

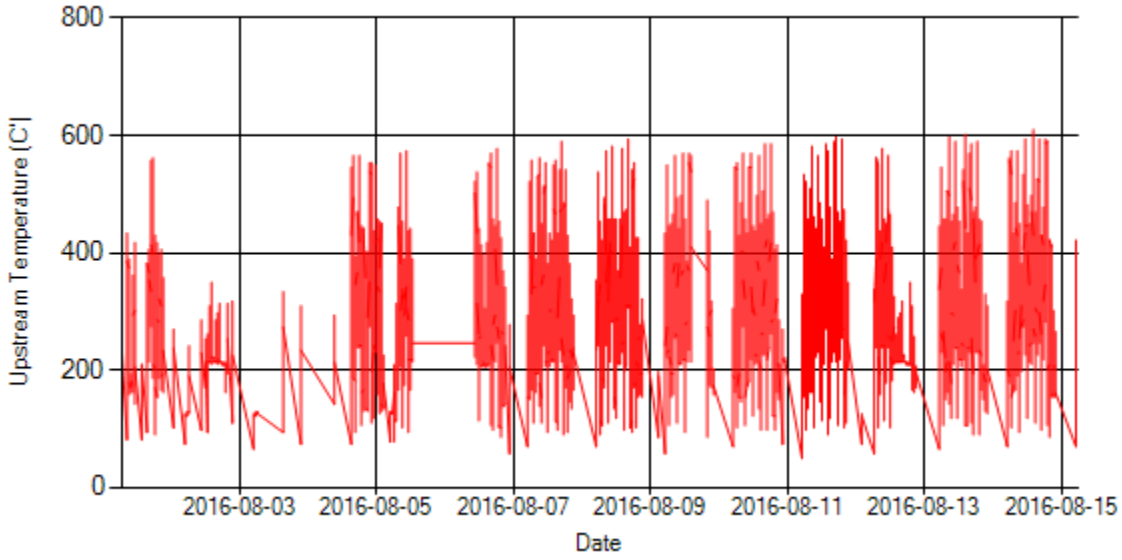


Figure 6- Temperature distribution over the period

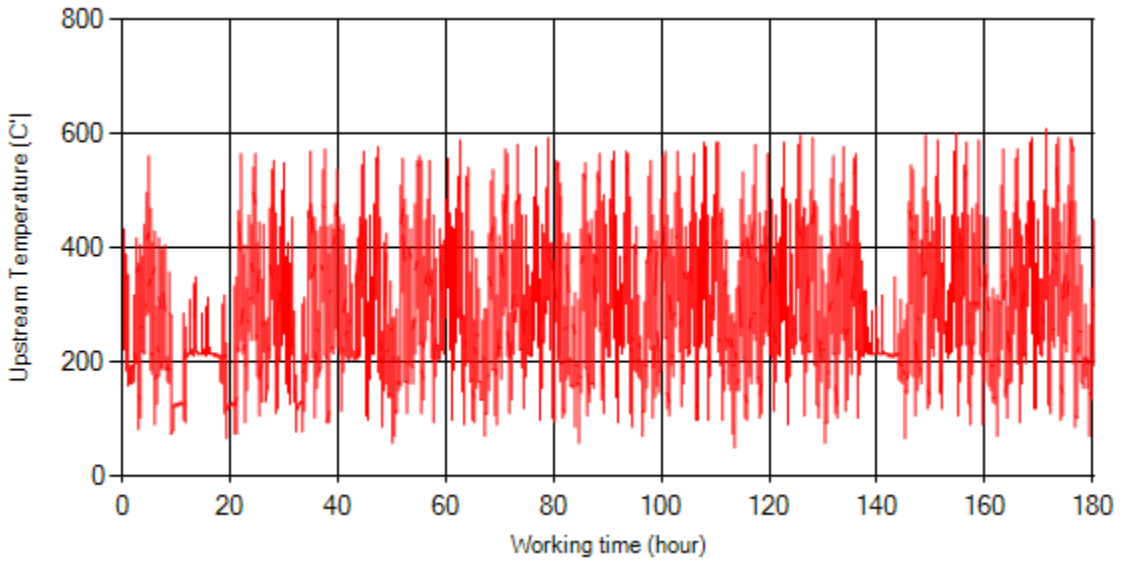


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

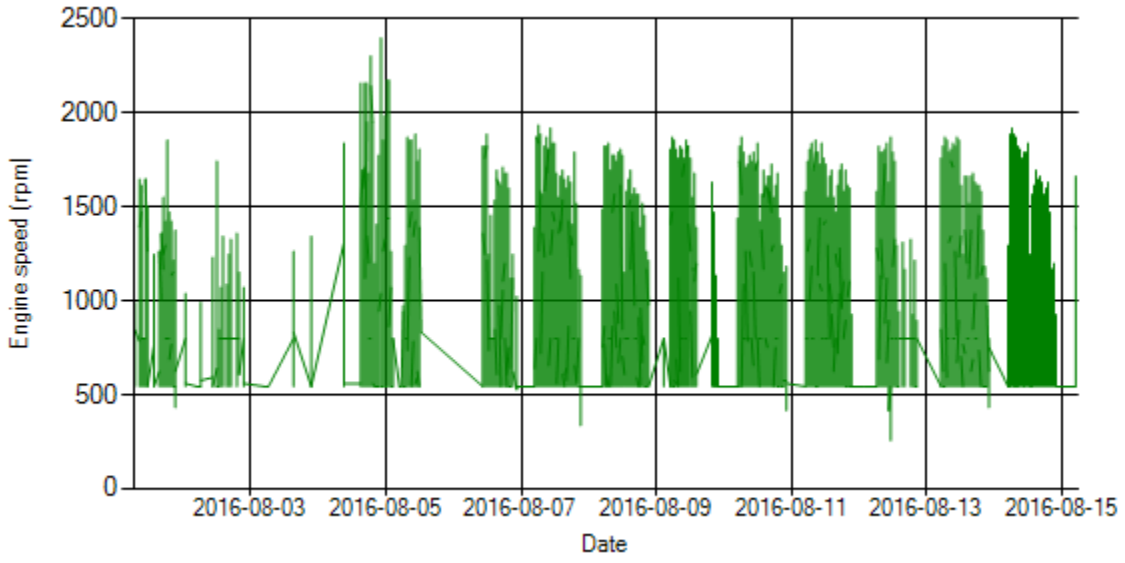


Figure 8- Engine speed distribution over the period

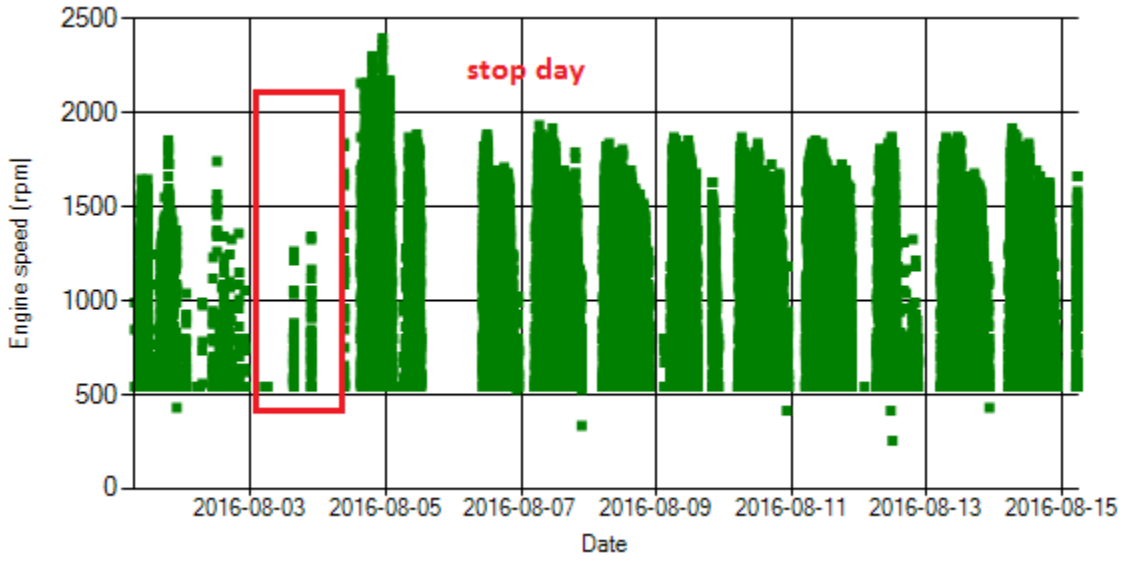


Figure 9- Engine speed diagram for calculating CPK's working days

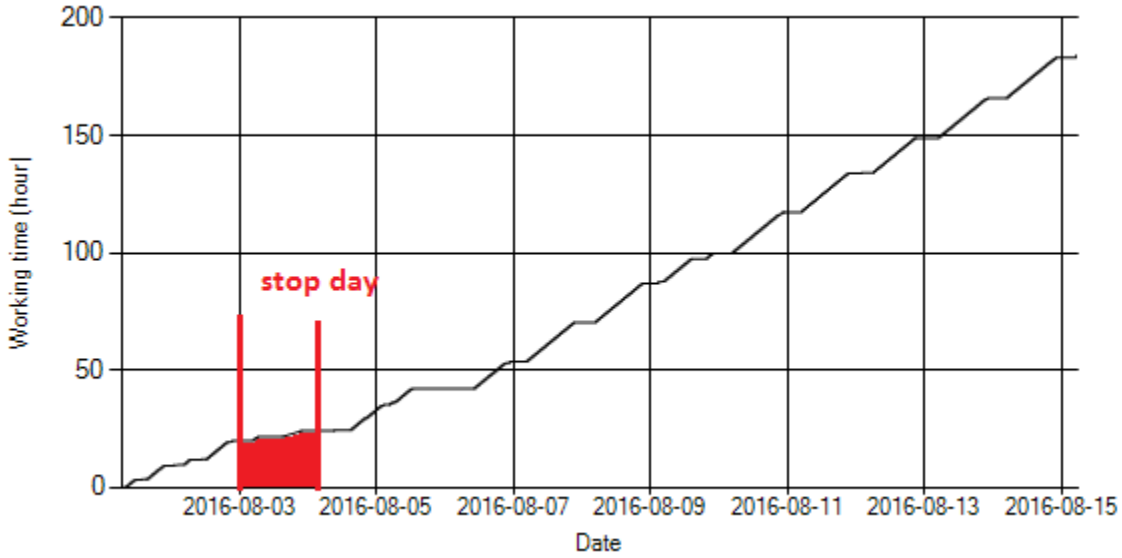


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 10. The lines parallel with Date axis show days without data logger data. As depicted in Figure 10 system was stationary for 1 day.

Pressure-Engine Speed diagrams

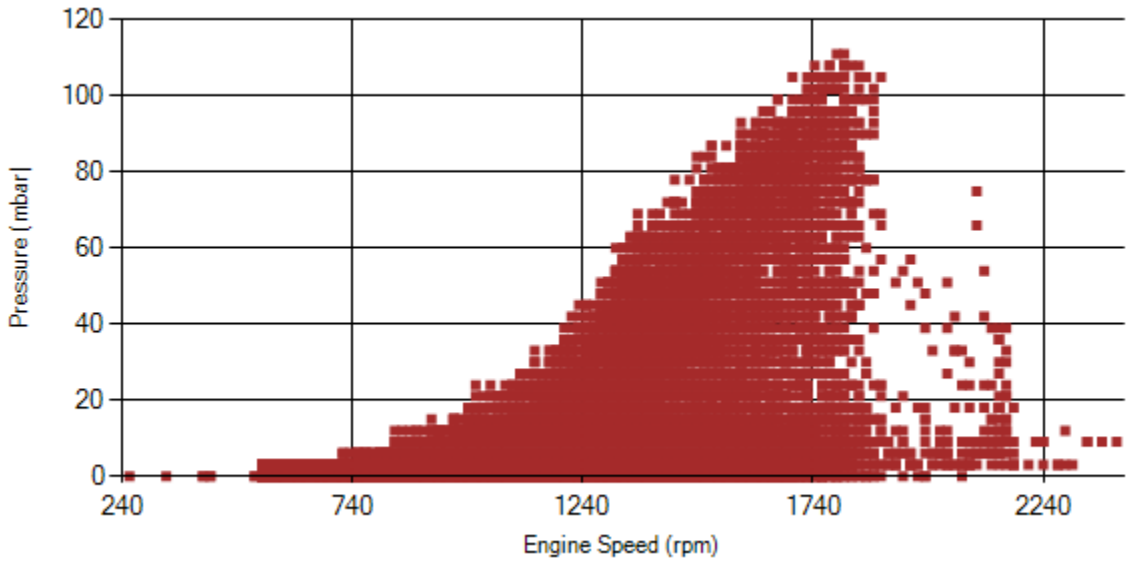


Figure 11- Pressure against engine speed

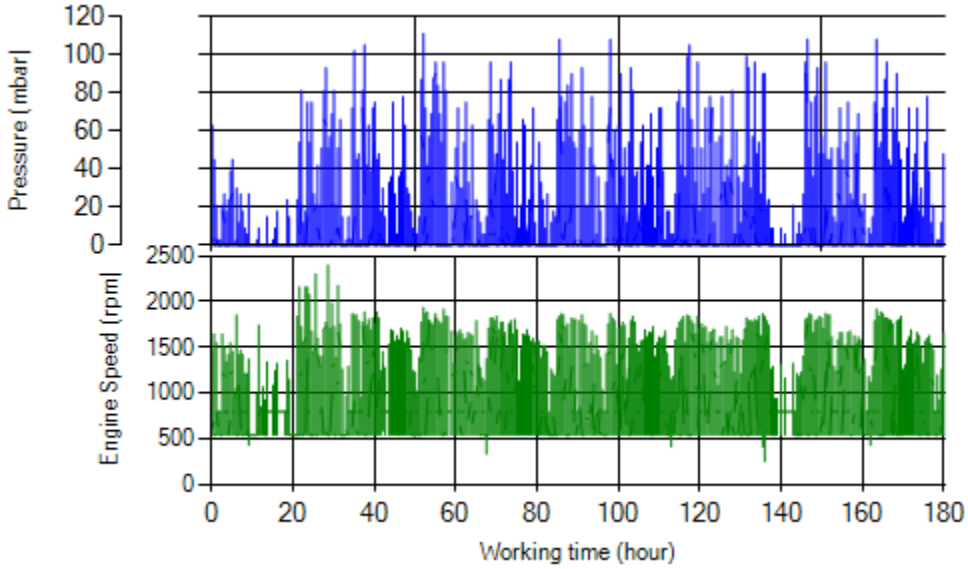


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

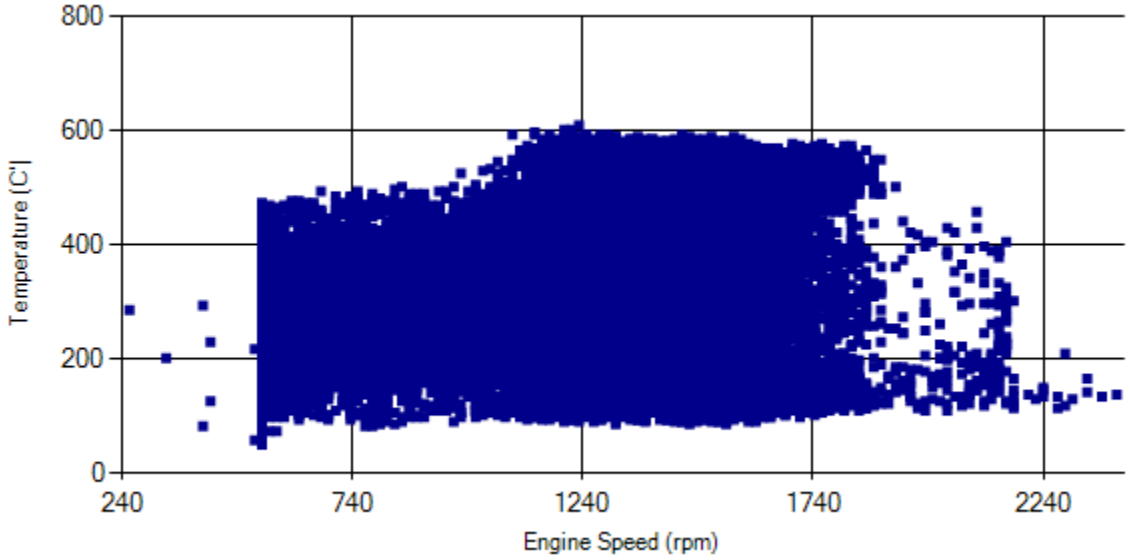


Figure 13- Temperature against engine speed

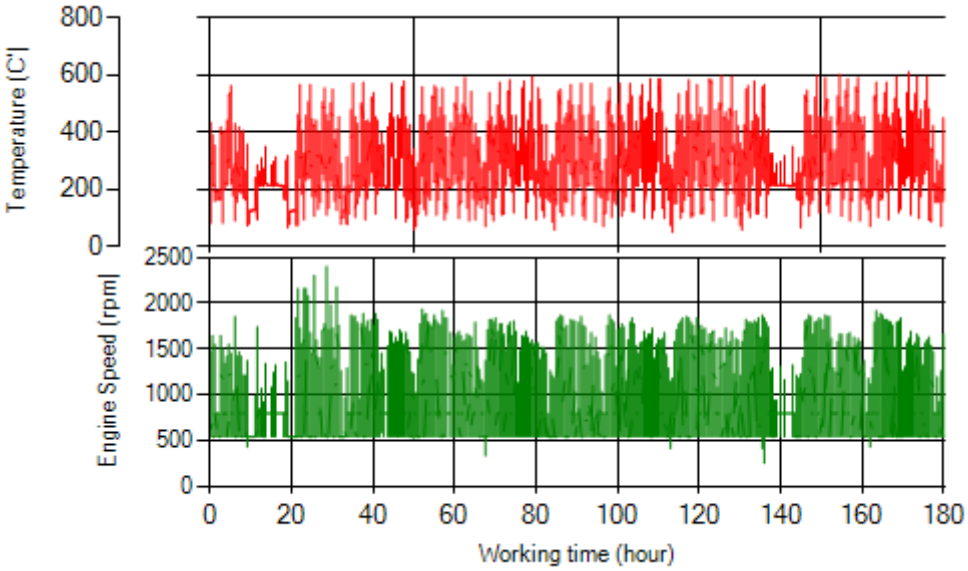


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

NOTE: system was working without DPF core on this period.

ASA Azmoon Sanat Arvin	Document Number: DPF2016082/1 Date: 05/Sep/2016

Overall Information

Table1- Overall Information

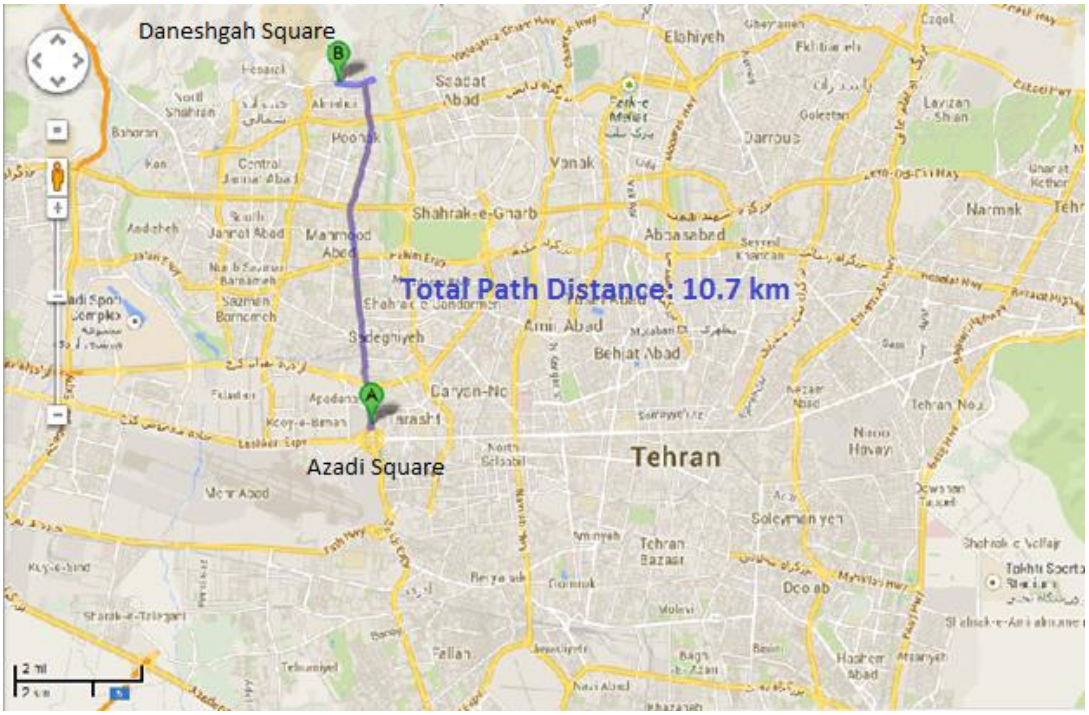
Vehicle plate number	78524
CPK data logger number	LN: 001443, DN: 1930,Sim +989218786219
Bus line	Number 4 (south to north Bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	PURItech (Passive system with FBC)
Installation date	28/Jan/2015
Report period	16/Aug/2016 – 31/Aug/2016 (sixeen days)
K value	-
K value	-

Table 2- DPF Maintenance History

Filter maintenance date	DPF core was removed on Jul 22nd and was cleaned on Aug 12th for the first time. Considering system relatively high backpressure, filter isolation defect and air filter's deformation, DPF core was removed on Sep 16th and installed on Nov 17th. The third cleaning was unavoidable after only 6 days working and was done on 29th Nov. System only worked for two days and DPF was replaced by muffler on Nov 30th. DPF was installed for the fourth time on Jan/19/2016 and was replaced by muffler after only three days working because of high backpressure. A new DPF core was installed on May/14/2016 and was cleaned on Jun/25/2016. The DPF core was replaced by muffler on Jul/10/2016 due to high backpressure.
Dosing status	Dosing value has been kept constant from installation date until now.

NOTE: The bus was stopped on this period due to technical problems.

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



Overall Information

Table1- Overall Information

Vehicle plate number	85182
CPK data logger number	LN: 001502, DN: 1999
Bus line	Number 10 (south to north Bus line)
Bus Terminals	Azadi square - Daneshgah square
Total path distance	10.7 km
DPF producer company	Tehag_01 (Catalyzed DPF)
Installation date	24/Sep/2015
Report period	01/Aug/2016 – 15/Aug/2016 (fifteen days)
K value - DPF upstream	1.85 [1/m]
K value – DPF downstream	0.04 [1/m]

Table 2- DPF Maintenance History

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

Table 3- Fuel and Additive Consumption Information

Bus mileage (from DPF installation date)	22844 km
Bus mileage over the period	1874 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	132 hours 1 minutes
Average working hours per day (including stop days)	8 hours 48 minutes
Bus average speed	14.2 km/hr
idle speed time to all working time ration	66.44 %
Total Bus fuel consumption over the period	1237 lit
Fuel consumption per hour	9.37 lit/hr
Average fuel consumption	0.66 lit/km

Temperature, Pressure and Engine Speed Overview

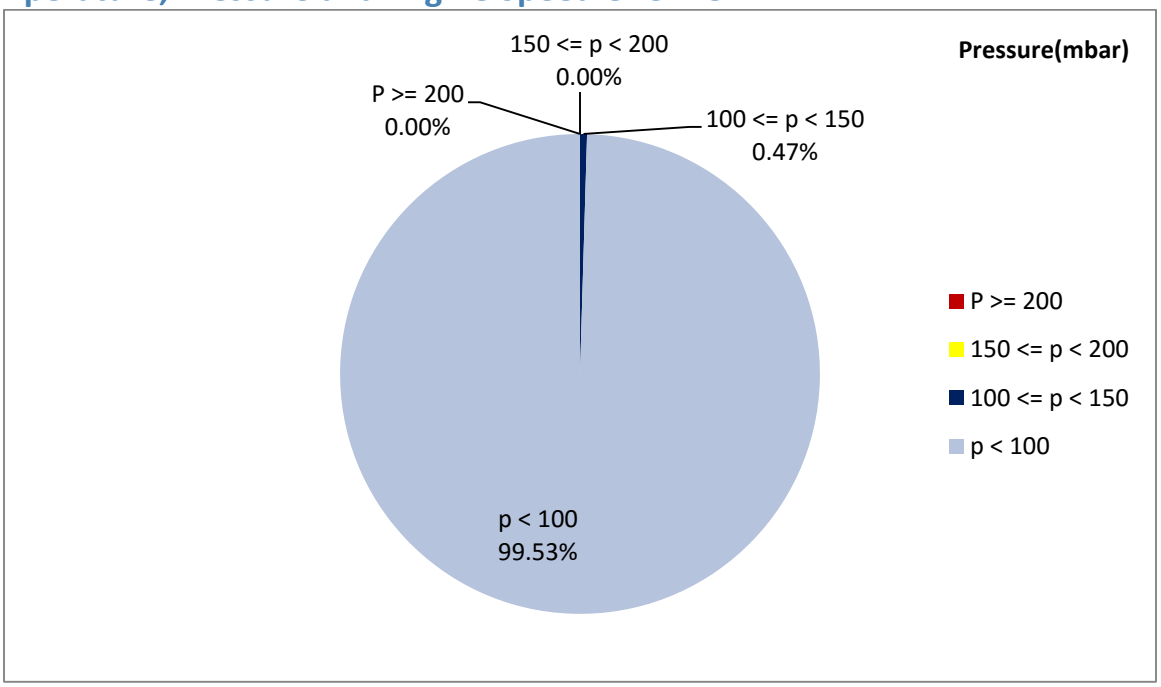


Figure 1- Pressure distribution over the working hours

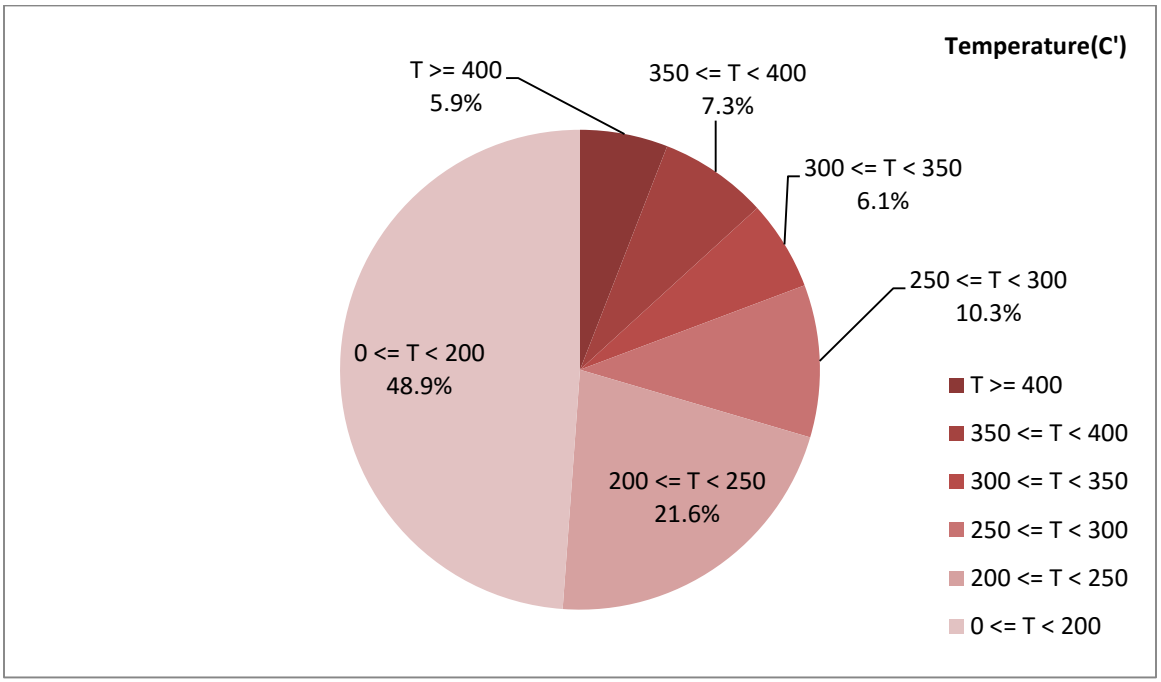


Figure 2-Temperature distribution over the working hours

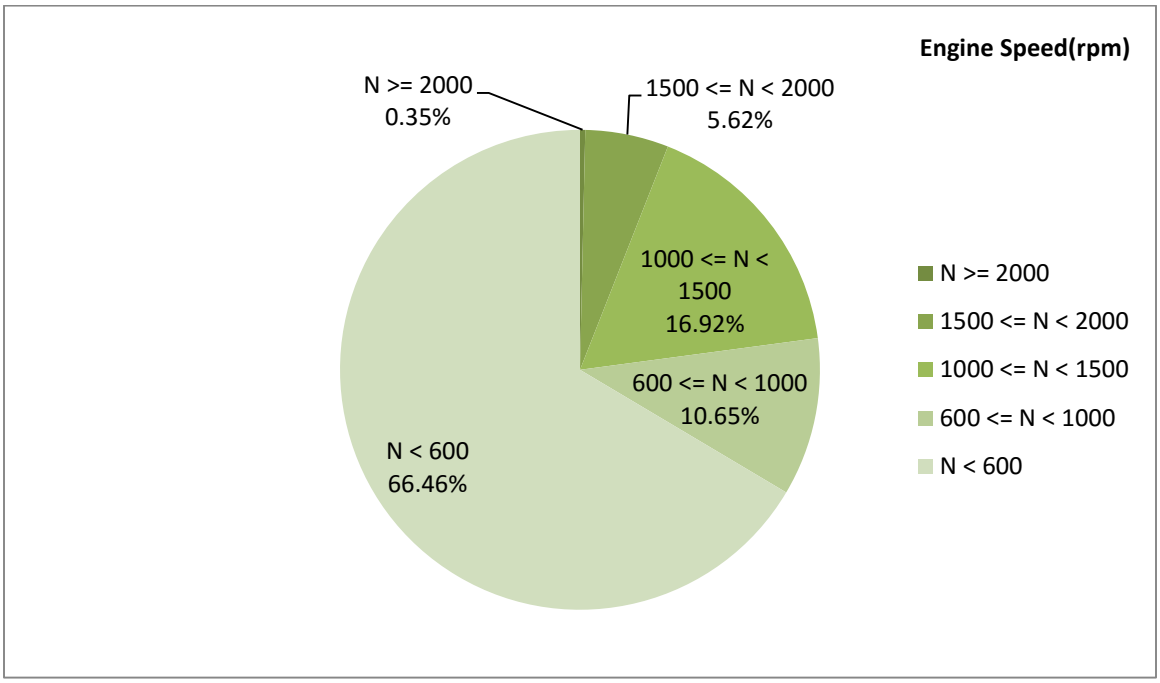


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
223.94	7.35	757

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
292.16	21.86	1178

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
482-50	276-0	2288-256

Detailed Pressure Analysis

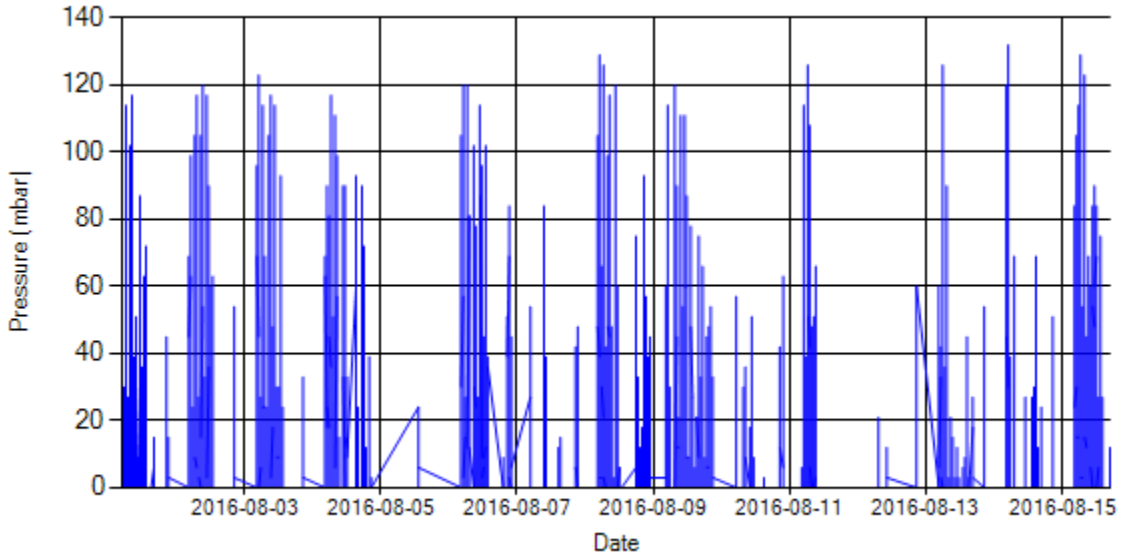


Figure 4- Pressure distribution over the period

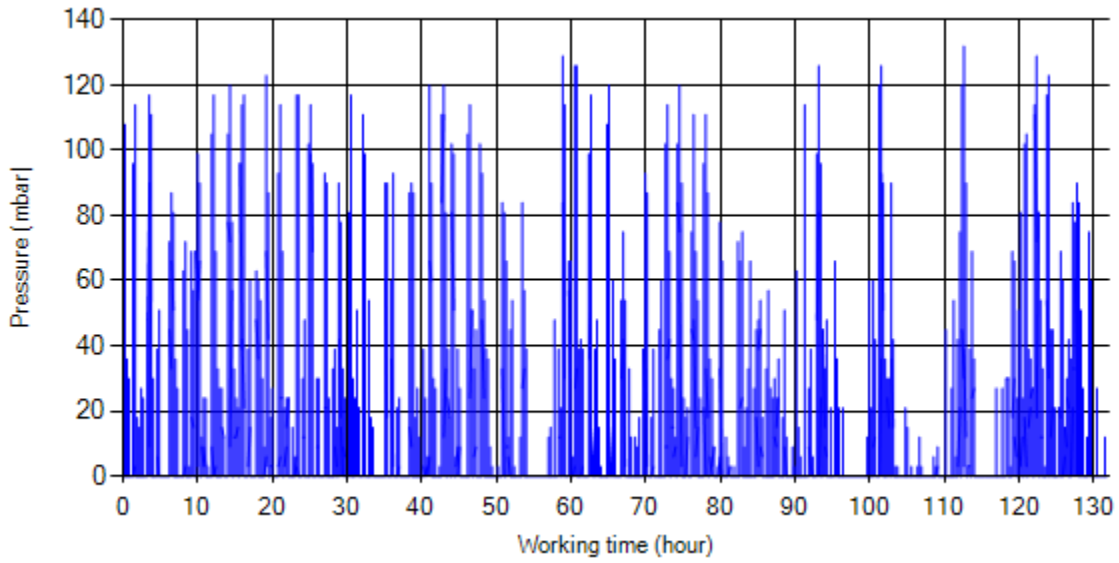


Figure 5- Pressure vs. working hours

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

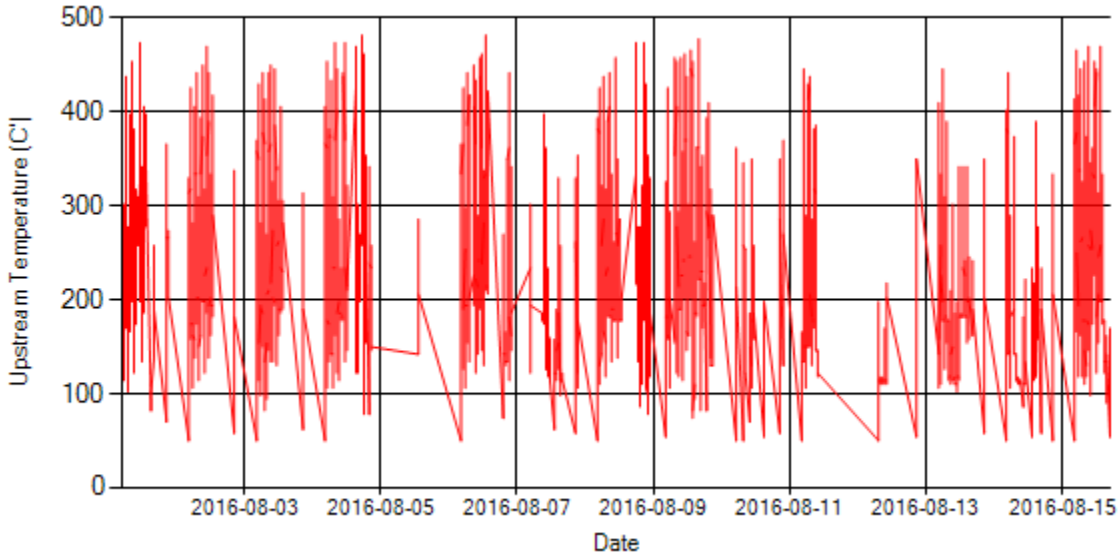


Figure 6- Temperature distribution over the period

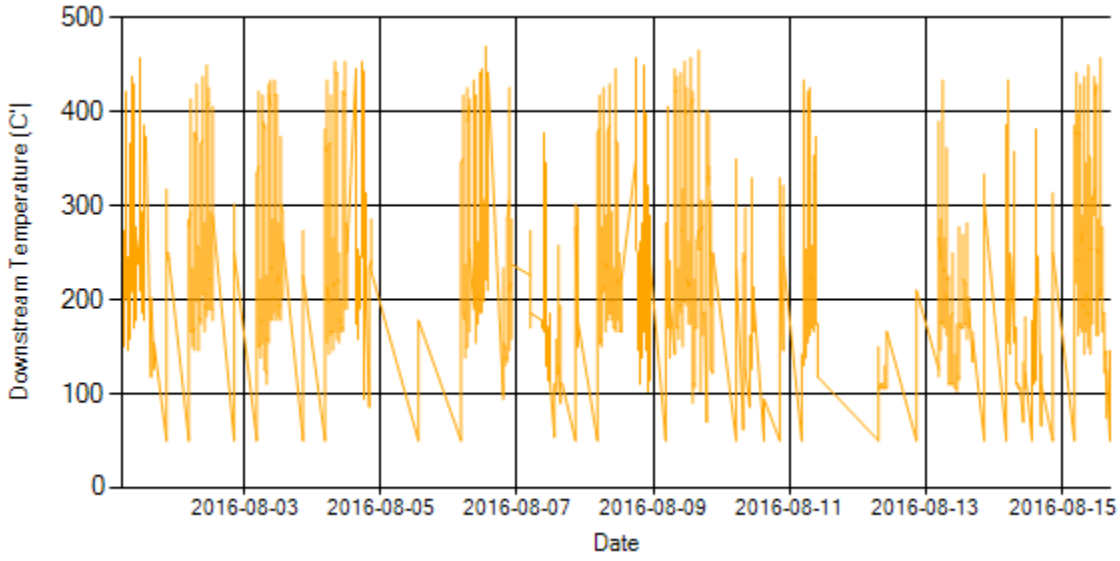


Figure 7- Temperature distribution over the period

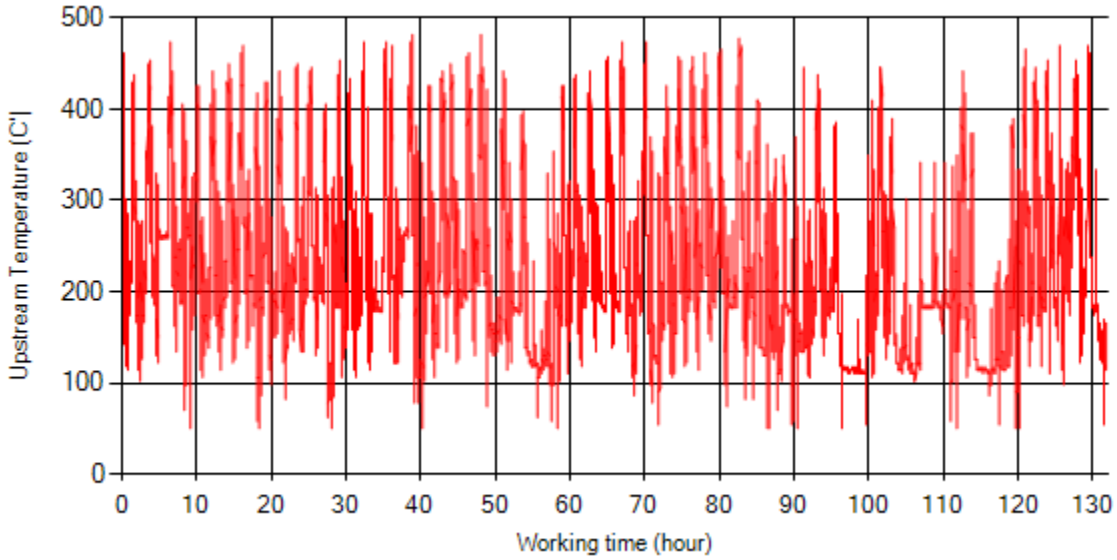


Figure 8- Temperature vs. working hours

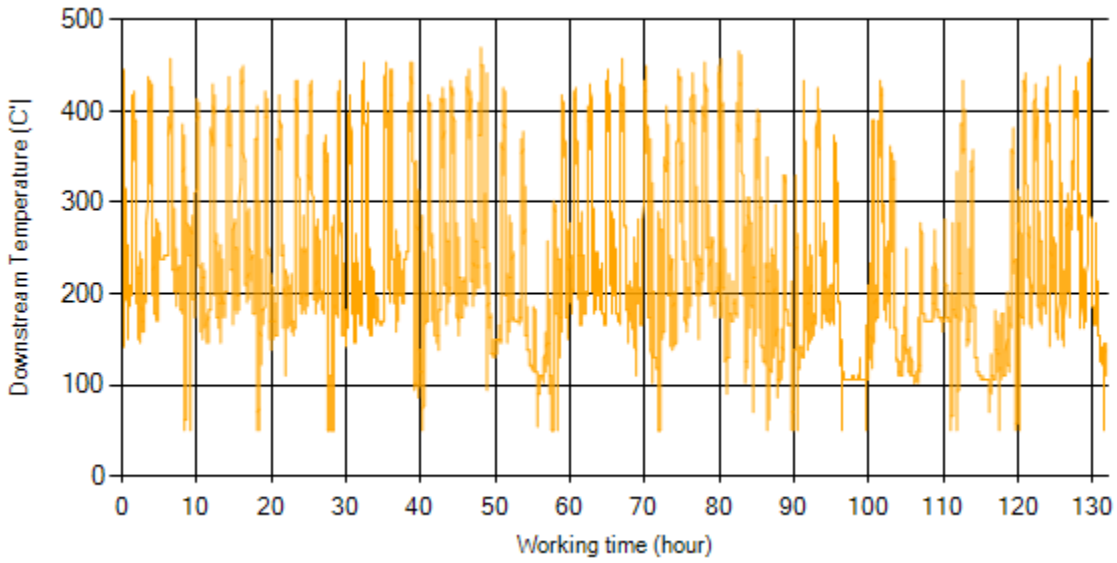


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

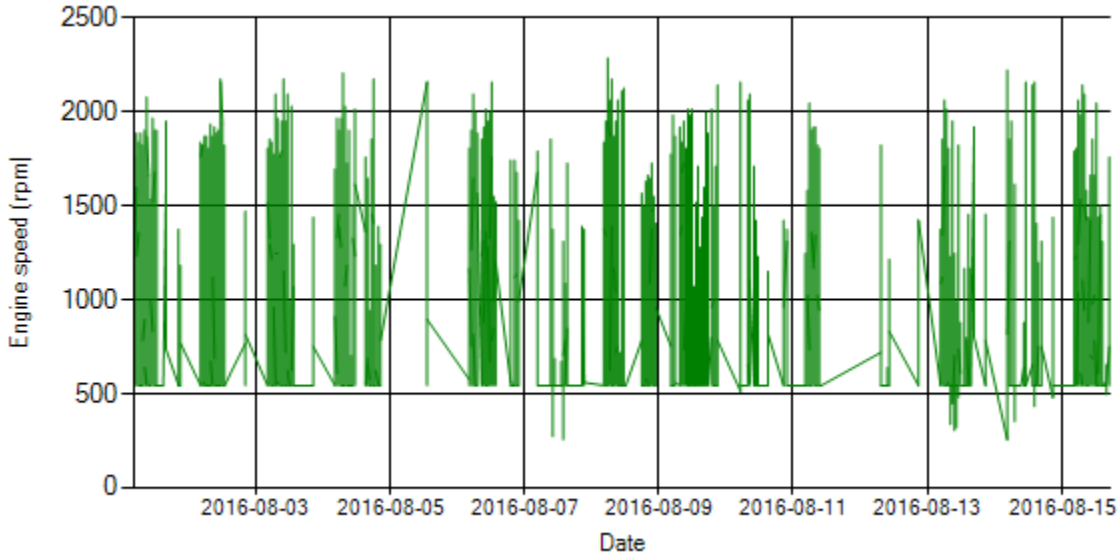


Figure 10- Engine speed distribution over the period

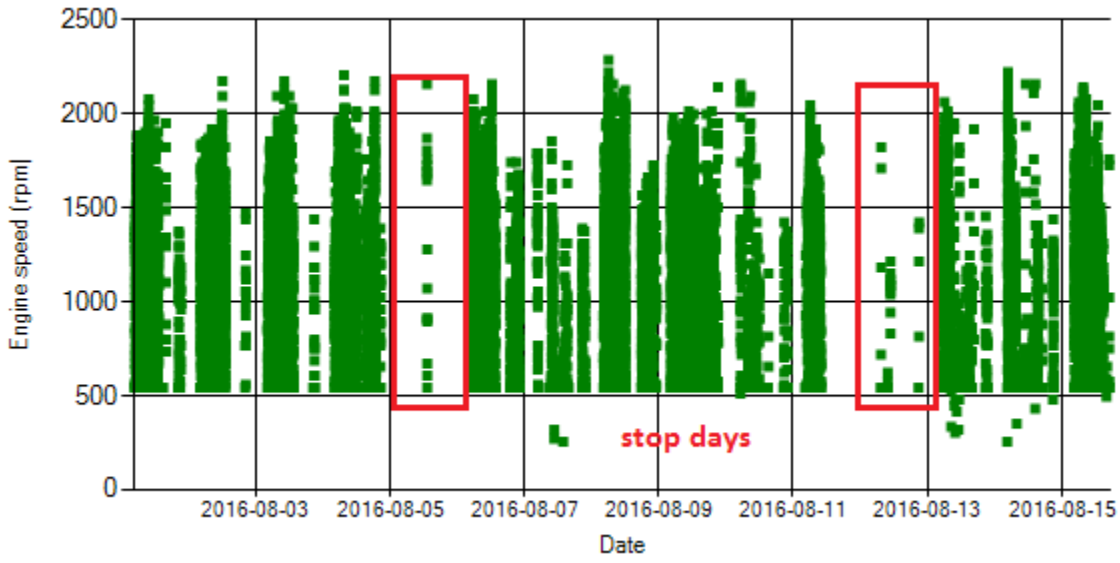


Figure 11- Engine speed diagram for calculating CPK's working days

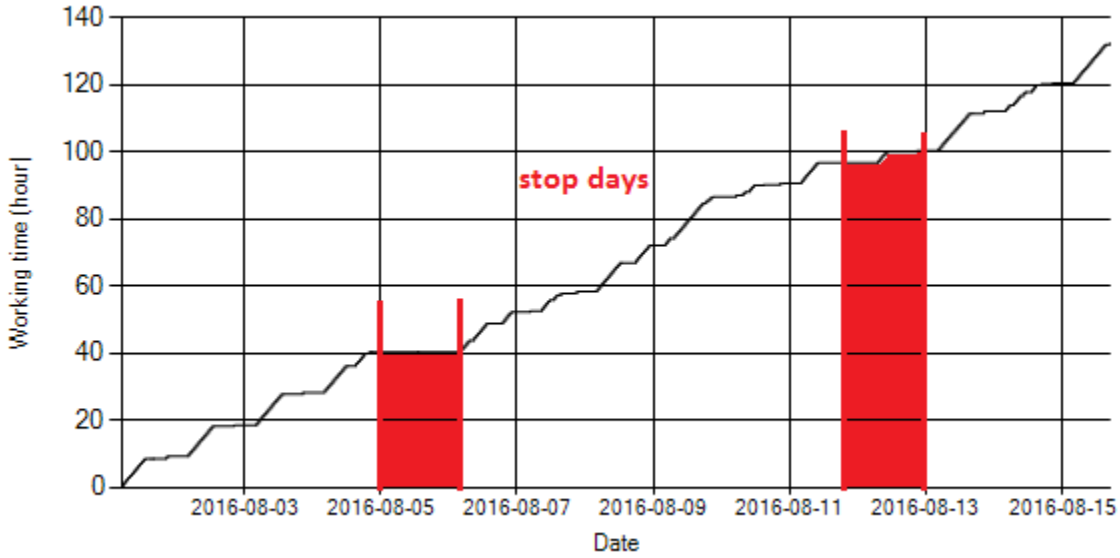


Figure 12- Time diagram for calculating CPK's working days

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 system was stationary for 2 days.

Pressure-Engine Speed diagrams

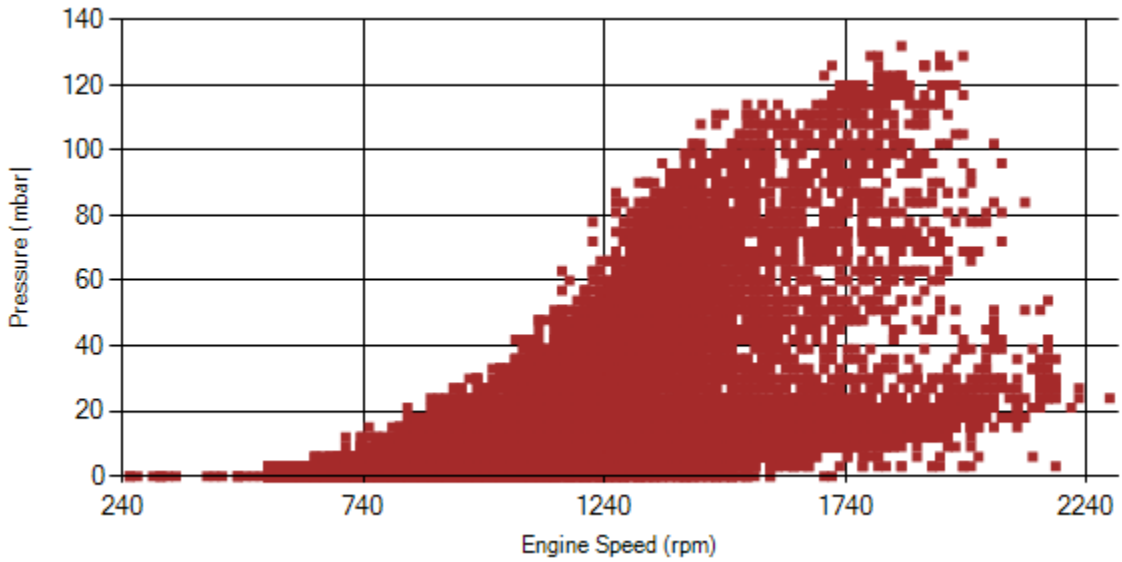


Figure 13- Pressure against engine speed

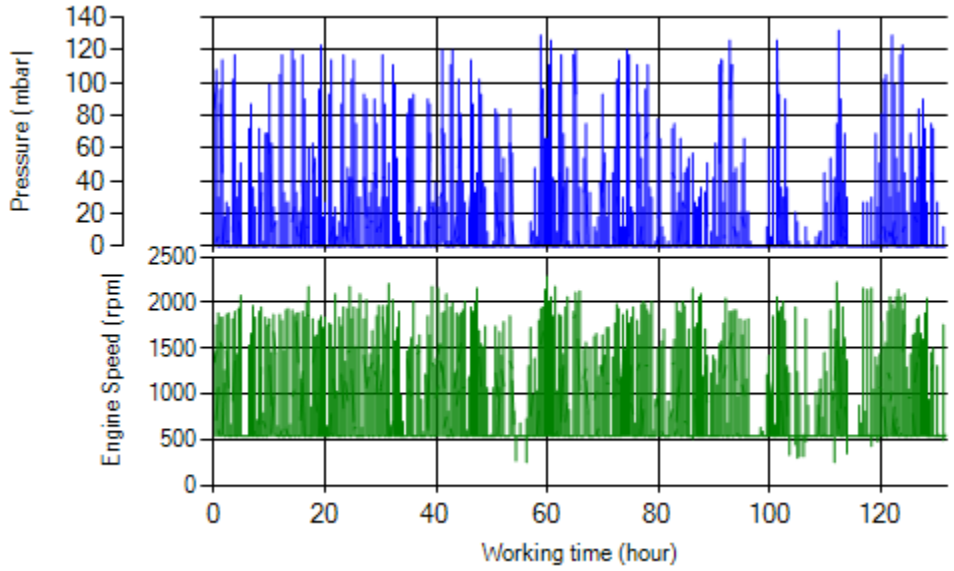


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

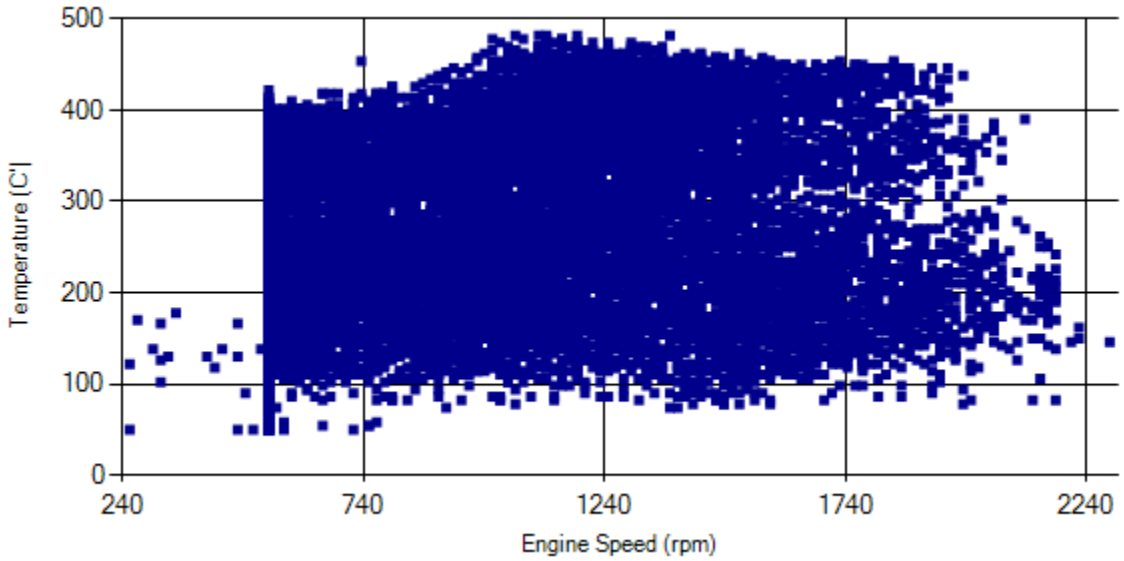


Figure 15- Temperature against engine speed

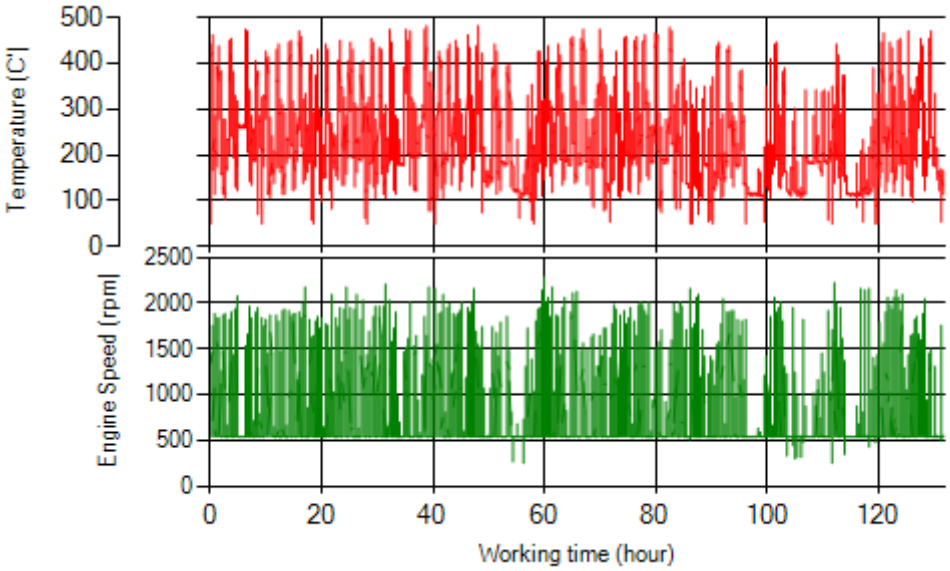


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 0.47% of working time pressure was above 100 mbar during this period.
- Figure 2 display flow temperature distribution for DPF's upstream. It can be obviously observed that 13.2% of total working-time temperature is above 350 ℃ and 29.6% above 250℃.

Filter operation status	Excellent ■	Good ☐
	Maintenance required ☐	Failed☐

Overall Information

Table1- Overall Information

Vehicle plate number	85182
CPK data logger number	LN: 001502, DN: 1999
Bus line	Number 10 (south to north Bus line)
Bus Terminals	Azadi square - Daneshgah square
Total path distance	10.7 km
DPF producer company	Tehag_01 (Catalyzed DPF)
Installation date	24/Sep/2015
Report period	16/Aug/2016 – 31/Aug/2016 (sixteen days)
K value - DPF upstream	1.85 [1/m]
K value – DPF downstream	0.04 [1/m]

Table 2- DPF Maintenance History

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

Table 3- Fuel and Additive Consumption Information

Bus mileage (from DPF installation date)	25173 km
Bus mileage over the period	2329 km
Working days over the period	11 days
Stop days	5 days
Data logger working days	11 days
Working hours over the period	146 hours 35 minutes
Average working hours per day (including stop days)	9 hours 46 minutes
Bus average speed	15.9 km/hr
idle speed time to all working time ration	48.81 %
Total Bus fuel consumption over the period	1374 lit
Fuel consumption per hour	9.37 lit/hr
Average fuel consumption	0.59 lit/km

Temperature, Pressure and Engine Speed Overview

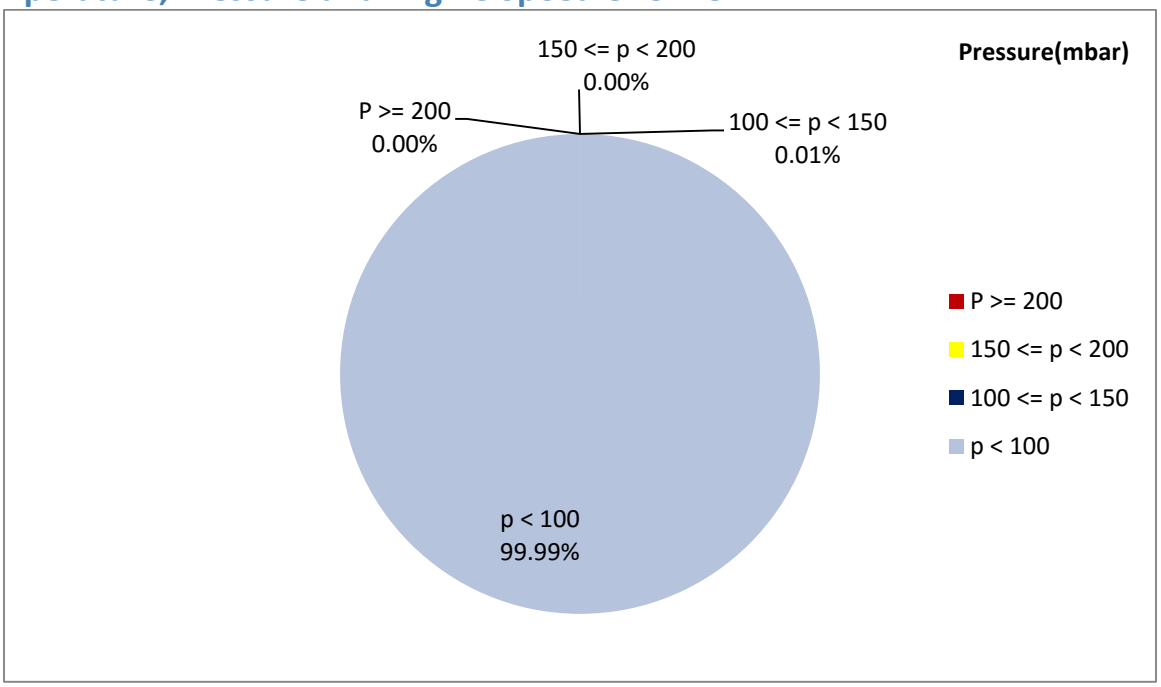


Figure 1- Pressure distribution over the working hours

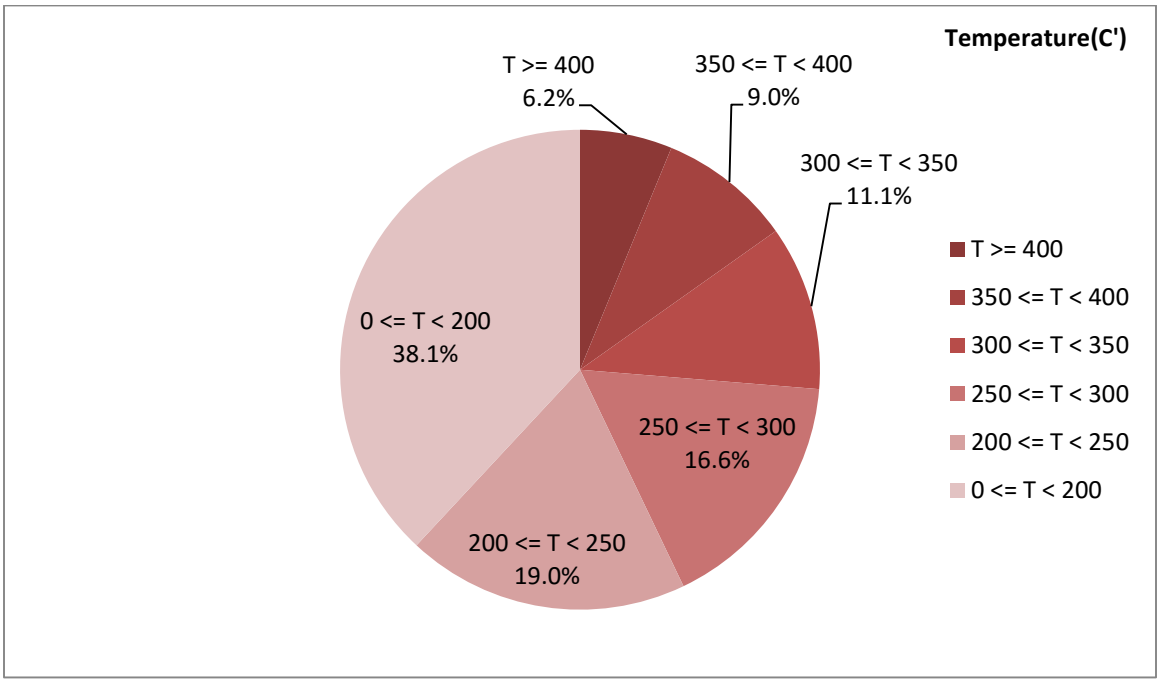


Figure 2-Temperature distribution over the working hours

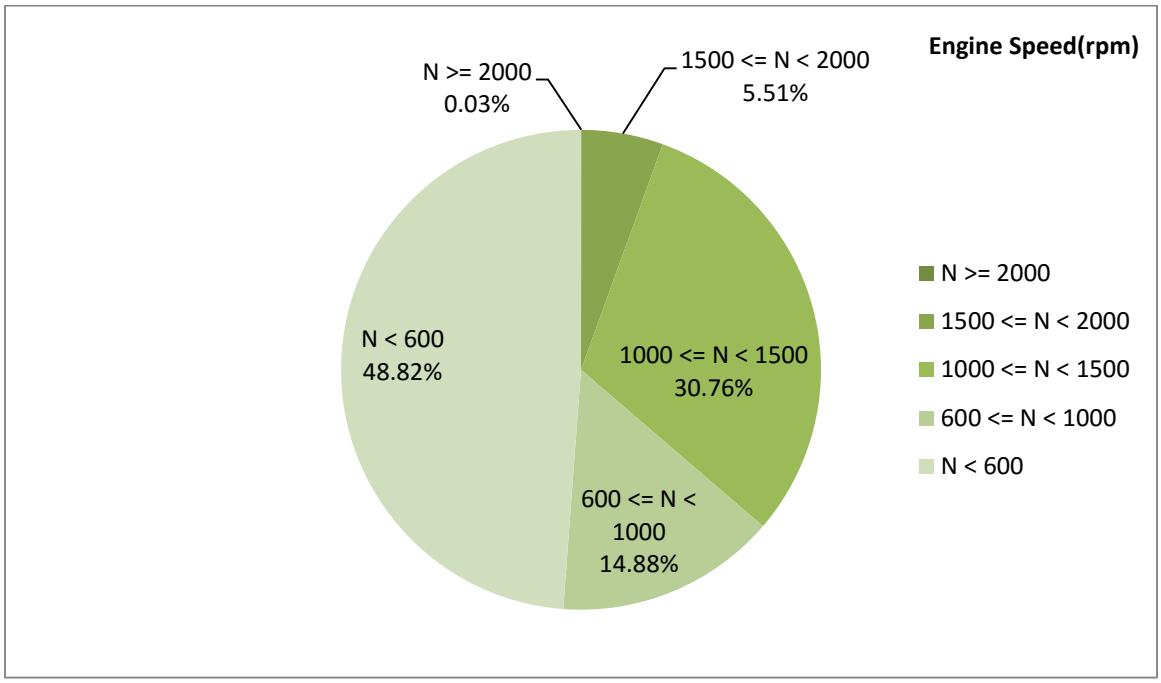


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
244.86	8.38	850

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
288.39	16.34	1140

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
490-50	111-0	2176-304

Detailed Pressure Analysis

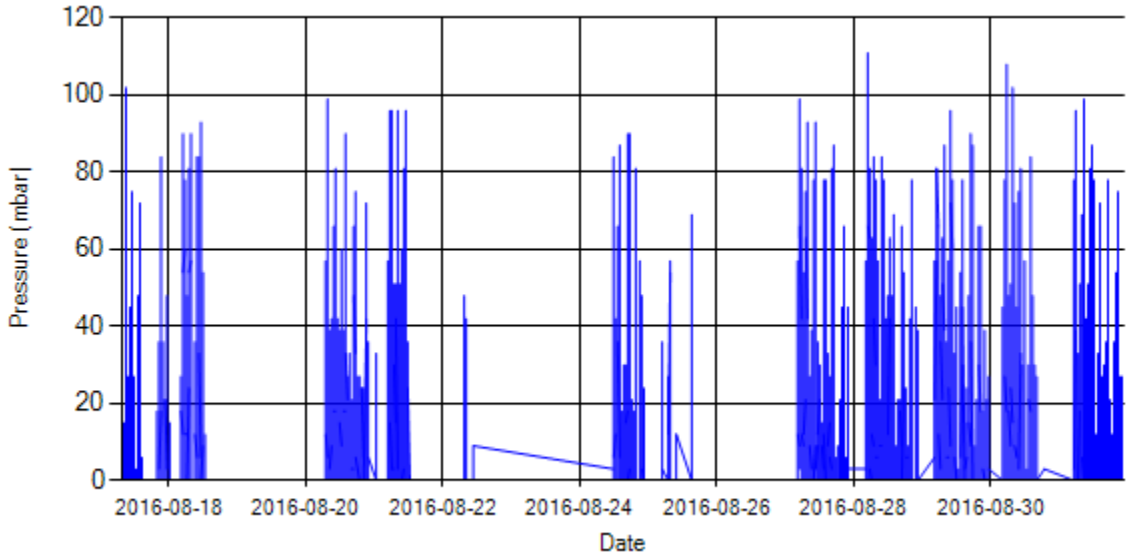


Figure 4- Pressure distribution over the period

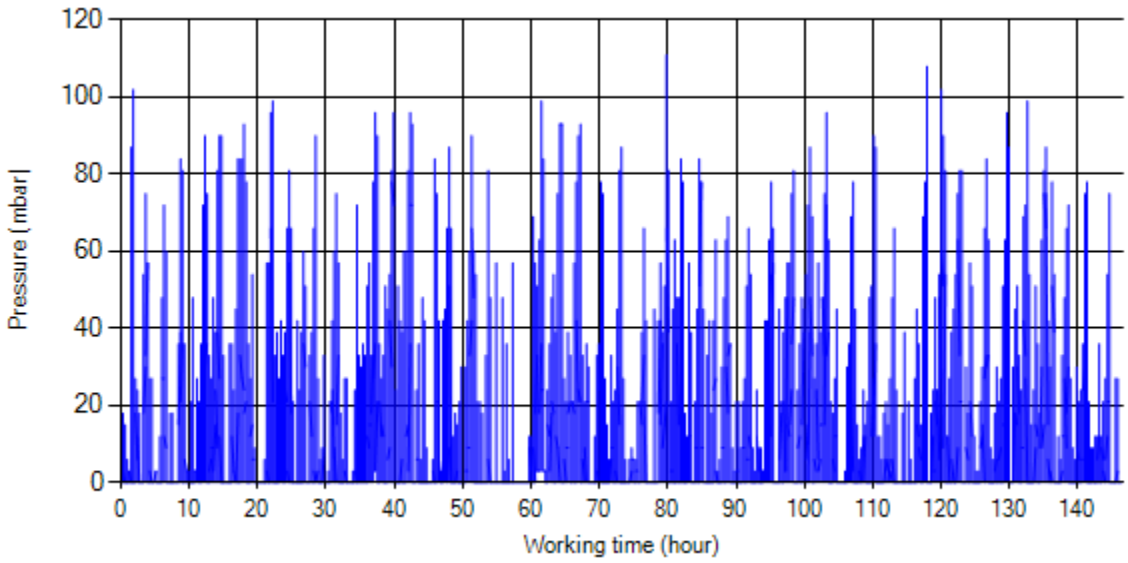


Figure 5- Pressure vs. working hours

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

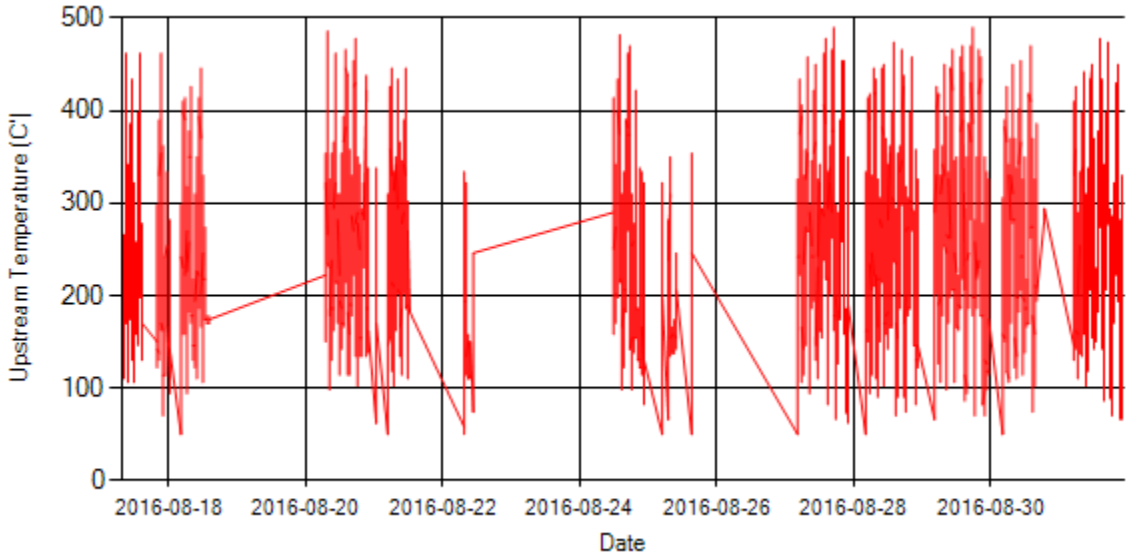


Figure 6- Temperature distribution over the period

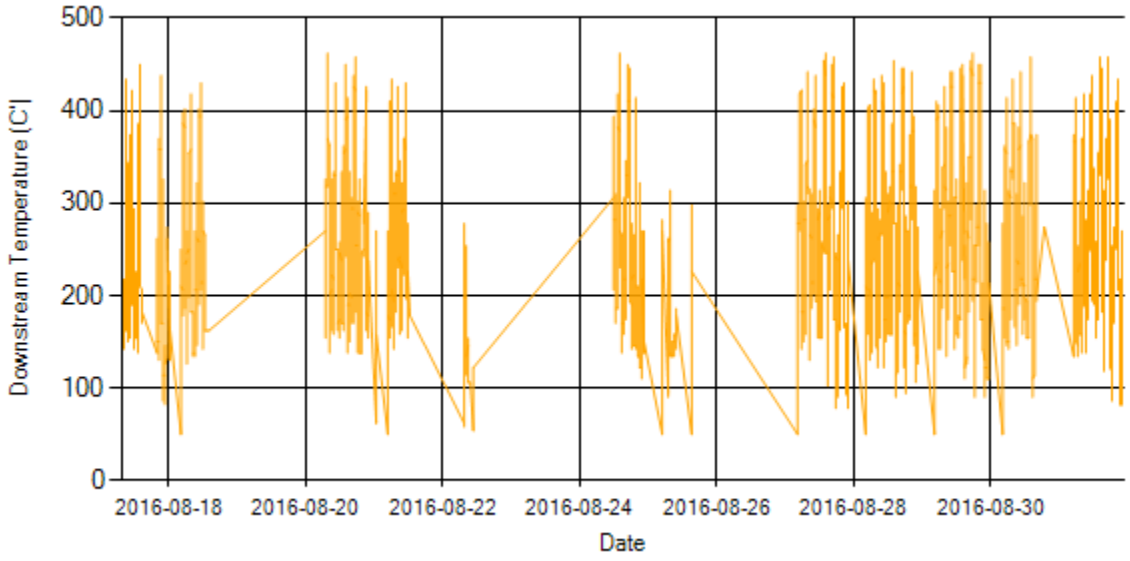


Figure 7- Temperature distribution over the period

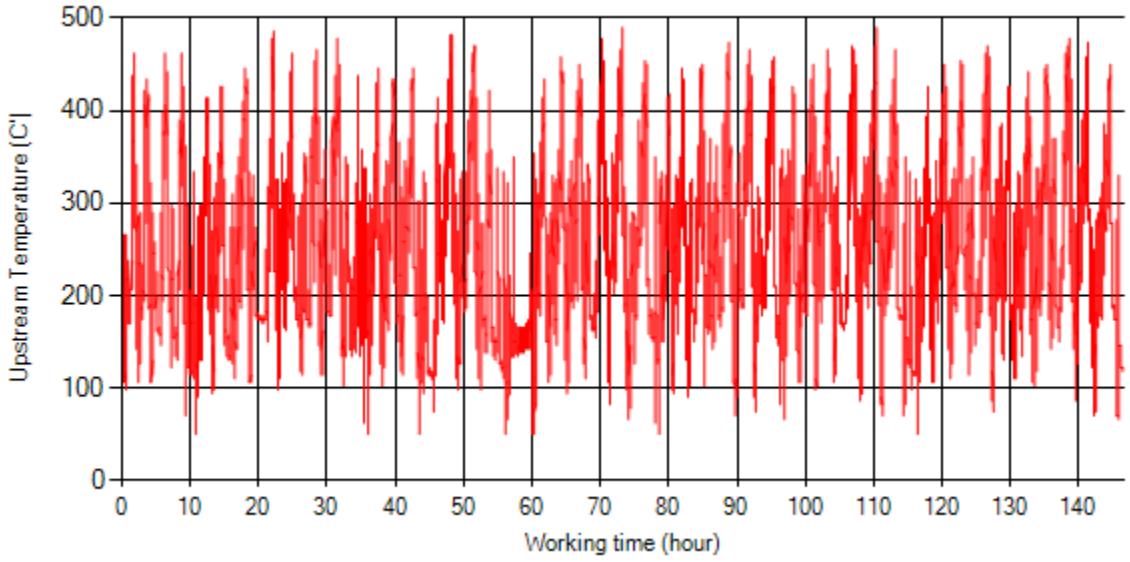


Figure 8- Temperature vs. working hours

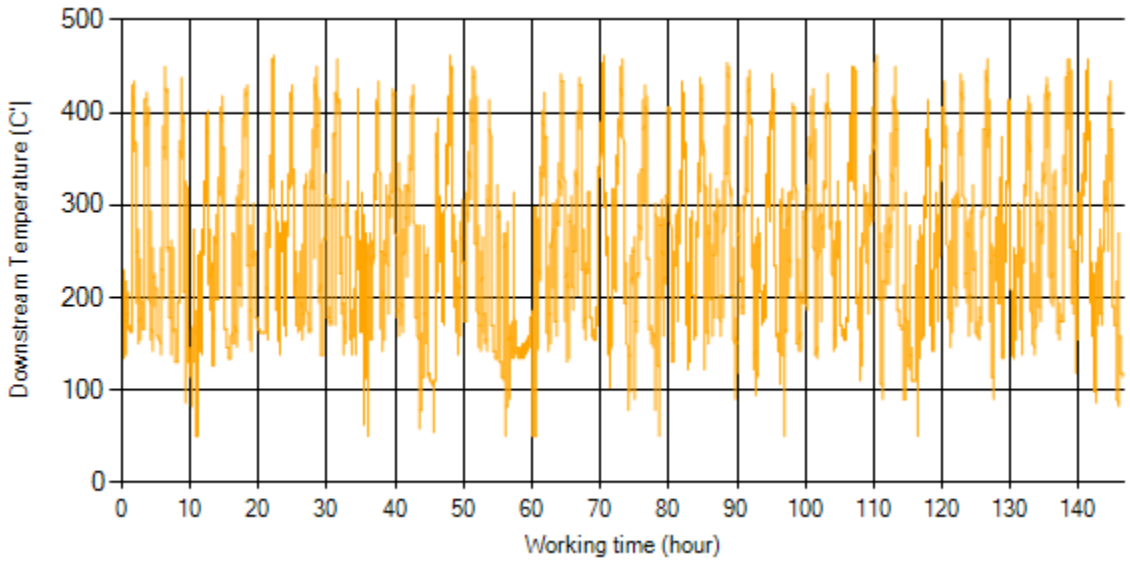


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

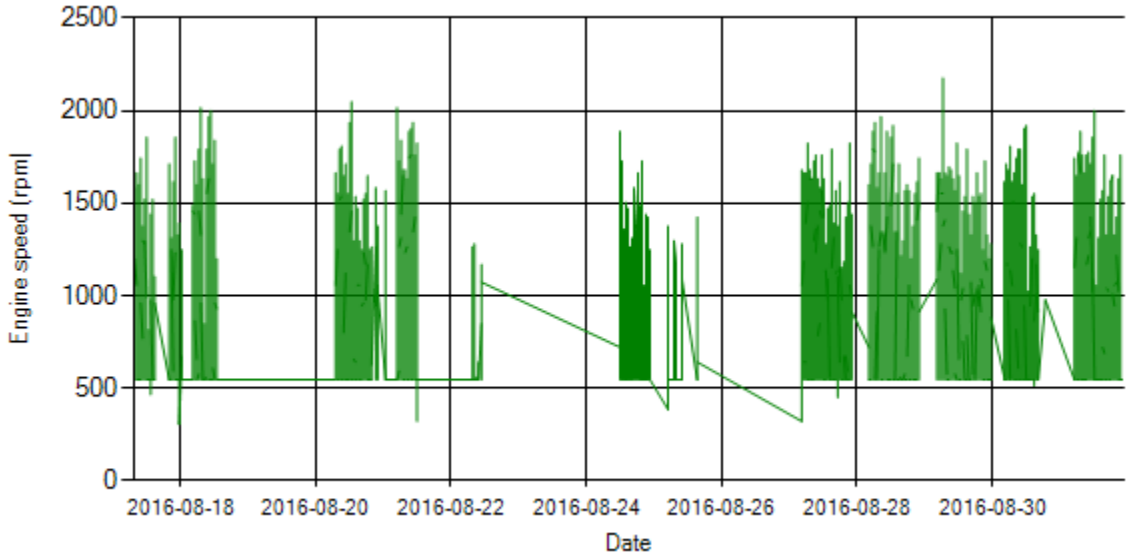


Figure 10- Engine speed distribution over the period

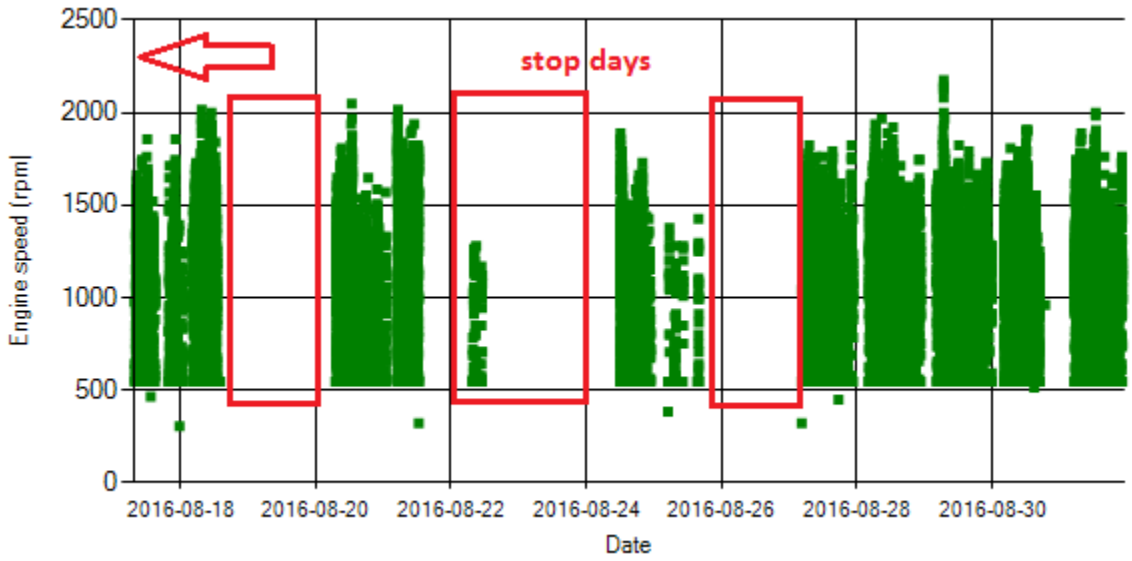


Figure 11- Engine speed diagram for calculating CPK's working days

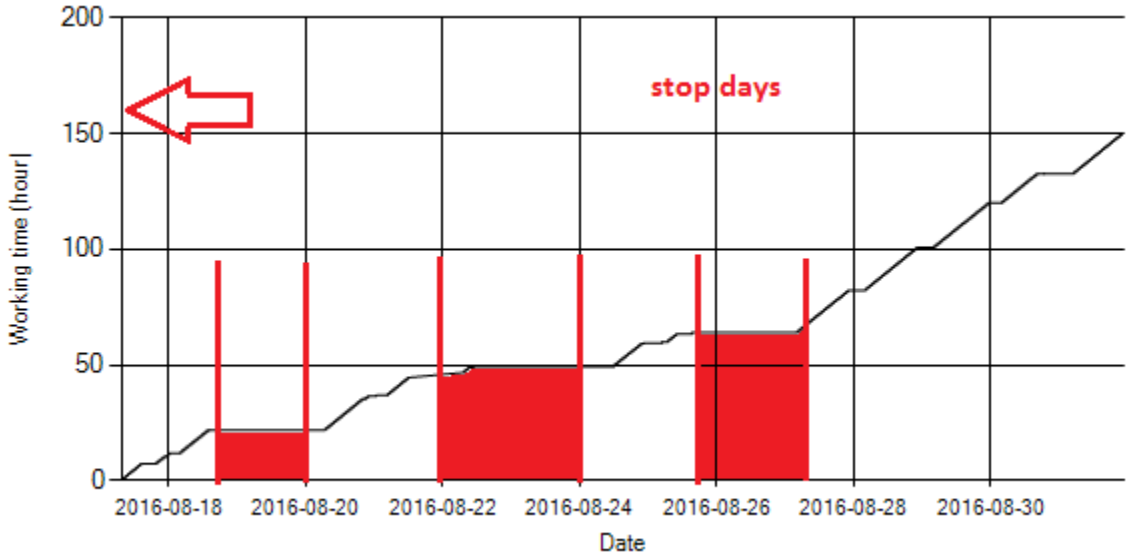


Figure 12- Time diagram for calculating CPK's working days

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 system was stopped for 5 days.

Pressure-Engine Speed diagrams

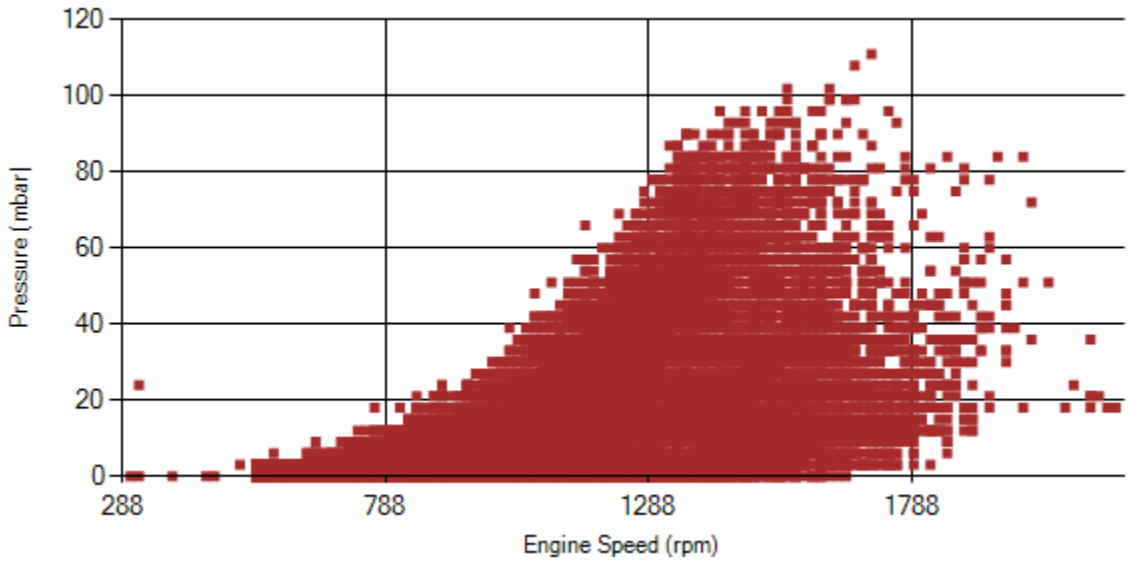


Figure 13- Pressure against engine speed

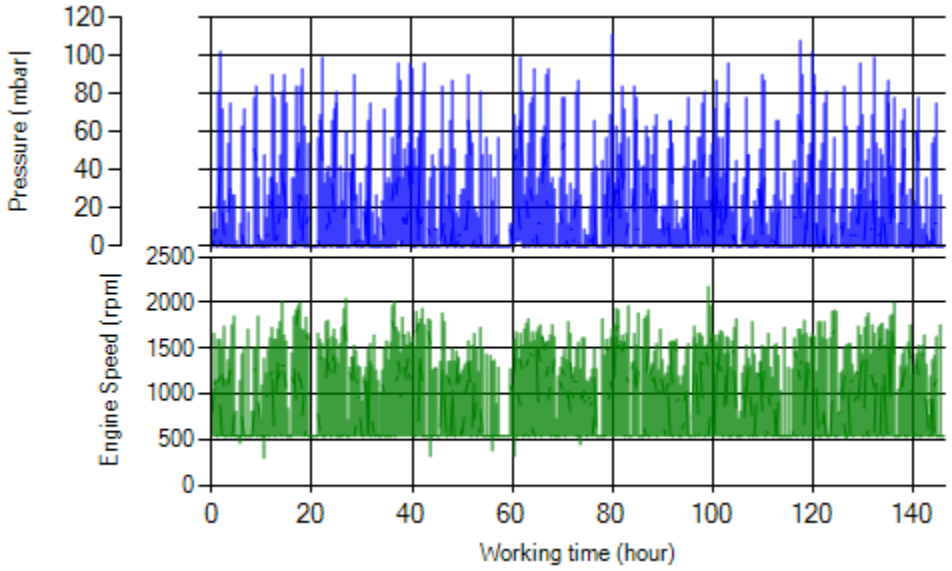


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

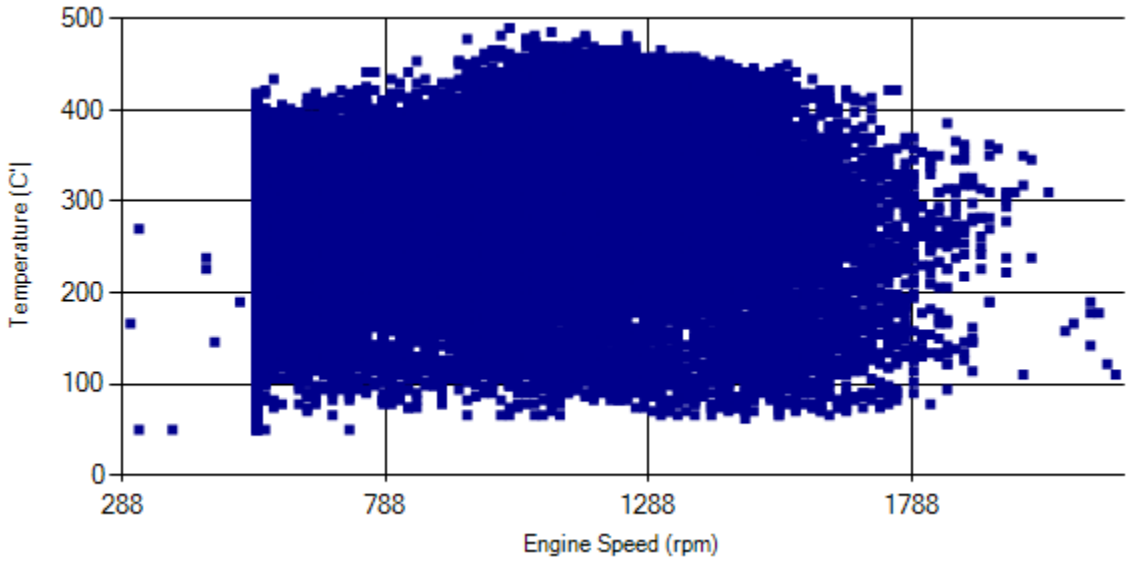


Figure 15- Temperature against engine speed

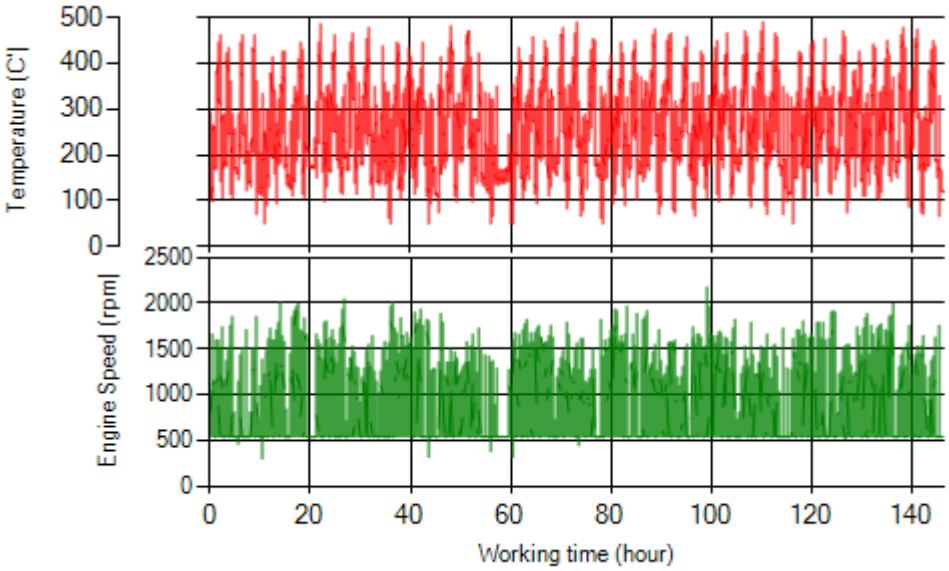


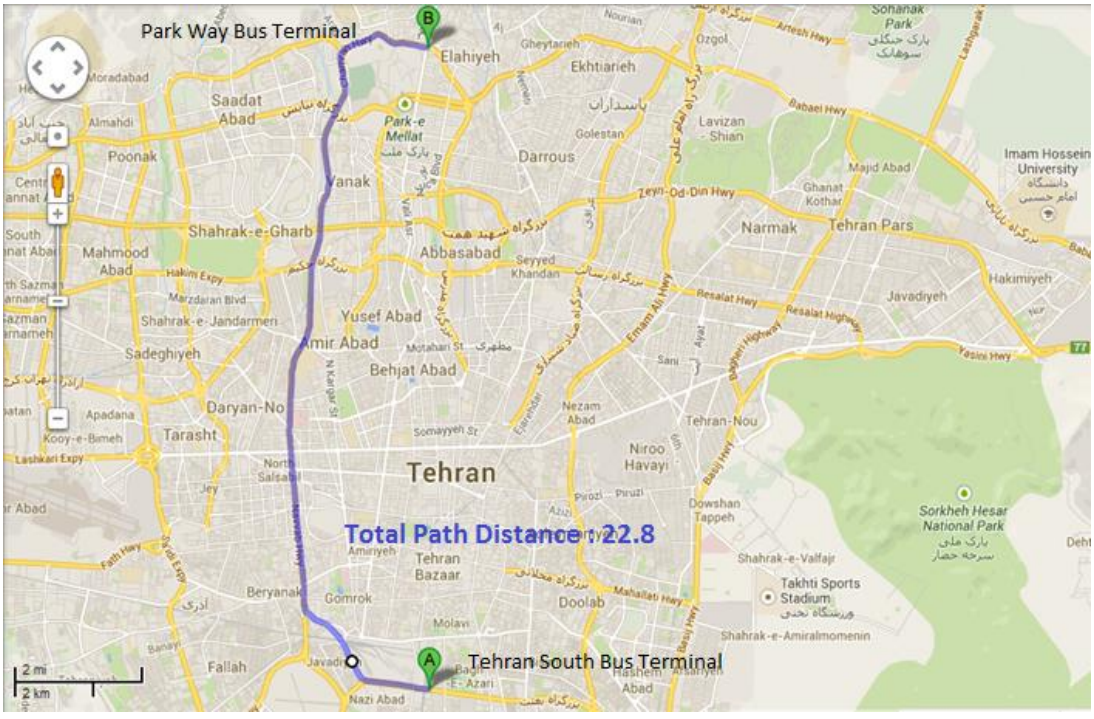
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 0.01% of working time pressure was above 100 mbar during this period.
- Figure 2 display flow temperature distribution for DPF's upstream. It can be obviously observed that 15.2% of total working-time temperature is above 350 ℃ and 42.9% above 250℃.

Filter operation status	Excellent ■	Good ☐
	Maintenance required ☐	Failed☐

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



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/Aug/2016- 15/Aug/2016 (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 was cleaned on 2016-02-03 for the first time and on 2016-07-10 for the second 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)	92240 km
Bus mileage over the period	2436 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	163 hours 26 minutes
Average working hours per day (including stop days)	10 hours 54 minutes
Bus average speed	14.9 km/hr
idle speed time to all working time ration	56.45 %
Total Bus fuel consumption over the period	1437 lit
Fuel consumption per hour	8.78 lit/hr
Average fuel consumption	0.59 lit/km
Total Bus additive consumption over the period	0.684 lit
Average additive consumption	280.7 cc/km
Additive consumption to fuel ration	476 cc/1000lit

Temperature, Pressure and Engine Speed Overview

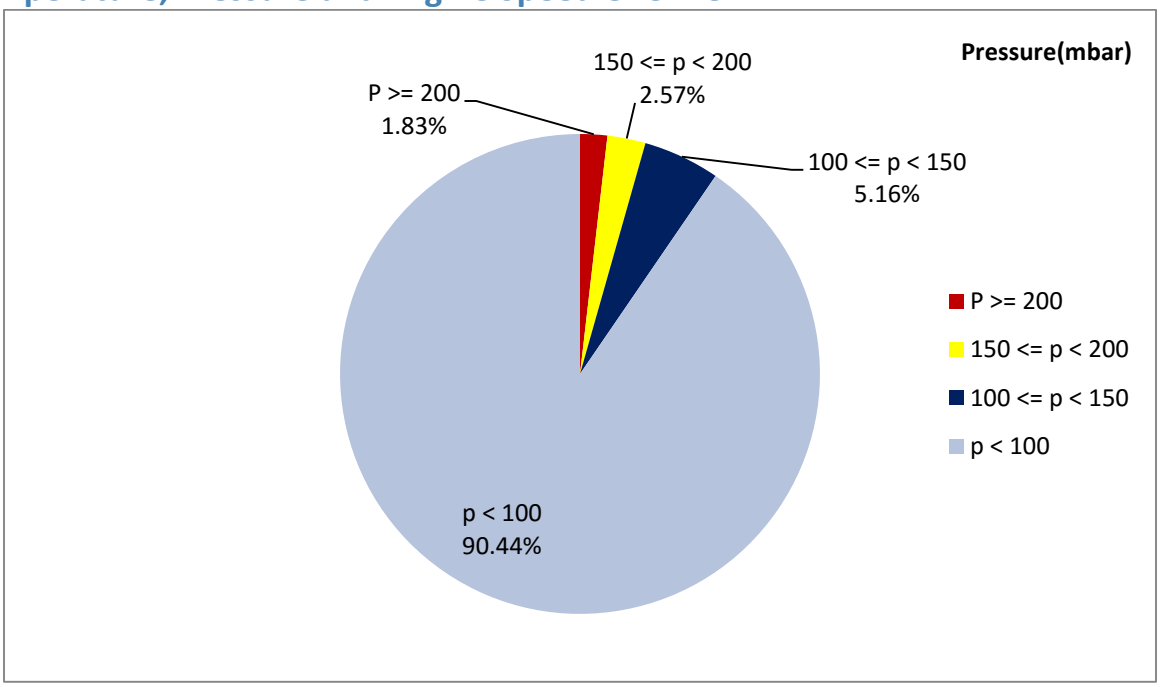


Figure 1- Pressure distribution over the working hours

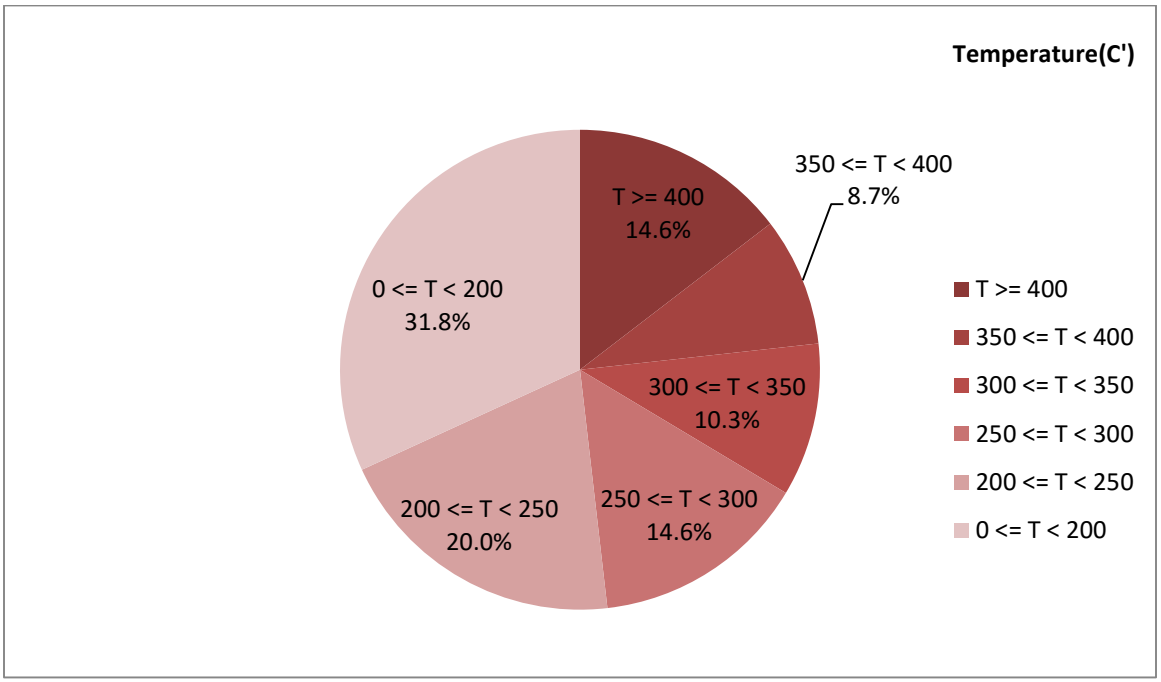


Figure 2-Temperature distribution over the working hours

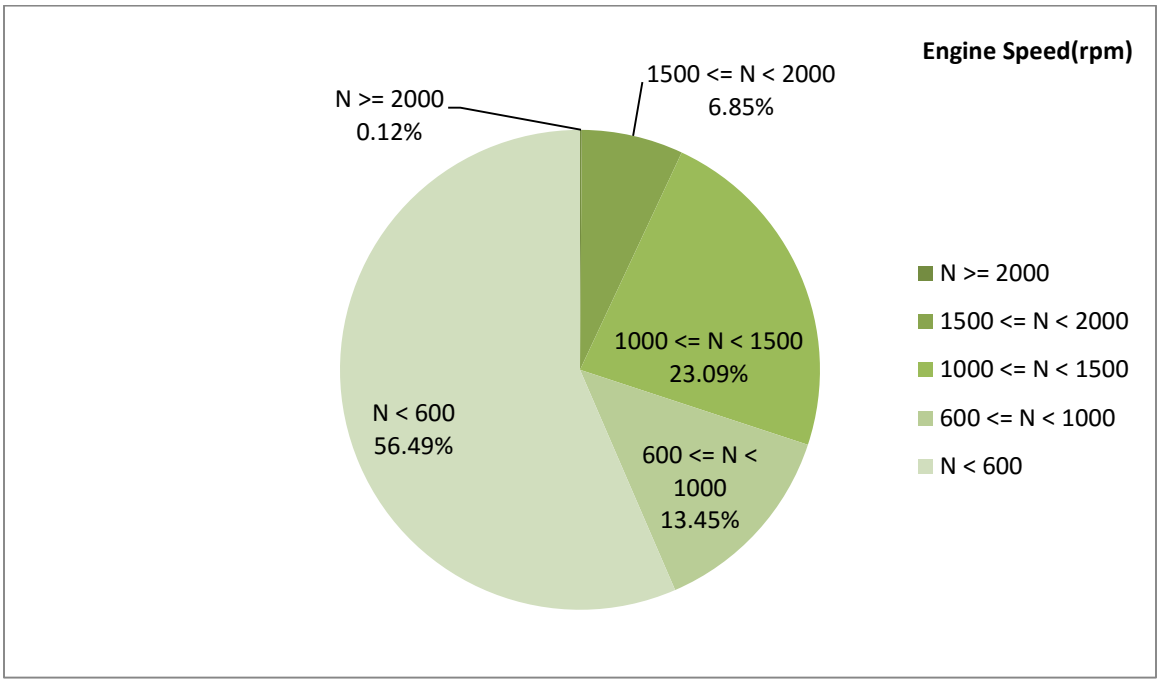


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
266.89	35.28	805

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
341.91	68.88	1161

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
642-54	342-0	2080-256

Detailed Pressure Analysis

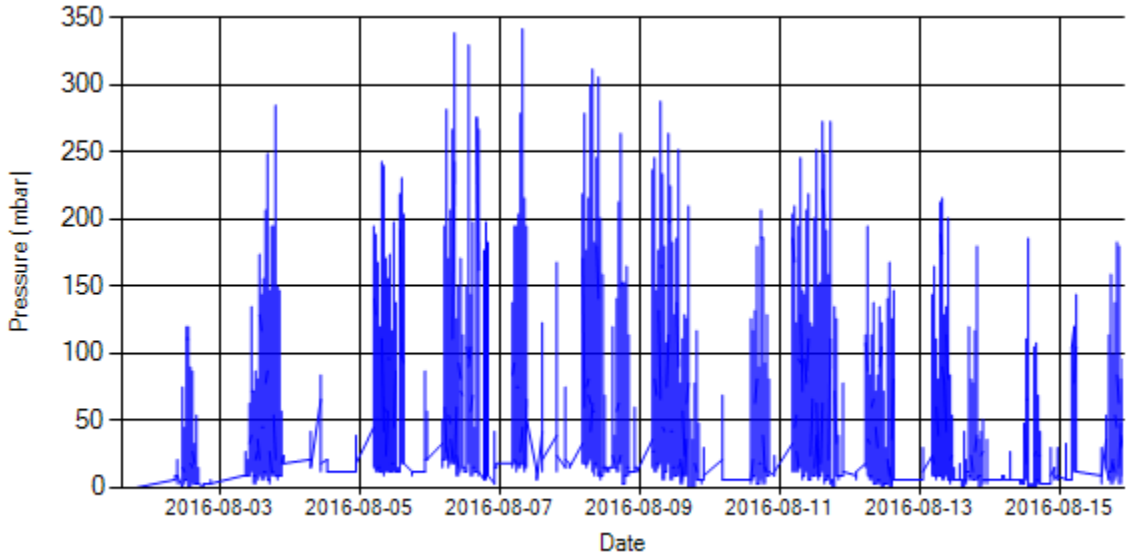


Figure 4- Pressure distribution over the period

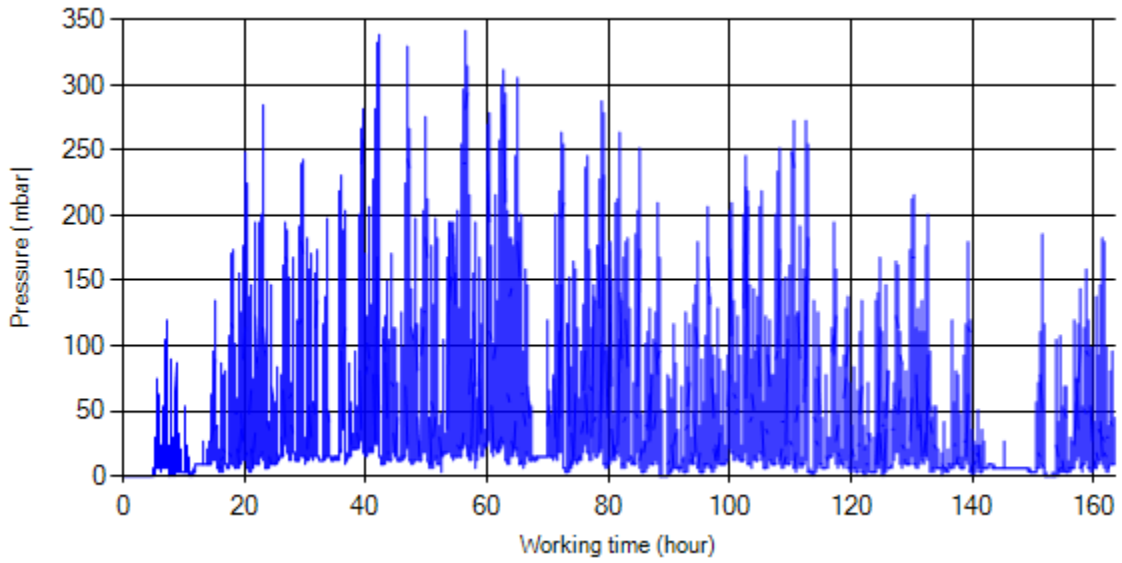


Figure 5- Pressure vs. working hours

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

Detailed Temperature Analysis

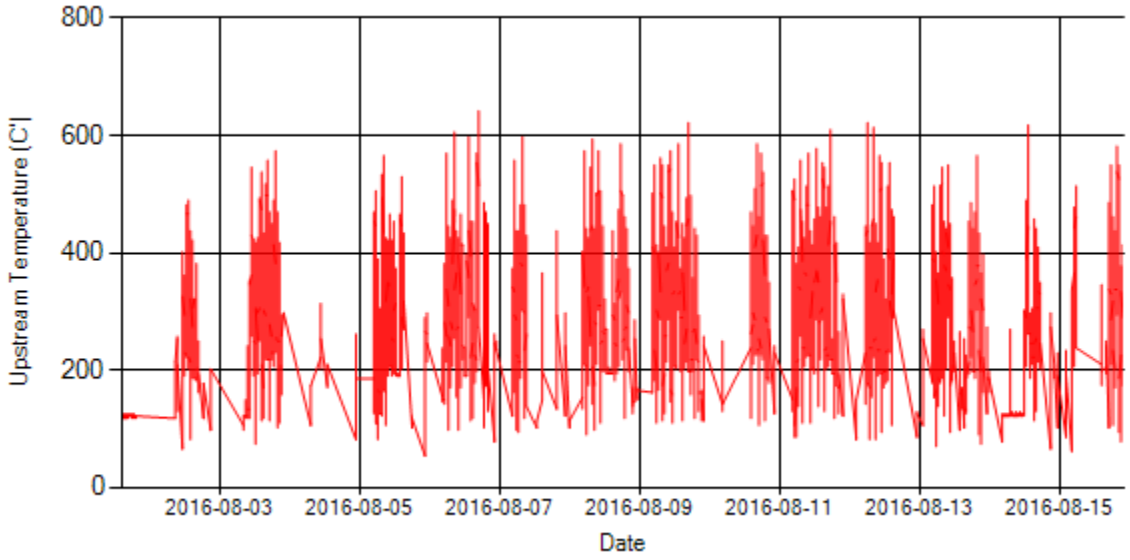


Figure 6- Temperature distribution over the period

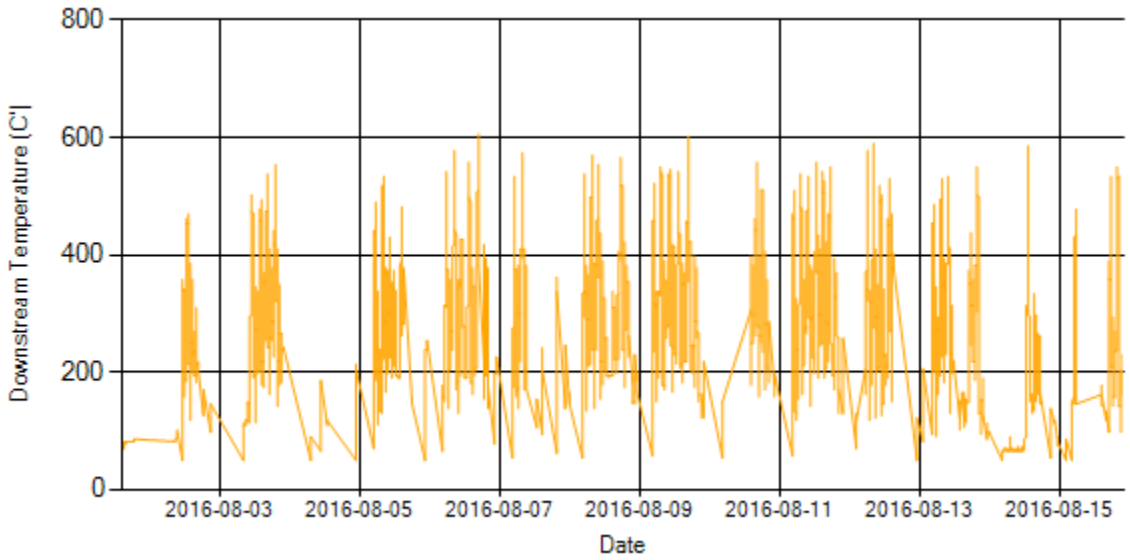


Figure 7- Temperature distribution over the period

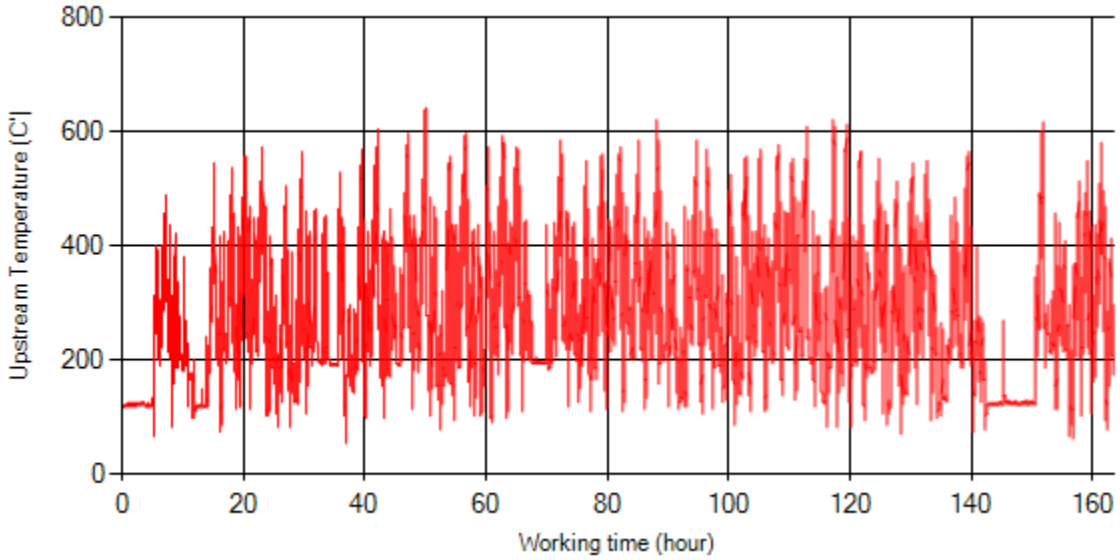


Figure 8- Temperature vs. working hours

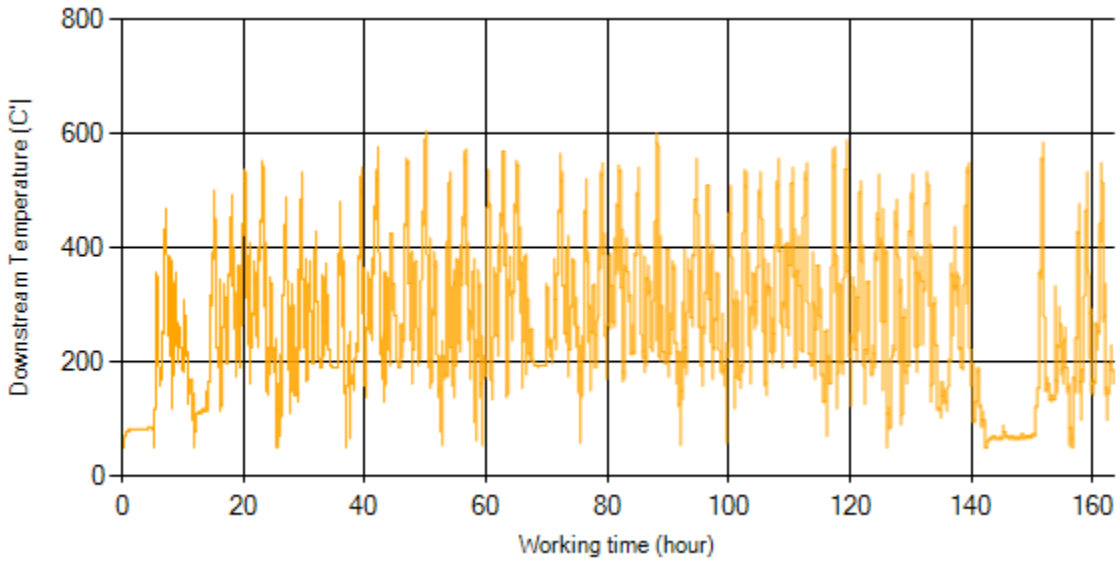


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

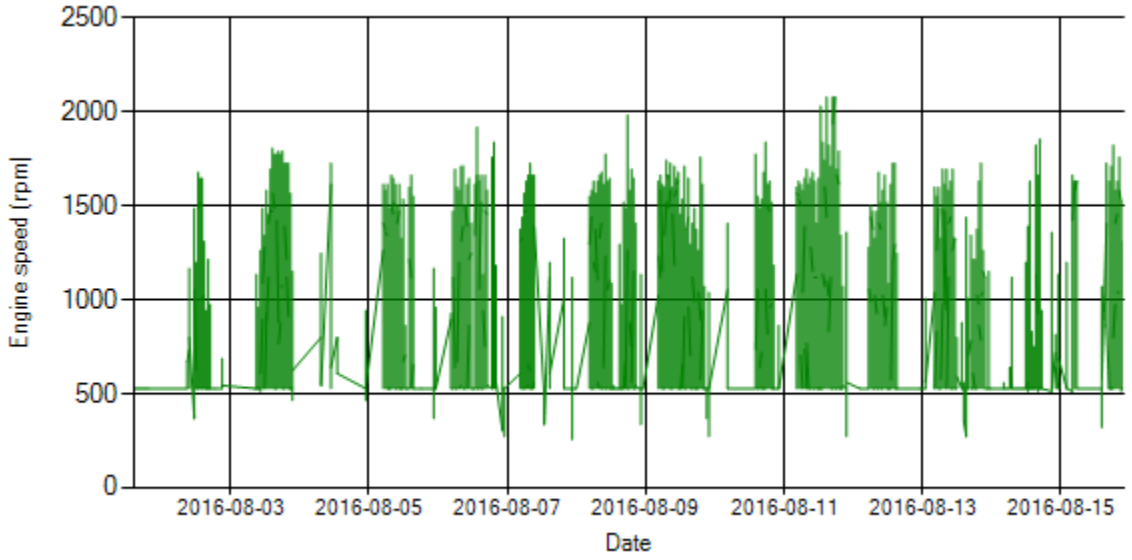


Figure 10- Engine speed distribution over the period

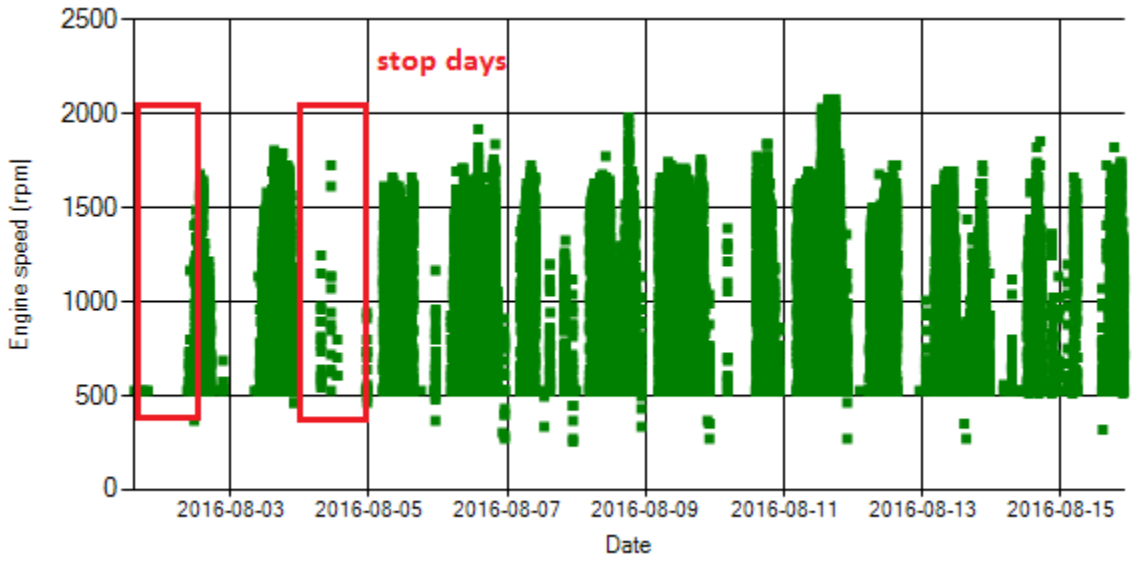


Figure 11- Engine speed diagram for calculating CPK's working days

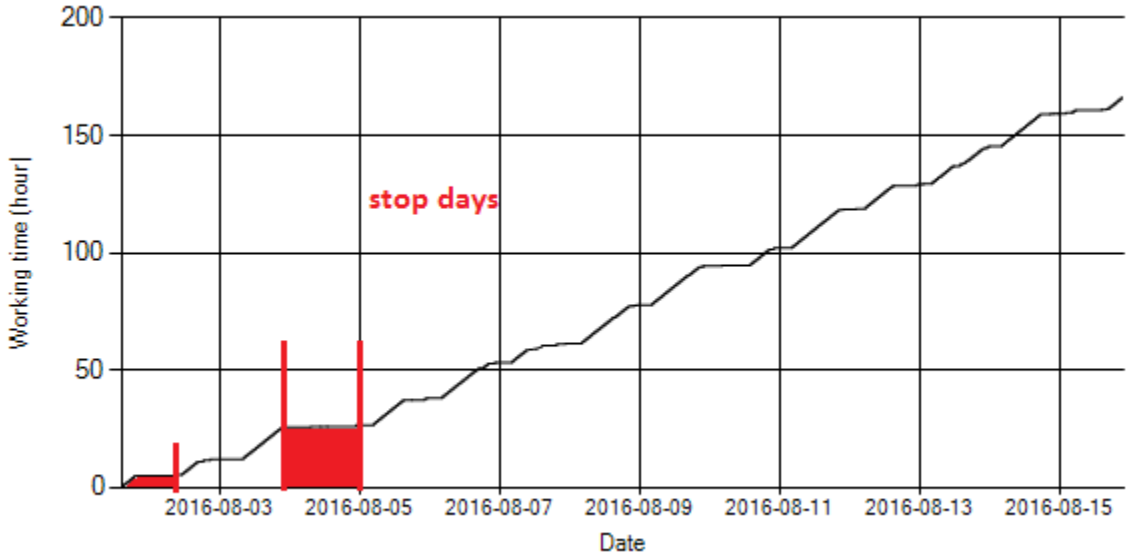


Figure 12- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 12. The lines parallel with Date axis show days without data logger data. As depicted in Figure 12 system was stationary for 2 days.

Pressure-Engine Speed diagrams

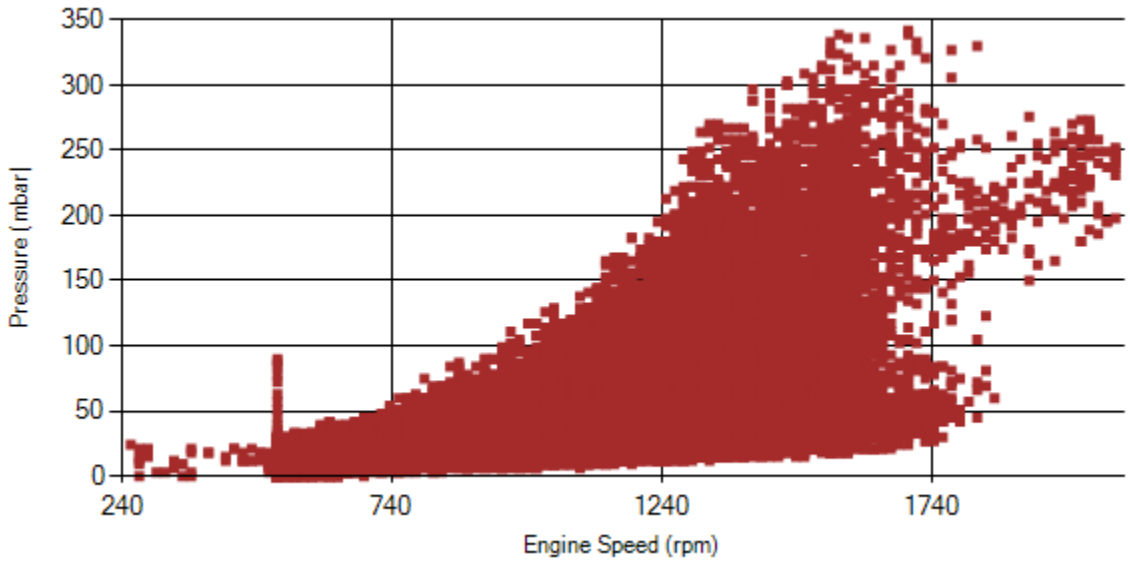


Figure 13- Pressure against engine speed

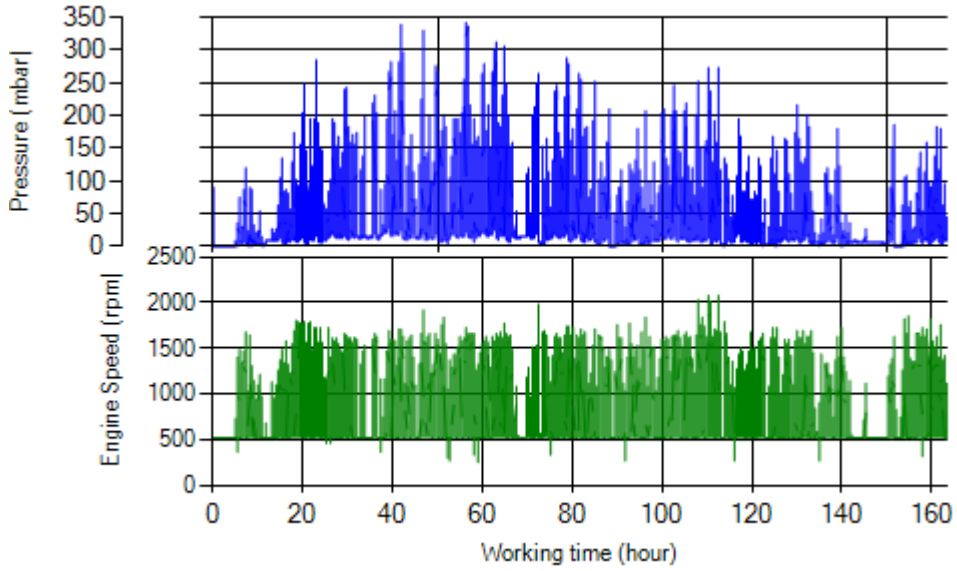


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

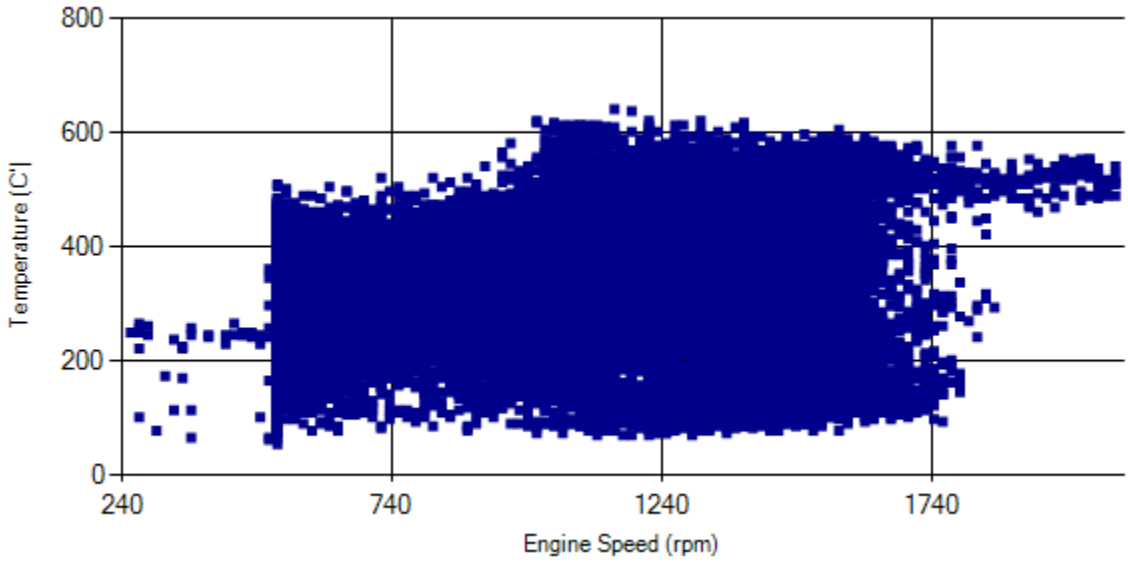


Figure 15- Temperature against engine speed

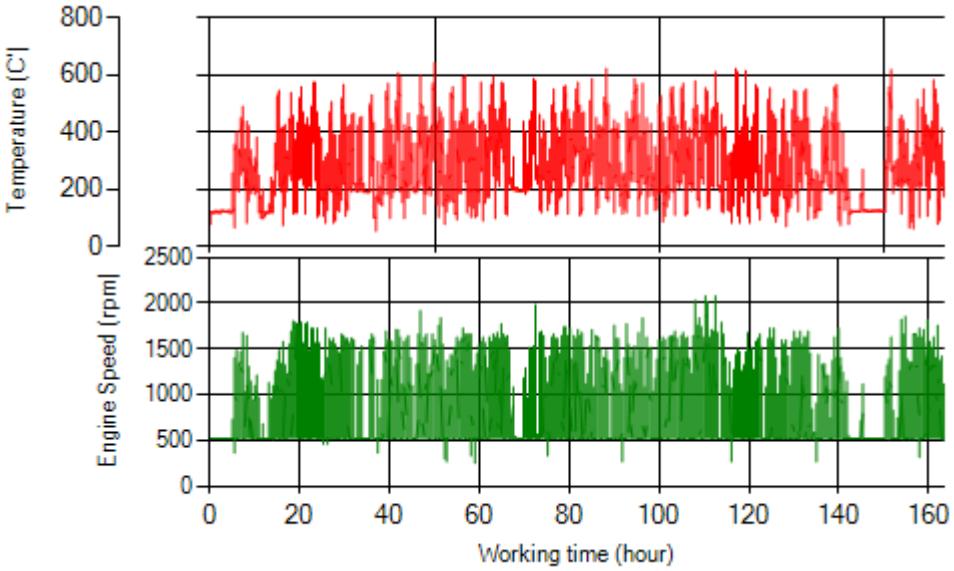


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 1.83% of working time, pressure was above 200 mbar and 4.4% above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 14.6% of total working time temperature is above 400 ℃ and 23.3% above 350℃.

Filter operation status	Excellent ☐	Good ■
	Maintenance required ☐	Failed ☐

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/Aug/2016- 31/Aug/2016 (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 was cleaned on 2016-02-03 for the first time and on 2016-07-10 for the second 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)	94460 km
Bus mileage over the period	2220 km
Working days over the period	13 days
Stop days	3 days
Data logger working days	13 days
Working hours over the period	148 hours 54 minutes
Average working hours per day (including stop days)	9 hours 18 minutes
Bus average speed	14.9 km/hr
idle speed time to all working time ration	55.32 %
Total Bus fuel consumption over the period	1288 lit
Fuel consumption per hour	8.64 lit/hr
Average fuel consumption	0.58 lit/km
Total Bus additive consumption over the period	0.615 lit
Average additive consumption	277.3 cc/km
Additive consumption to fuel ration	478 cc/1000lit

Temperature, Pressure and Engine Speed Overview

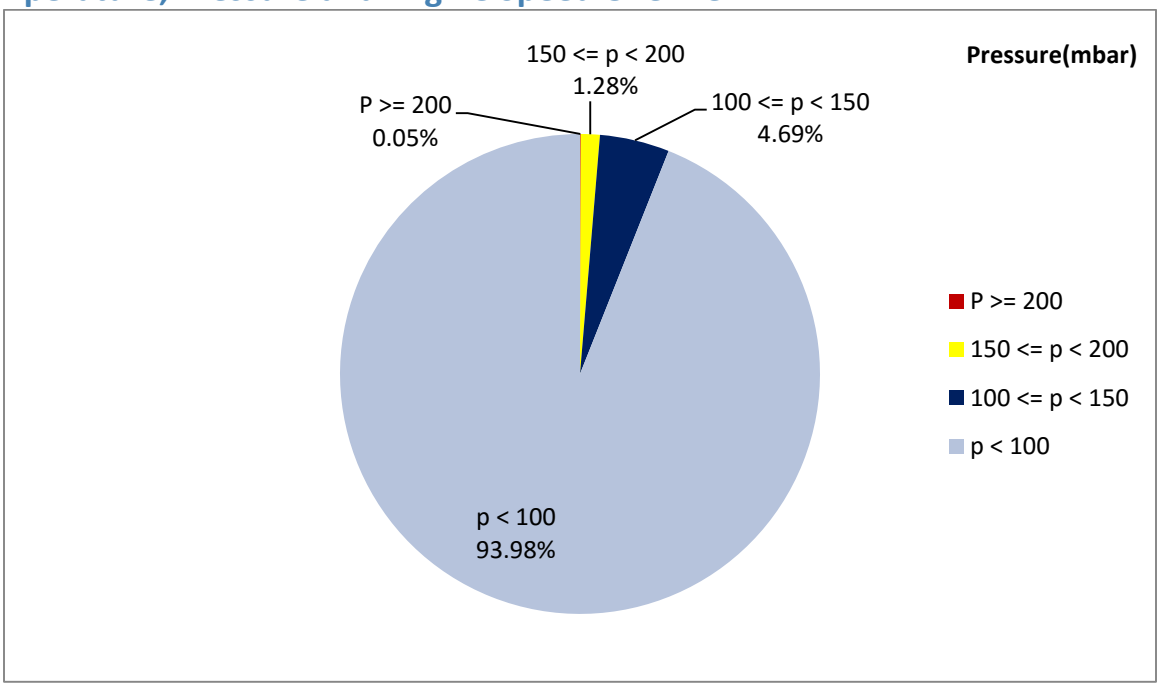


Figure 1- Pressure distribution over the working hours

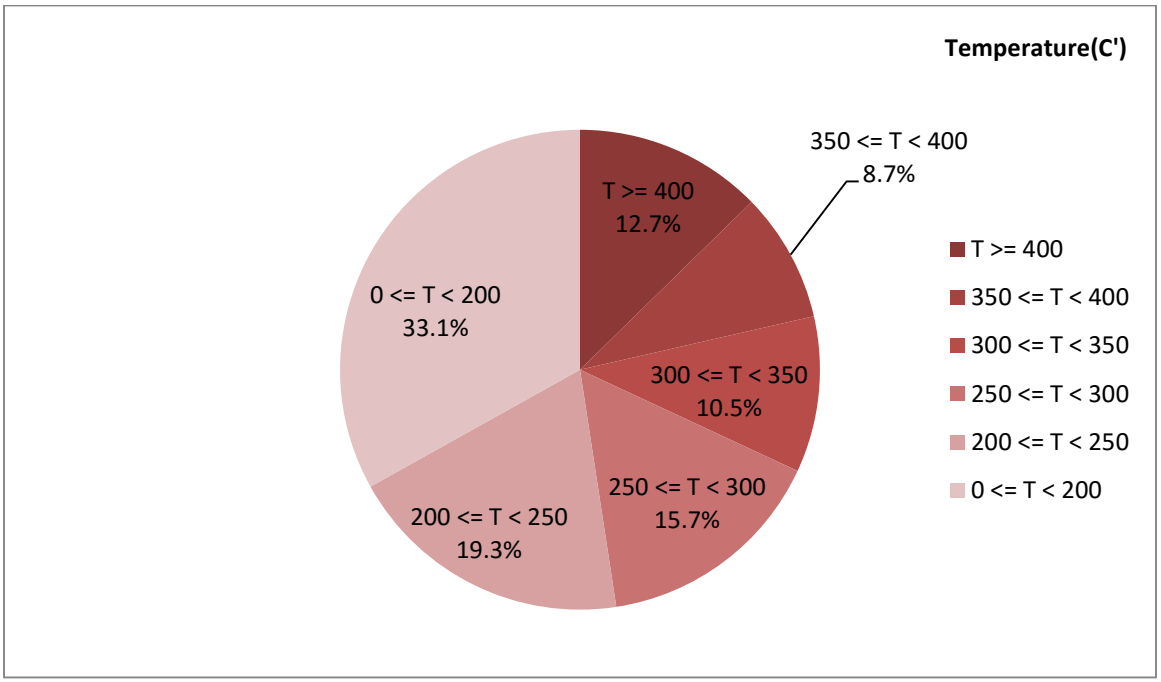


Figure 2-Temperature distribution over the working hours

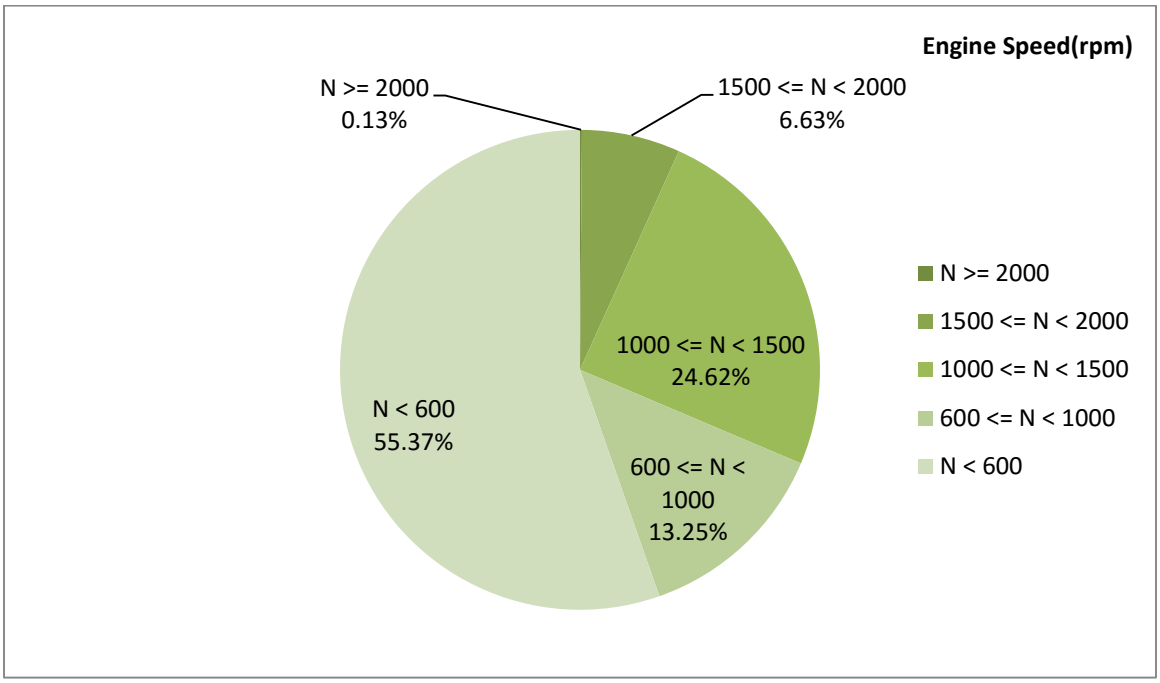


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
263.06	27.95	815

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
328.51	52.17	1167

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
590-50	231-0	2272-256

Detailed Pressure Analysis

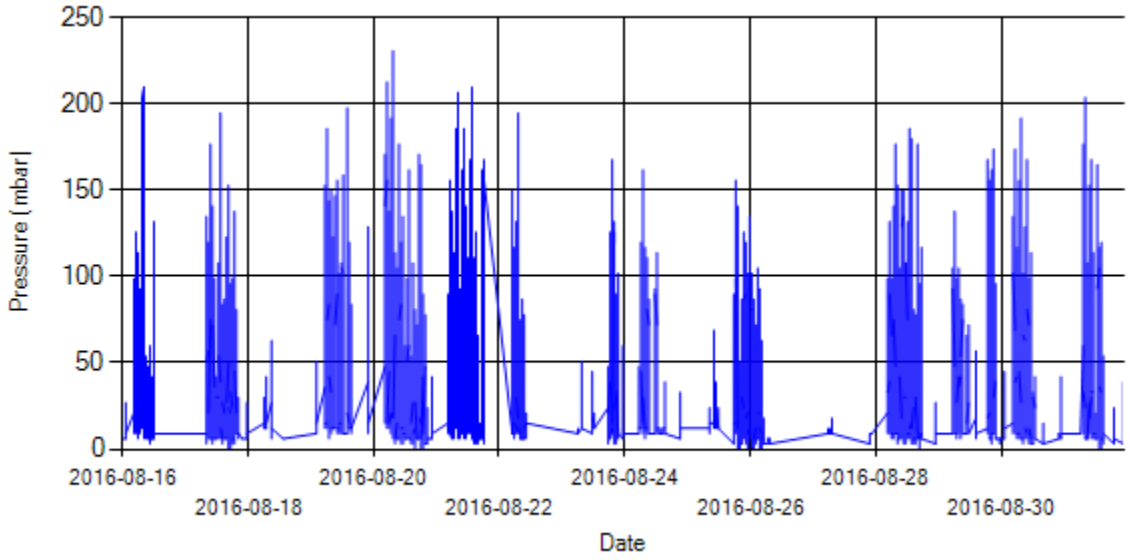


Figure 4- Pressure distribution over the period

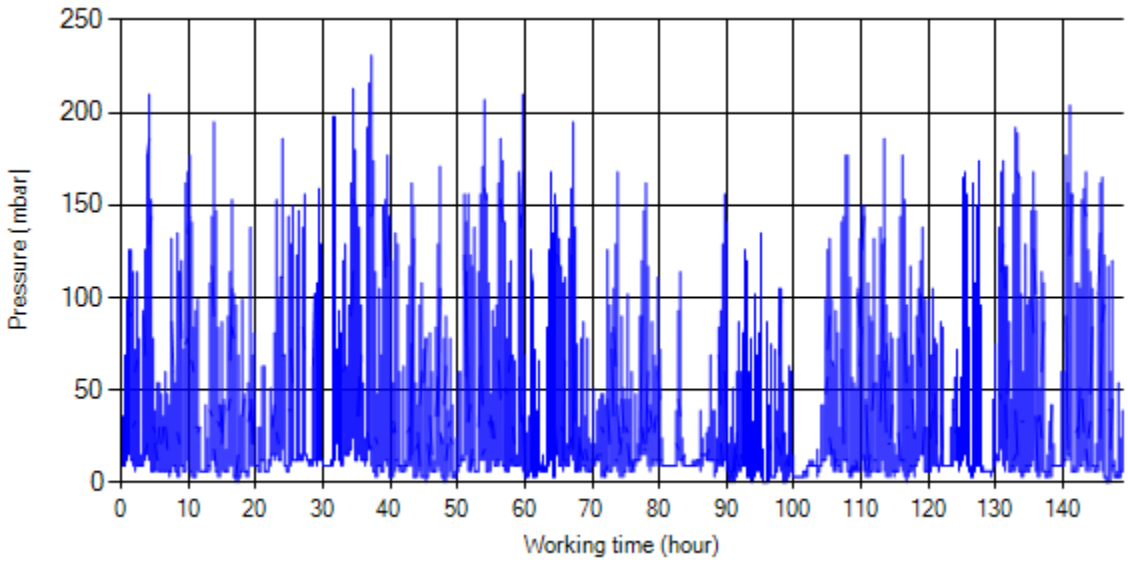


Figure 5- Pressure vs. working hours

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

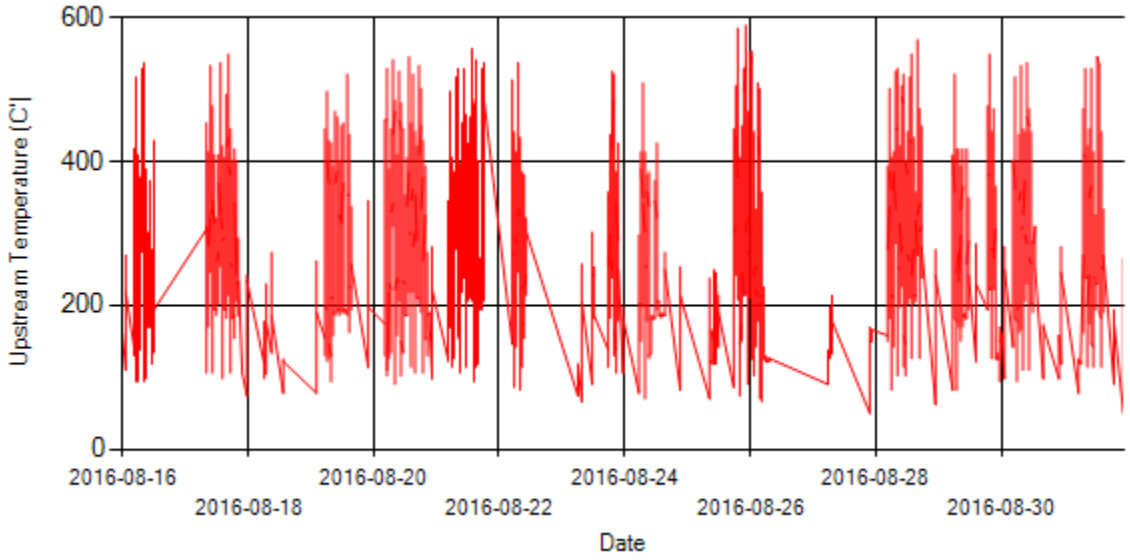


Figure 6- Temperature distribution over the period

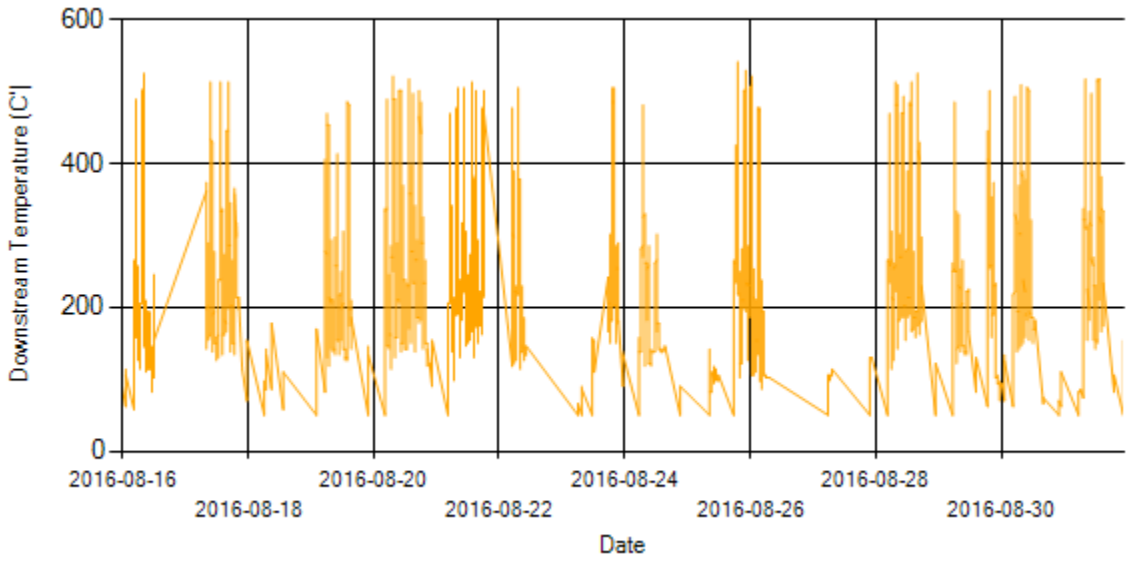


Figure 7- Temperature distribution over the period

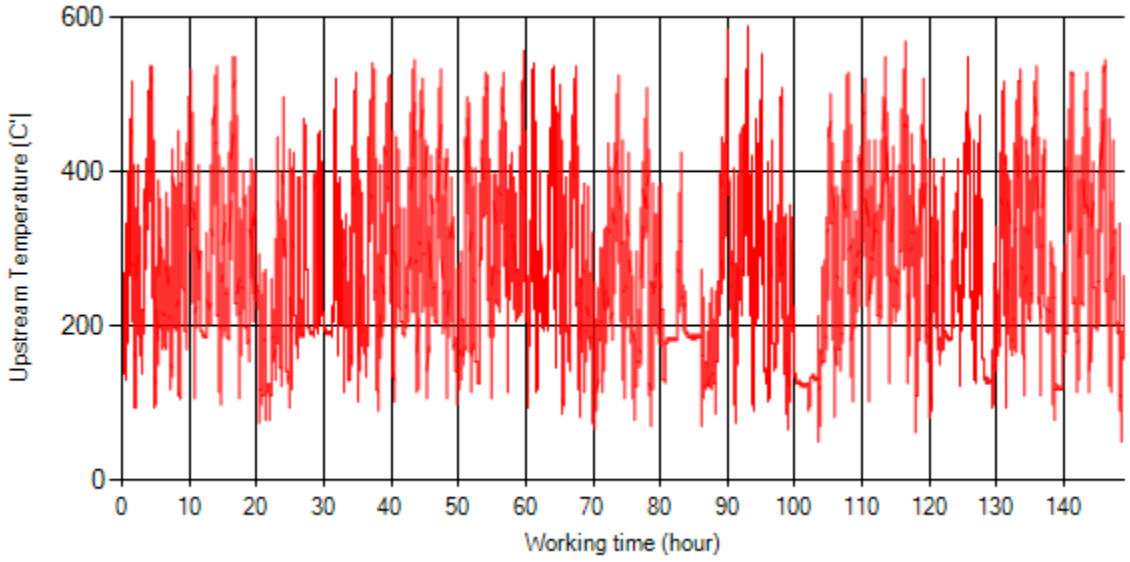


Figure 8- Temperature vs. working hours

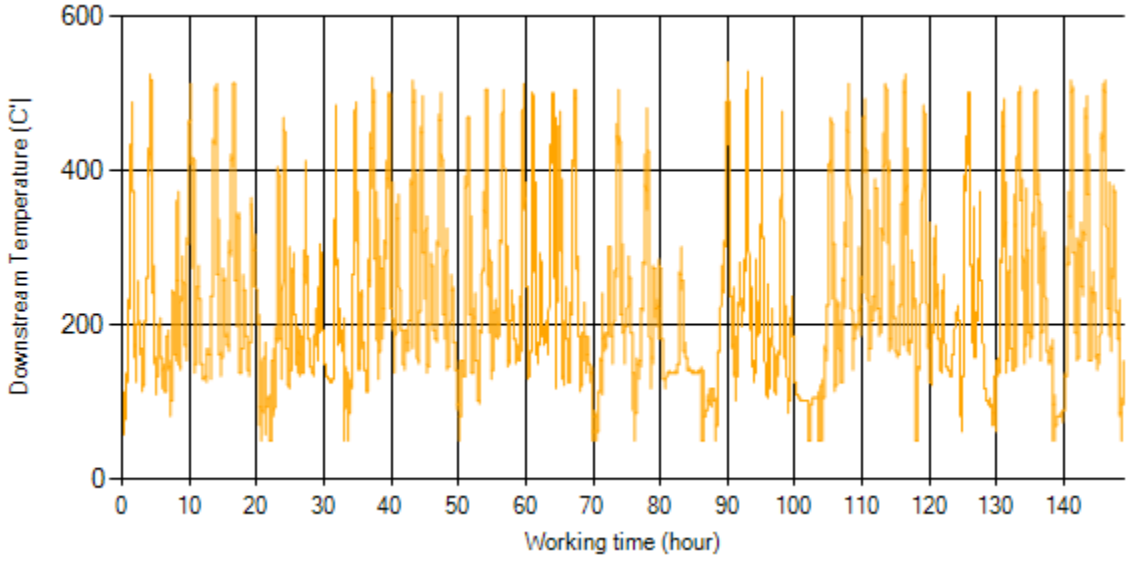


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

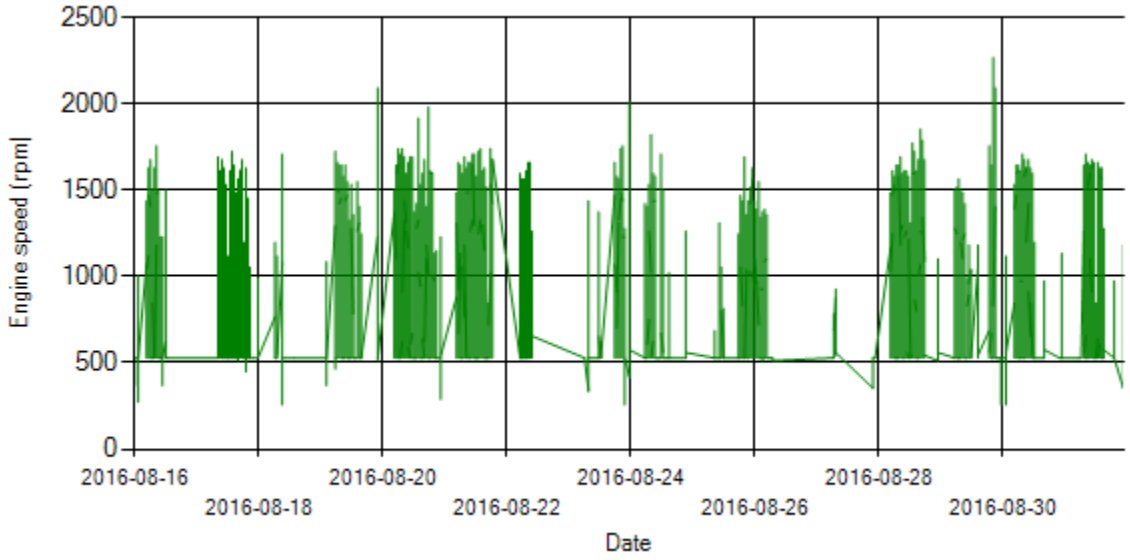


Figure 10- Engine speed distribution over the period

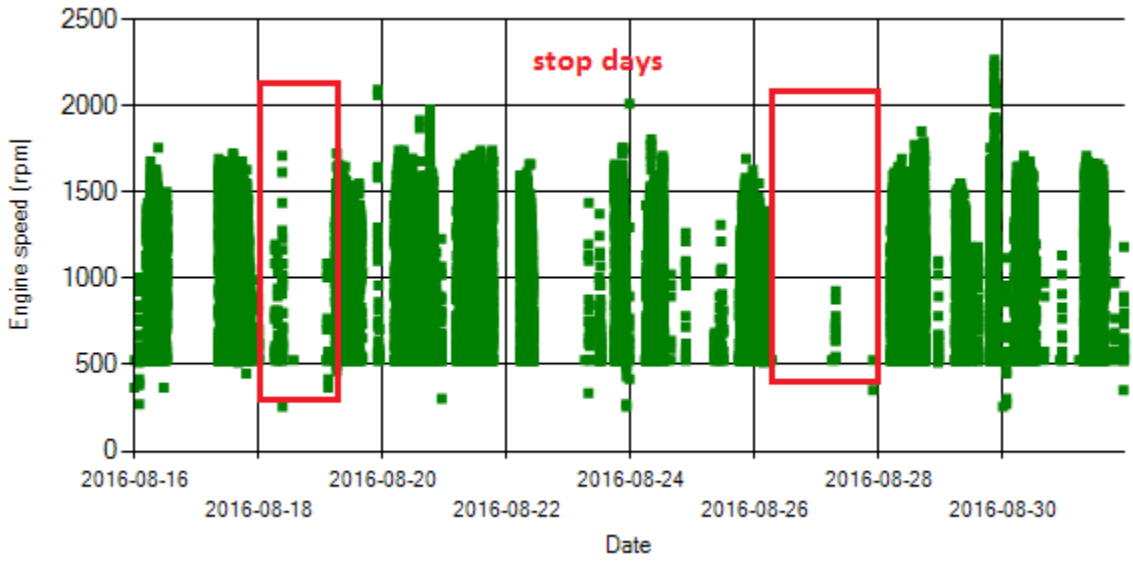


Figure 11- Engine speed diagram for calculating CPK's working days

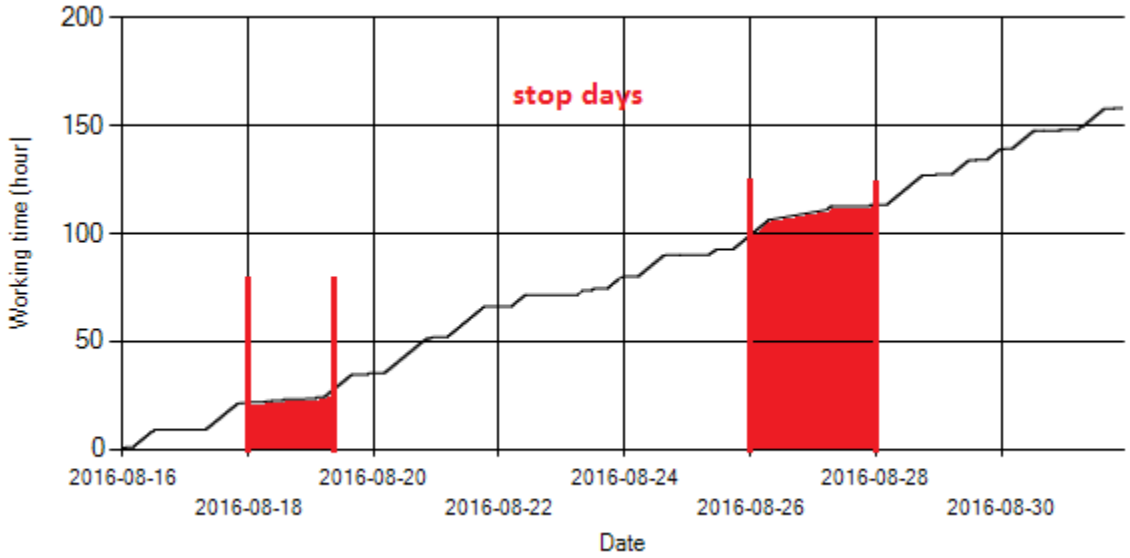


Figure 12- Time diagram for calculating CPK's working days

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 system was stopped for 3 days.

Pressure-Engine Speed diagrams

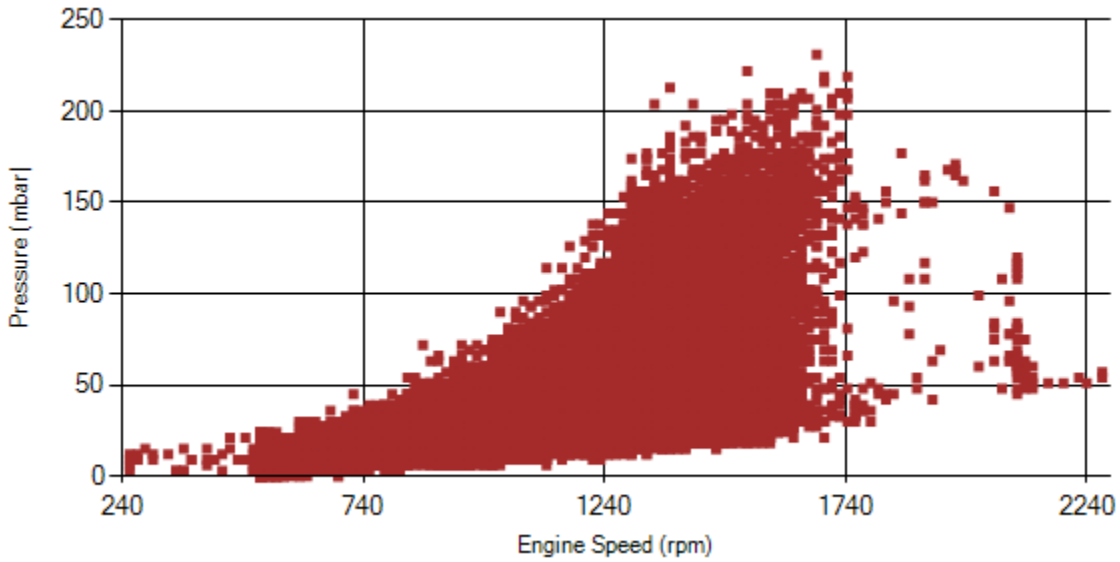


Figure 13- Pressure against engine speed

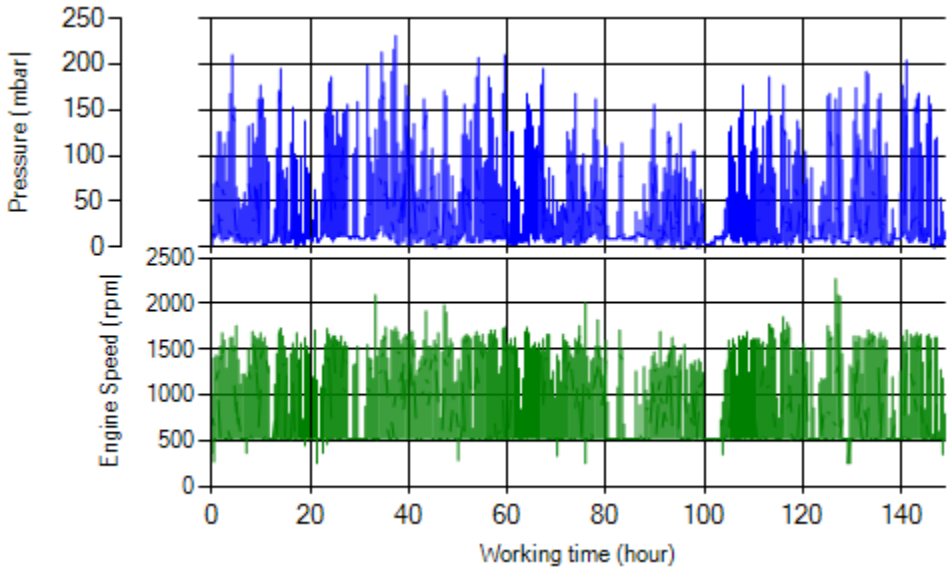


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

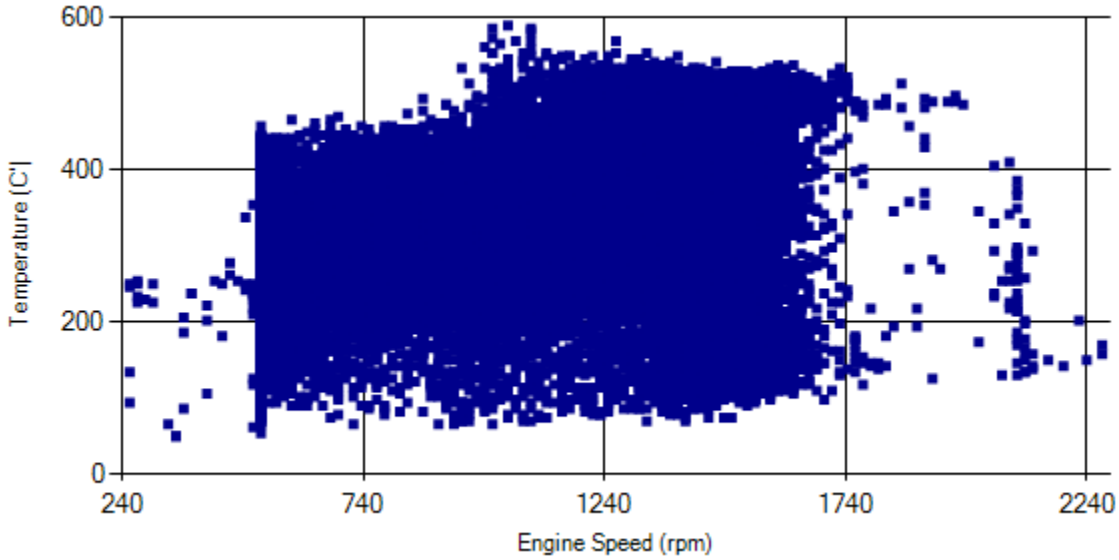


Figure 15- Temperature against engine speed

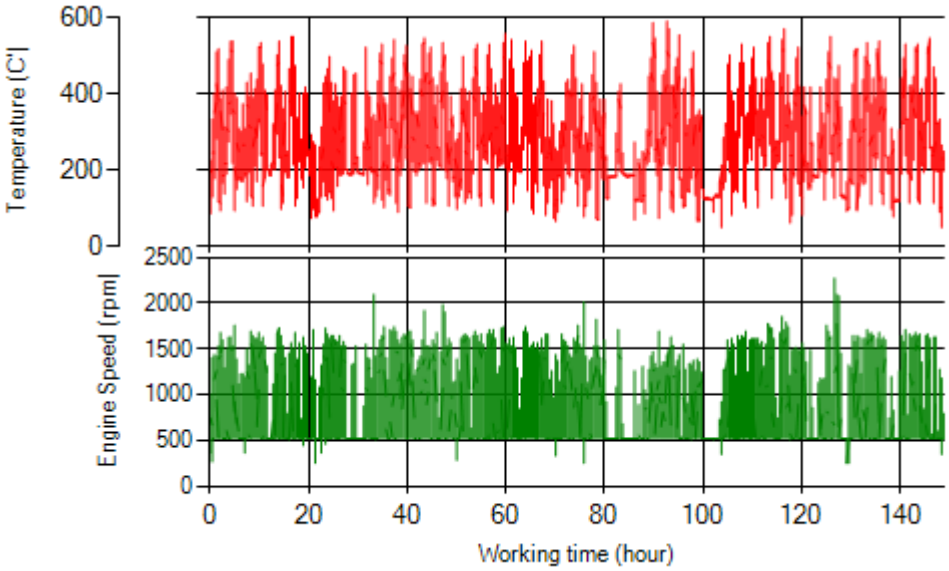


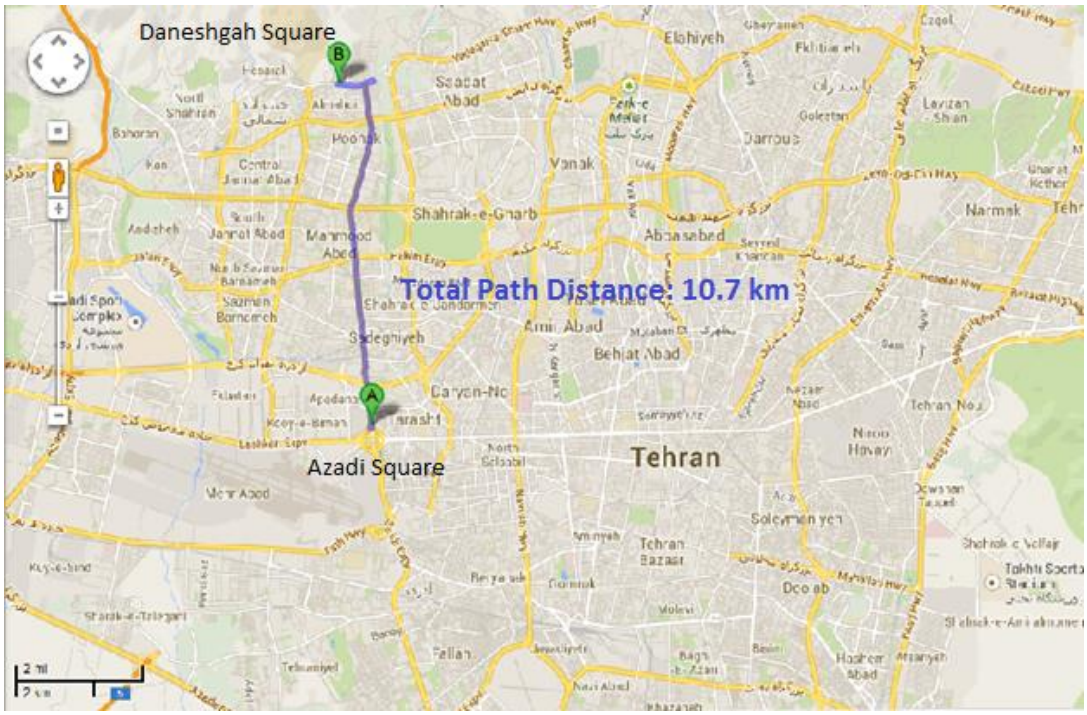
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 0.05% of working time, pressure was above 200 mbar and 1.33% above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 12.7% of total working time temperature is above 400 ℃ and 21.4% above 350℃.

Filter operation status	Excellent ■	Good ☐
	Maintenance required ☐	Failed ☐

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



AZMOON SANAT ARVIN	Document Number: DPF2016081/1 Date: 22/Aug/2016

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/Aug/2016 – 15/Aug/2016 (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 22nd Jul for the first time and on 15th Dec for the second time after 44355 km mileage from installation date. Third cleaning was done on 8th Aug 2016.
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)	72668 km
Bus mileage over the period	828 km
Working days over the period	8 days
Stop days	7 days
Data logger working days	8 days
Working hours over the period	56 hours 46 minutes
Average working hours per day (including stop days)	5 hours 9 minutes
Bus average speed	14.6 km/hr
idle speed time to all working time ration	46.51 %
Total Bus fuel consumption over the period	439 lit
Fuel consumption per hour	7.73 lit/hr
Average fuel consumption	0.53 lit/km
Total Bus additive consumption over the period	0.209 lit
Average additive consumption	253.4 cc/km
Additive consumption to fuel ration	478 cc/1000lit

Temperature, Pressure and Engine Speed Overview

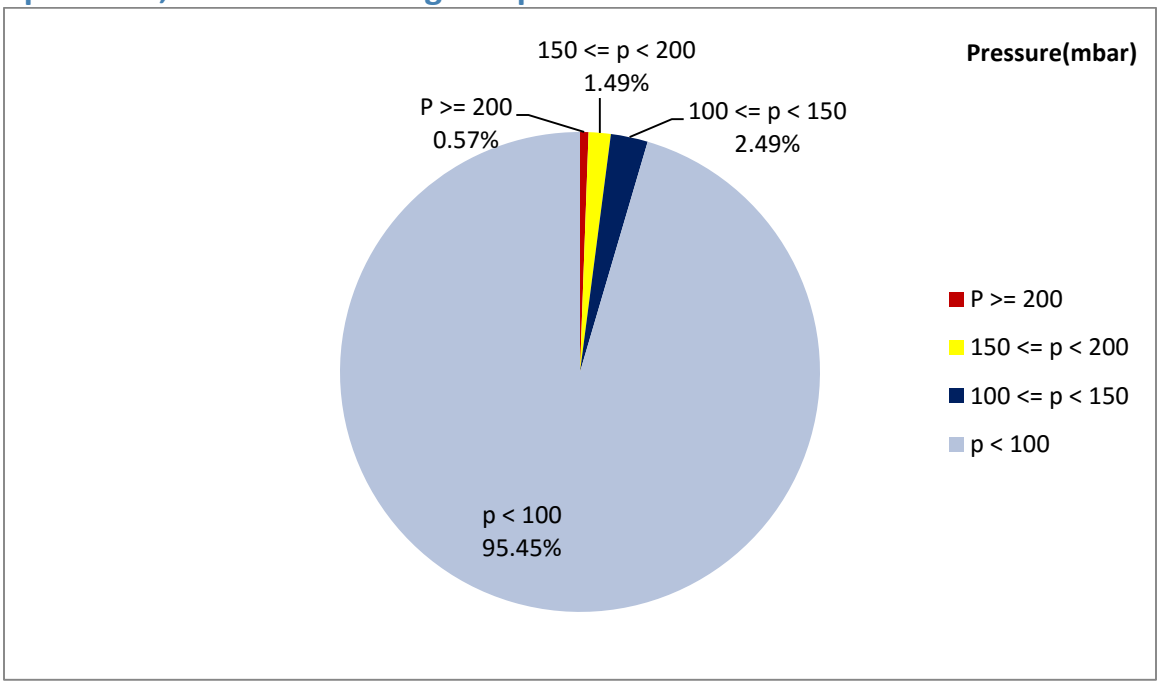


Figure 1- Pressure distribution over the working hours

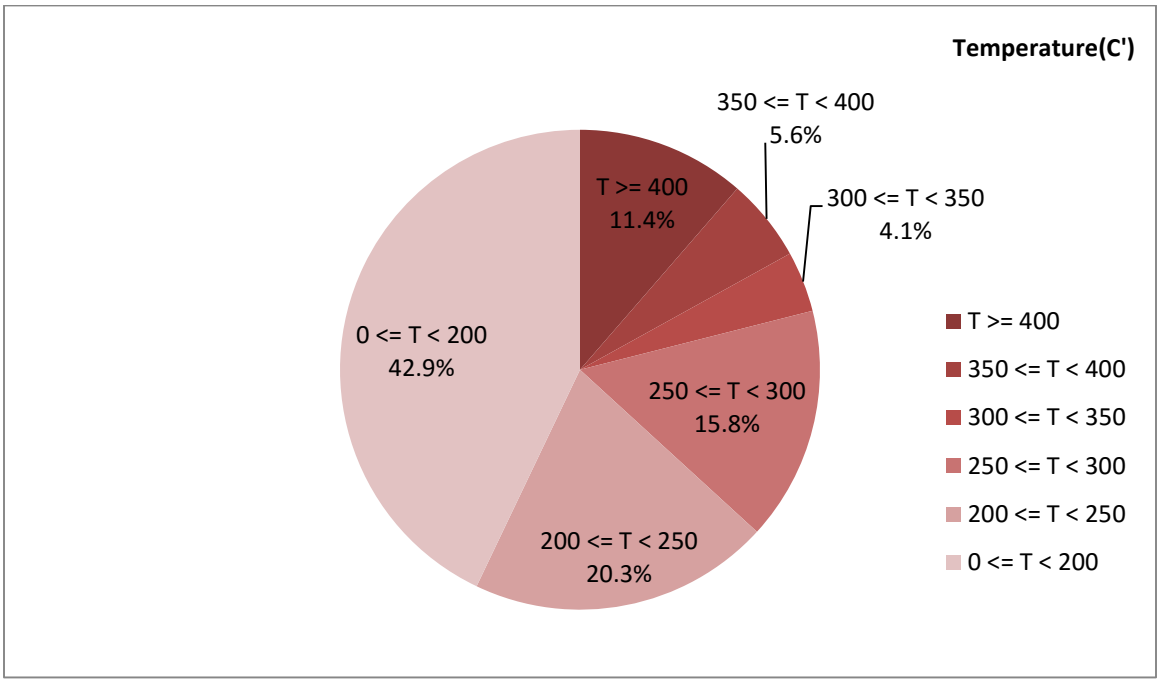


Figure 2-Temperature distribution over the working hours

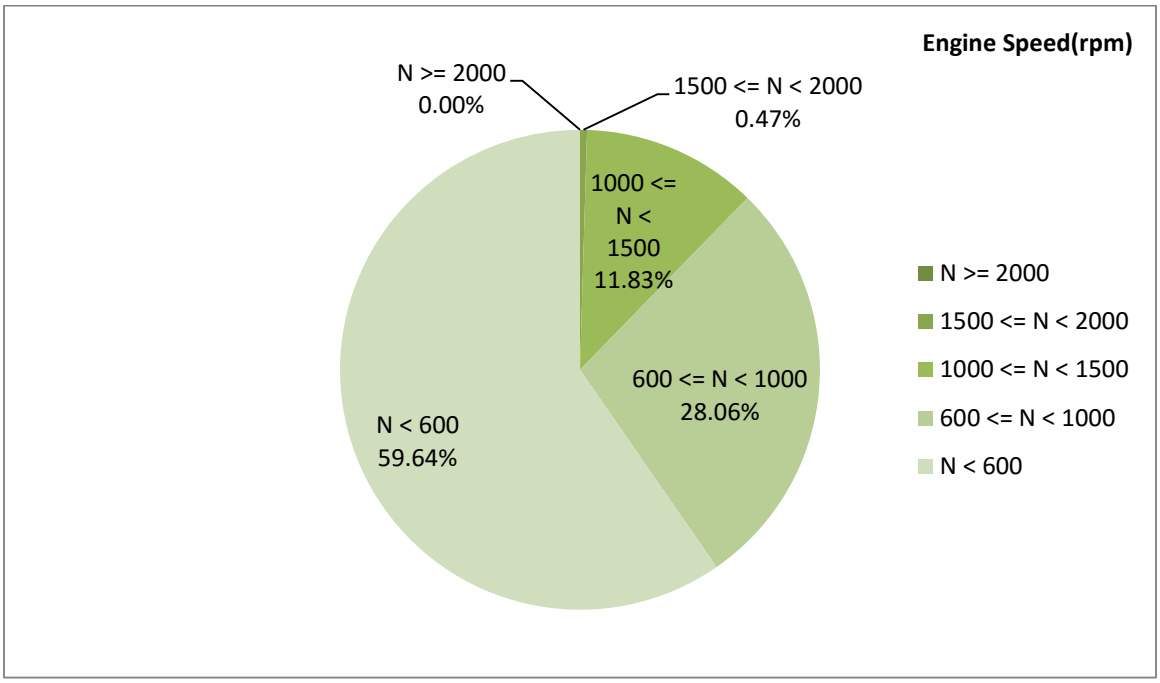


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
243.4	23.55	658

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
267.47	34.74	777

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
566-50	321-0	1968-256

Detailed Pressure Analysis

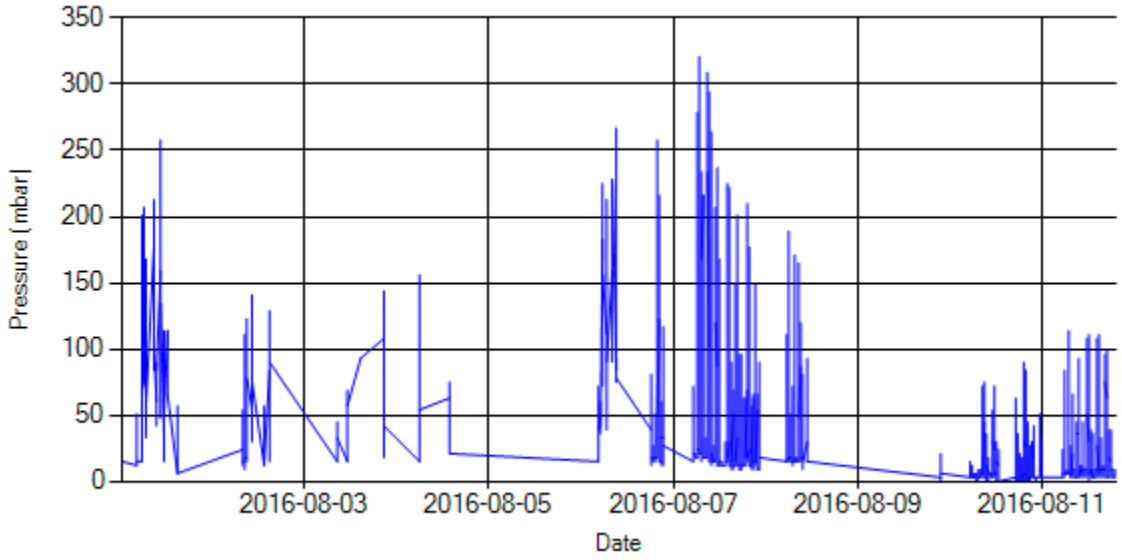


Figure 4- Pressure distribution over the period

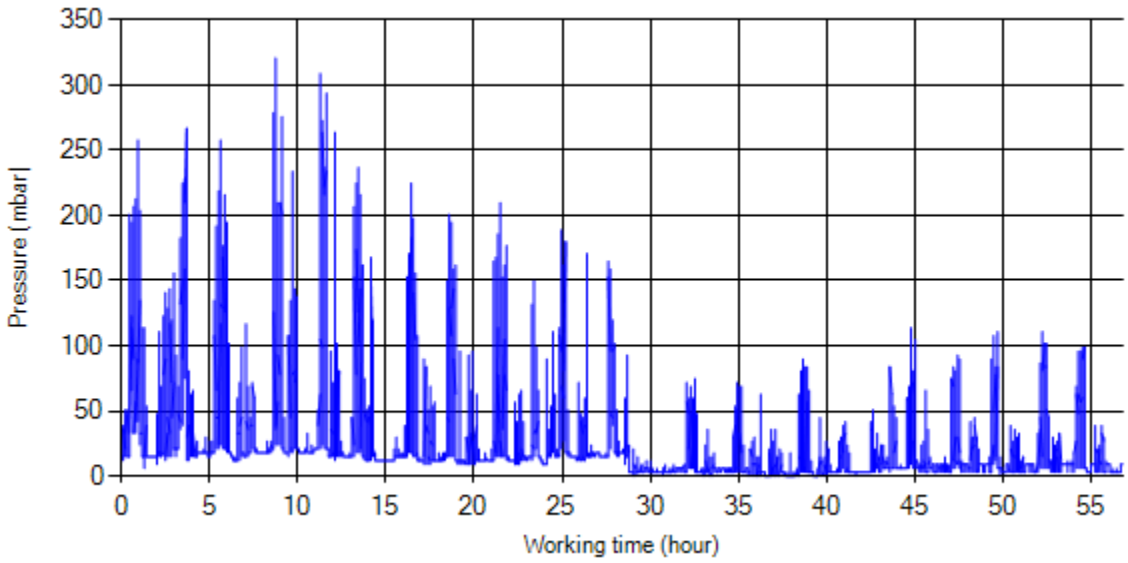


Figure 5- Pressure vs. working hours

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

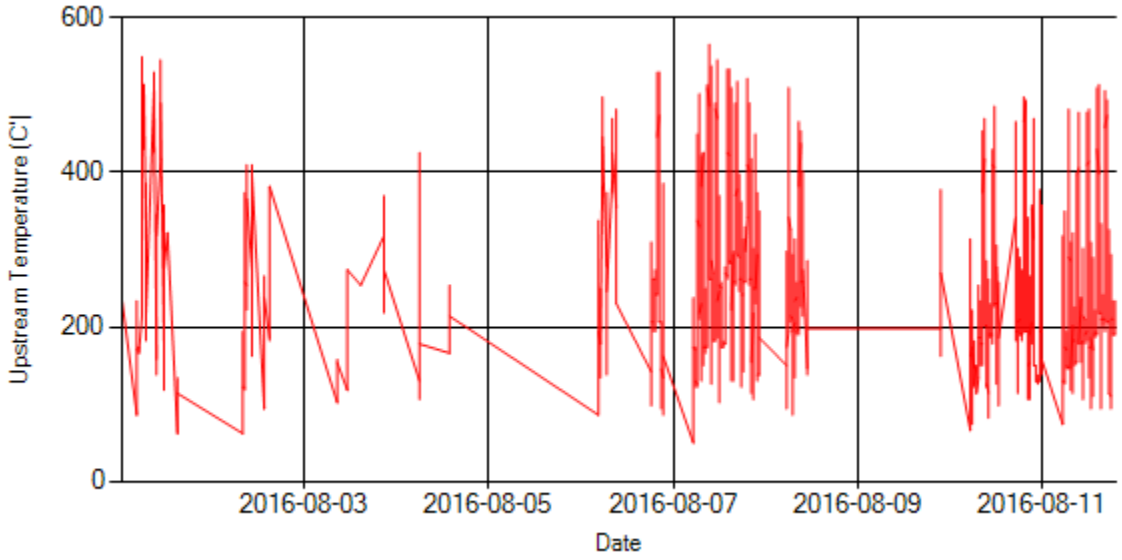


Figure 6- Temperature distribution over the period

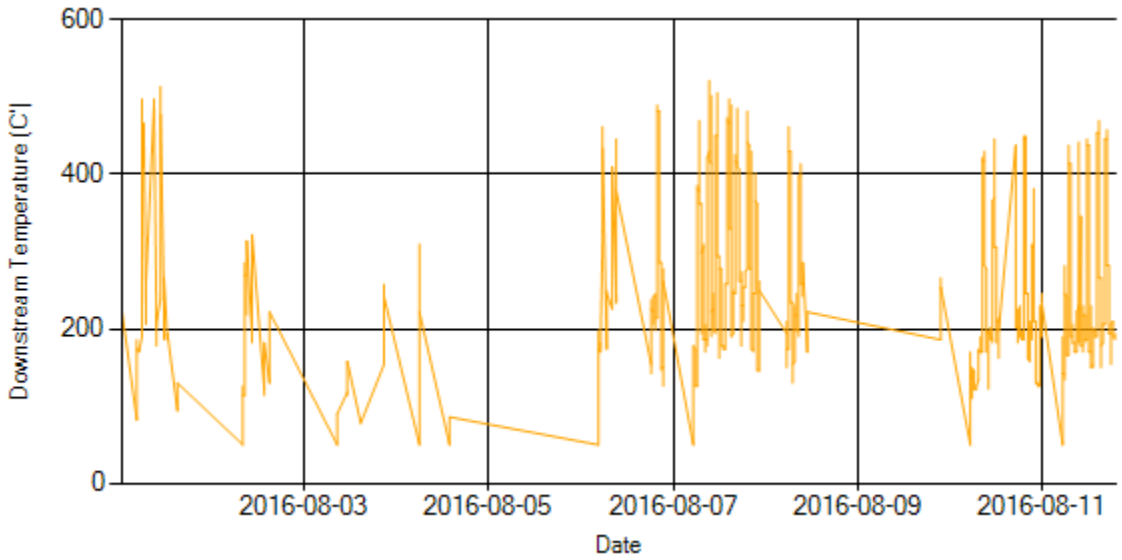


Figure 7- Temperature distribution over the period

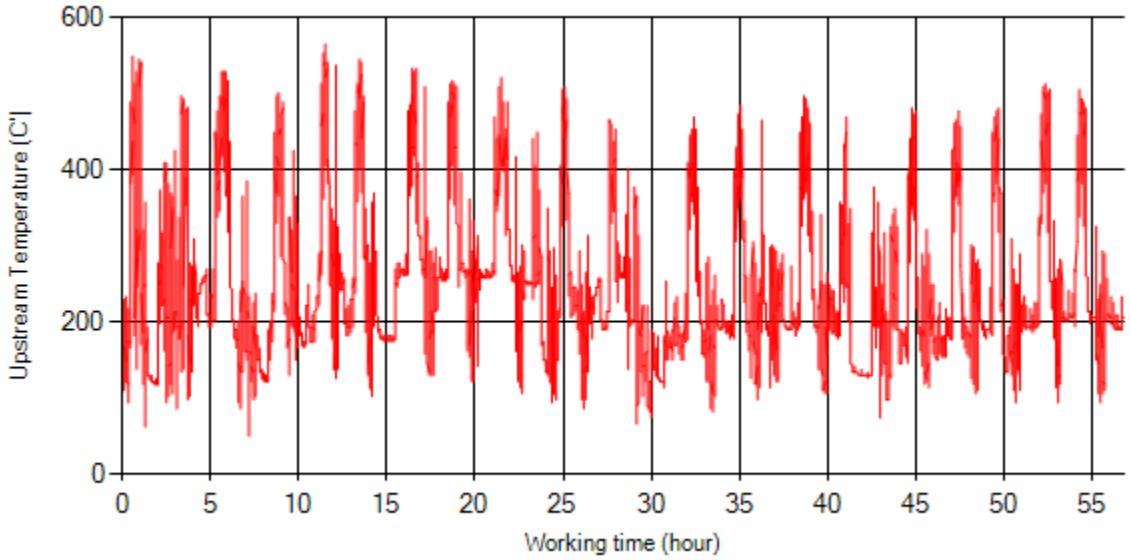


Figure 8- Temperature vs. working hours

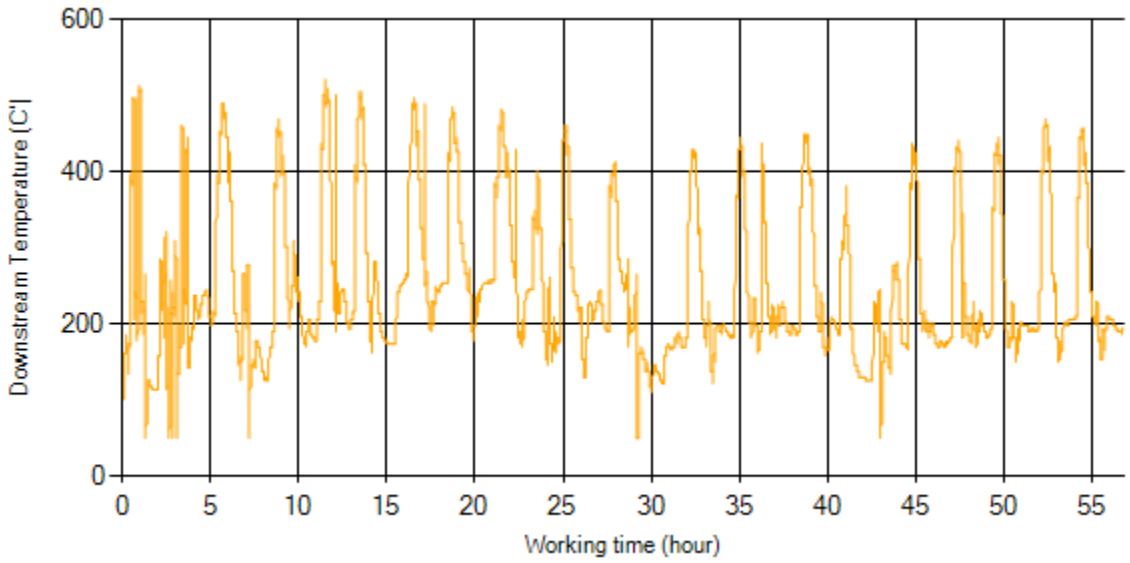


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

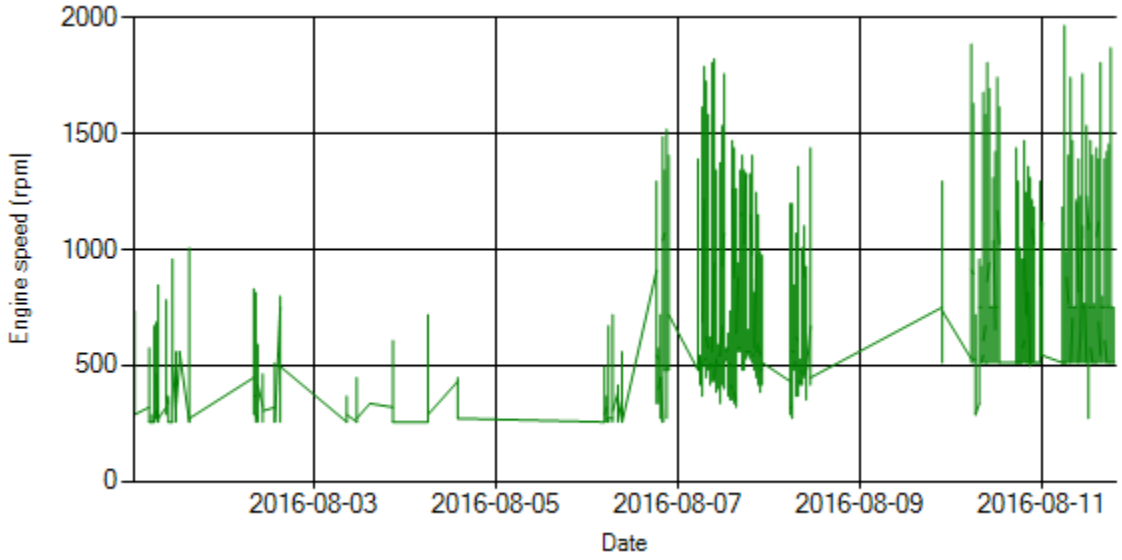


Figure 10- Engine speed distribution over the period

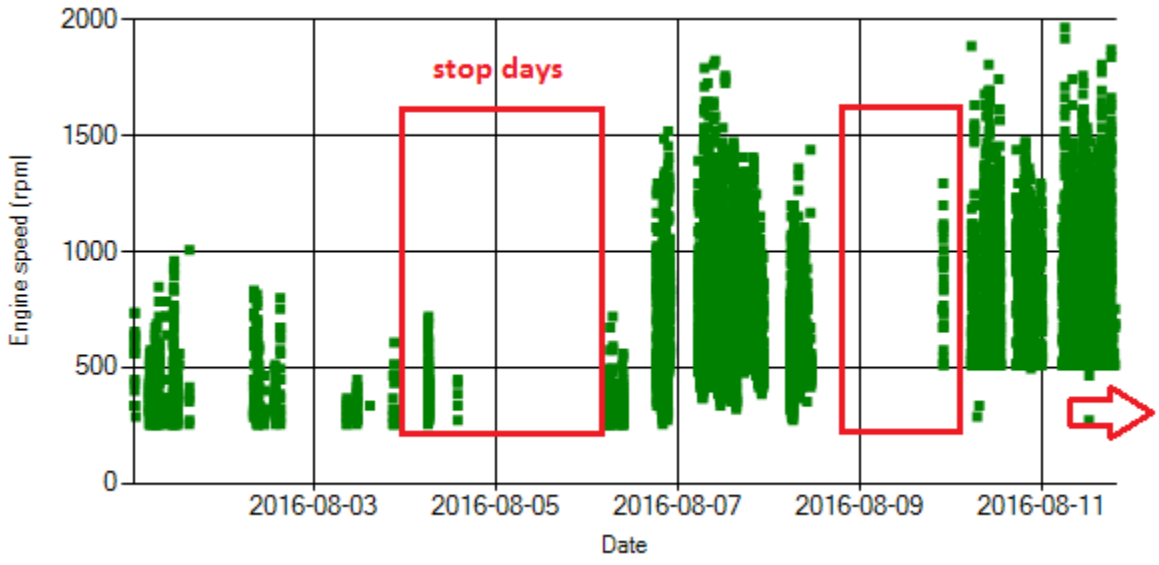


Figure 11- Engine speed diagram for calculating CPK's working days

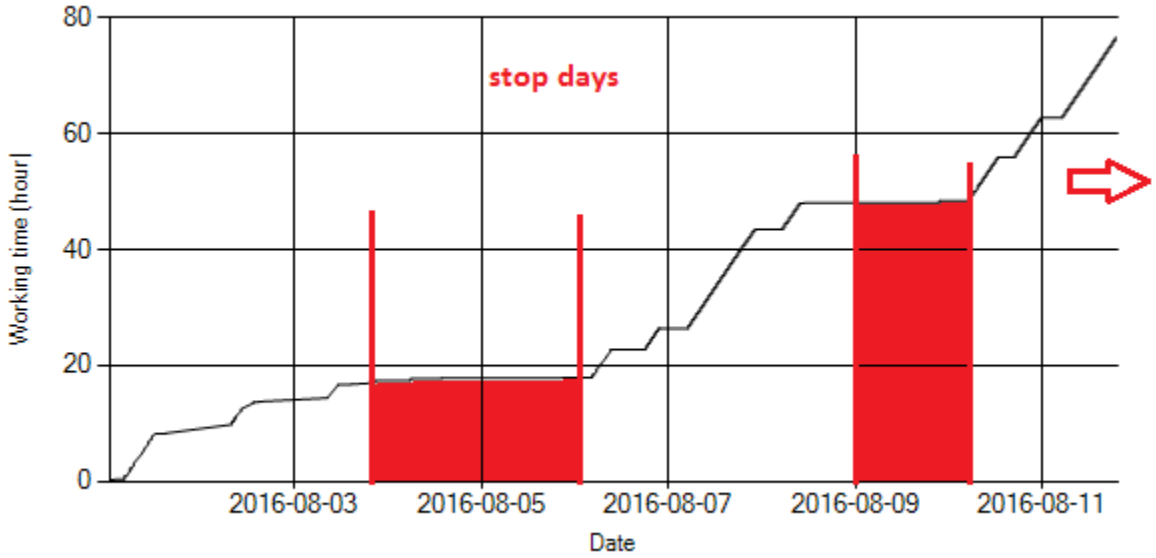


Figure 12- Time diagram for calculating CPK's working days

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 system was stationary for 7 days.

Pressure-Engine Speed diagrams

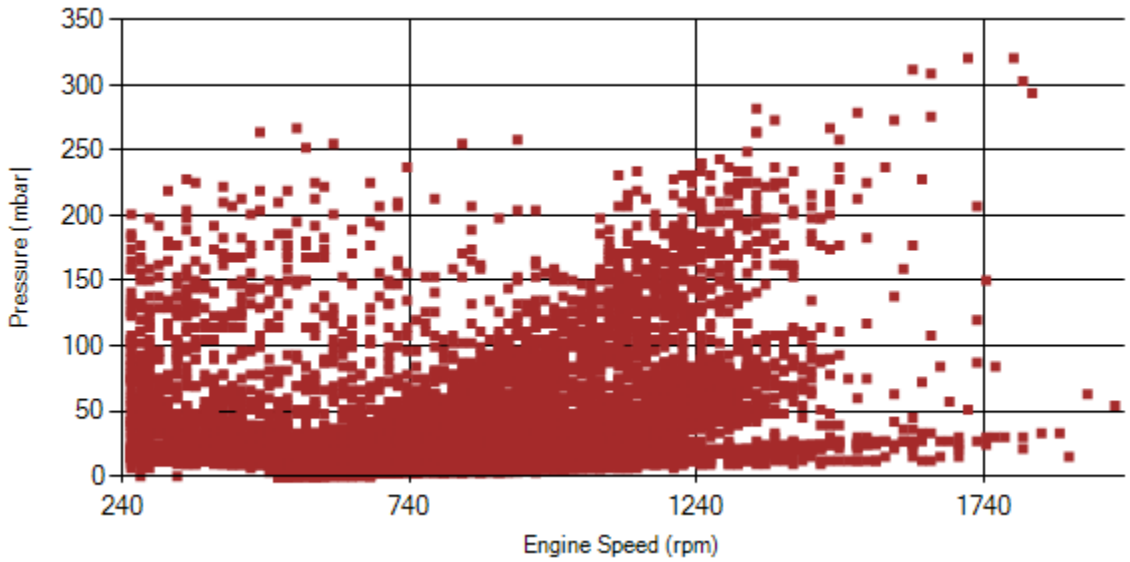


Figure 13- Pressure against engine speed

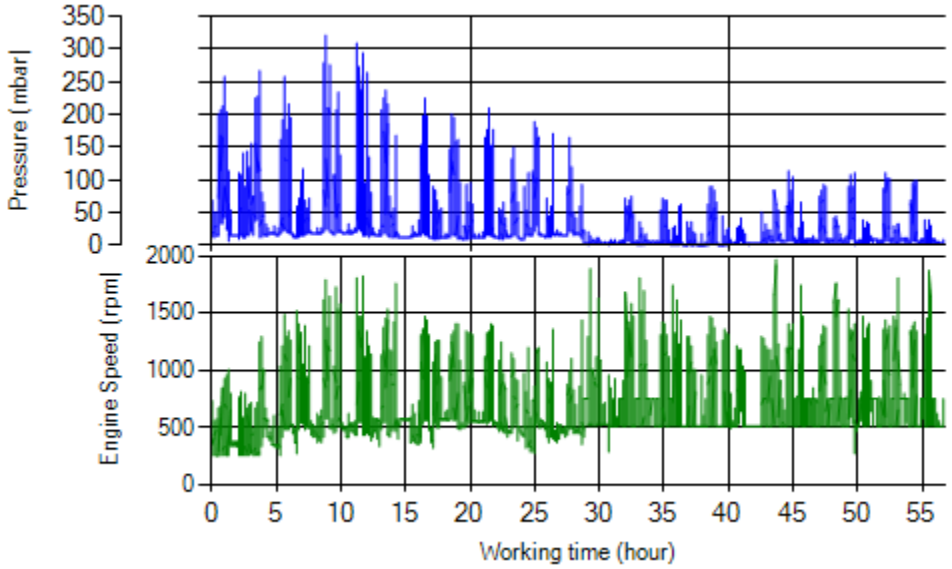


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

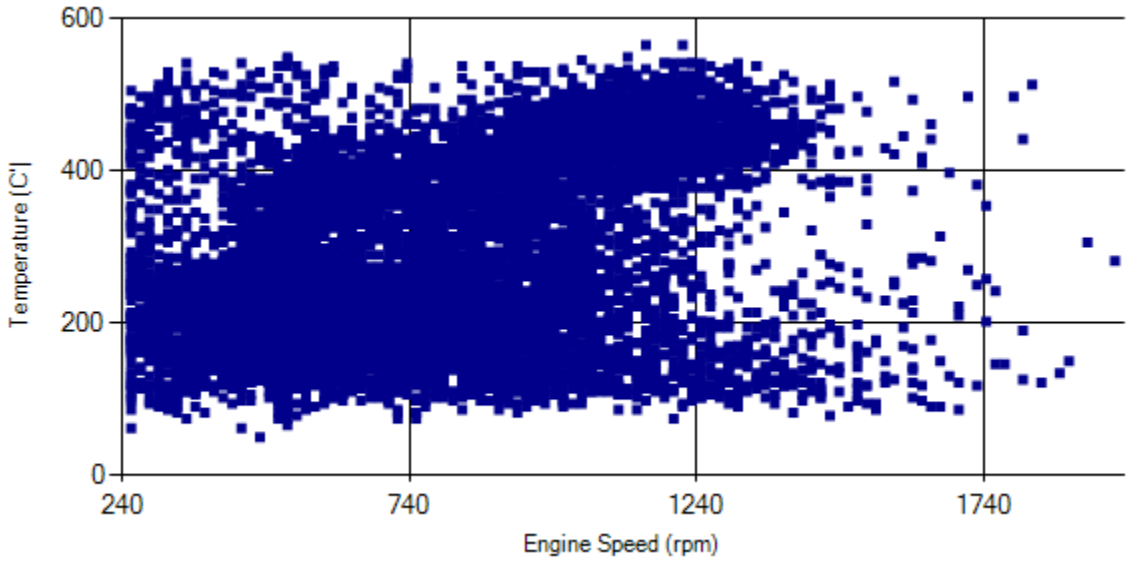


Figure 15- Temperature against engine speed

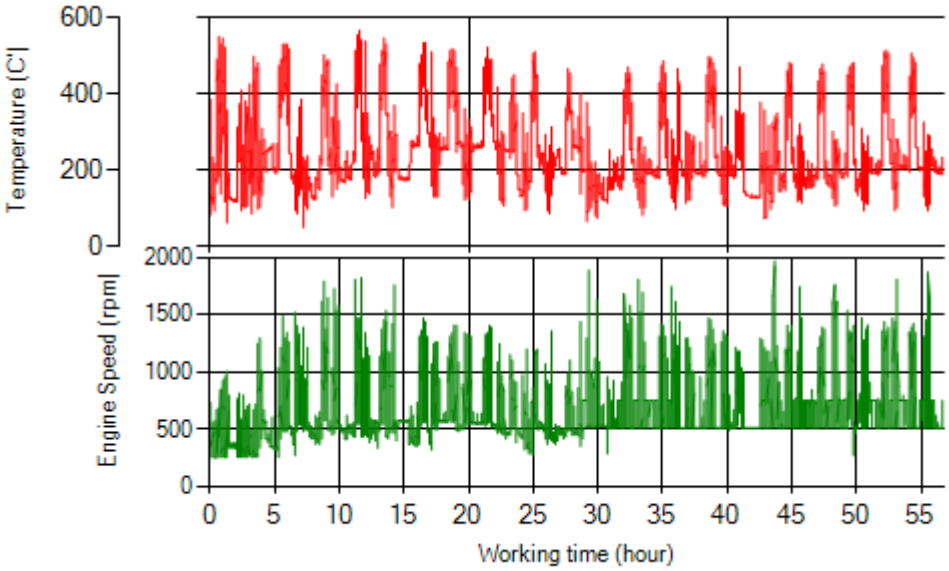


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 0.57% of working time, pressure was above 200 mbar and 2.06% was above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 11.4% of total working time temperature is above 400 ℃ and 17% above 350℃.

Filter operation status	Excellent ☐	Good ■
	Maintenance required ☐	Failed ☐

AZMOON SANAT ARVIN	Document Number: DPF2016082/1 Date: 05/Sep/2016

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/Aug/2016 – 31/Aug/2016 (sixteen days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF was cleaned on 22nd Jul for the first time and on 15th Dec for the second time after 44355 km mileage from installation date. Third cleaning was done on 8th Aug 2016.
Dosing status	Dosing value has been kept constant from installation date until now.

NOTE: The bus was stopped on this period due to technical problems.

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an effective way to control solid particulate

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