Diesel Particulate Filters' Feasibility Study Report

Report's Period:

2016/06/01 - 2016/06/30

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

هسته پژوهشی سوخت،
احتراق و آلایندگی

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 30/Jun/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	659 days	82530 km	DPF core was cleaned on Jun 13th after about 36000 km for the first time.
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	520 days	91006 km	DPF core was cleaned on Aug 12th after about 26500 km, for the first time. Considering system high backpressure, filter isolation defect, DPF core was removed on Sep 16th and installed on Nov 17th. The third cleaning was unavoidable after only 6 days working and was done on 29th Nov. System worked for two days and DPF was replaced by muffler on Nov 30 th . DPF was installed for the fourth time on Jan/19/2016 and was replaced by muffler after only three

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

				days working because of high backpressure. A new DPF core was installed on May/14/2016.
HJS _02 (Active system with FBC - Electrical Heater) V.ID: 85423 (line 4)	19/Feb/2015	511 days	- km	DPF was cleaned on 2016-02-03 for the first time.
HJS_03 (Active system with FBC - Electrical Heater) V.ID: 33572 (line 2)	19/Feb/2015	498days	68132 km	DPF core was cleaned on Oct 5th after about 30801 km, 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	494 days	70851 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	261 days	16202 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	127 days	10242 km	DPF has been working from installation date until now without any cleaning.

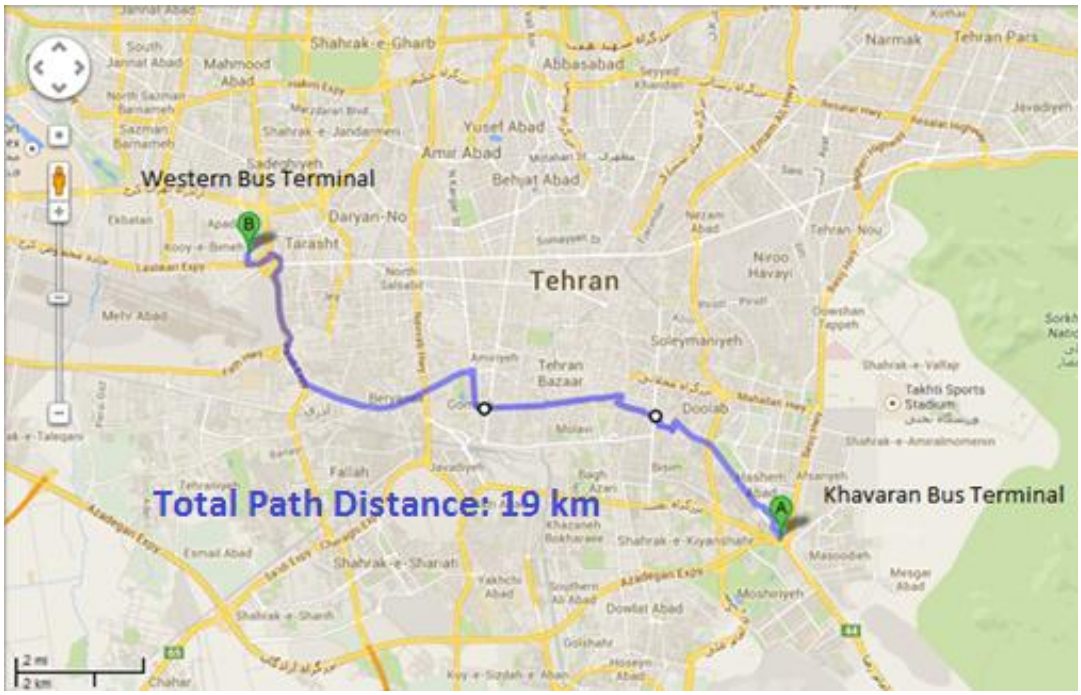
Table 3 represents DPFs' operation status during January. DPFs detailed information could be found in the next section.

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	7	2
85423 (line 4)	HJS _02	7	2
78515 (line 4)	Dinex_01	6	6
78524 (line 4)	PURItech	1	1
33572 (line 2)	HJS_03	1	3
33637 (line 2)	Dinex_02	5	5
85476 (line 10)	HJS_04	2	2
85182 (line 10)	Tehag_01	1	1
33592 (line 2)	Tehag_02	6	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/Jun/2016 – 15/Jun/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.
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)	65483 km
Bus mileage over the period	1177 km
Working days over the period	7 days
Stop days	8 days
Data logger working days	7 days
Working hours over the period	79 hours 10 minutes
Average working hours per day (including stop days)	5 hours 16 minutes
Bus average speed	14.9 km/hr
idle speed time to all working time ration	52.16 %
Total Bus fuel consumption over the period	670.9 lit
Fuel consumption per hour	8.49 lit/hr
Average fuel consumption	0.57 lit/km
Total Bus additive consumption over the period	0.32 lit
Average additive consumption	376 cc/km
Additive consumption to fuel ration	477 cc/1000lit

Temperature, Pressure and Engine Speed Overview

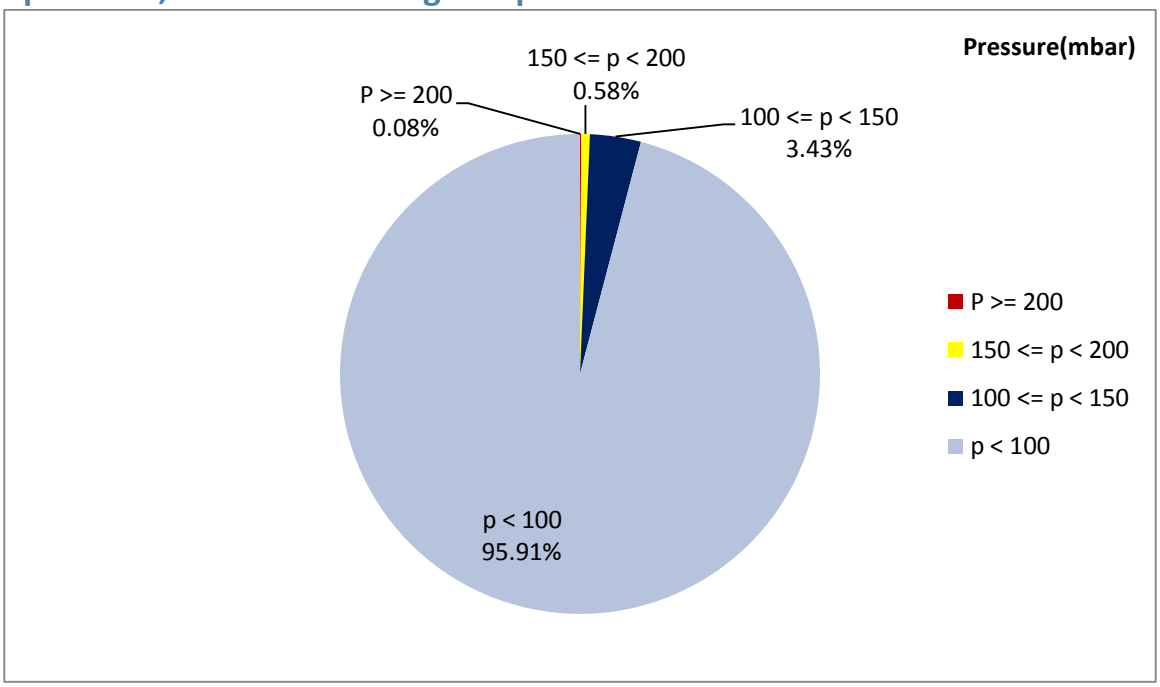


Figure 1- Pressure distribution over the working hours

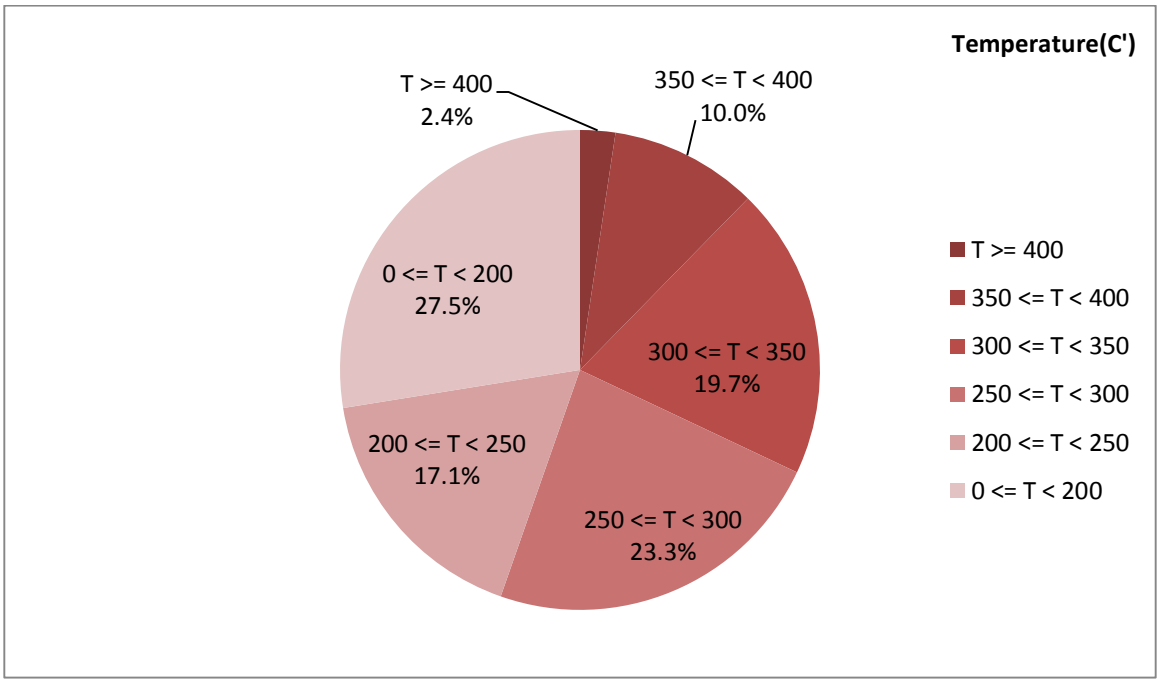


Figure 2-Temperature distribution over the working hours

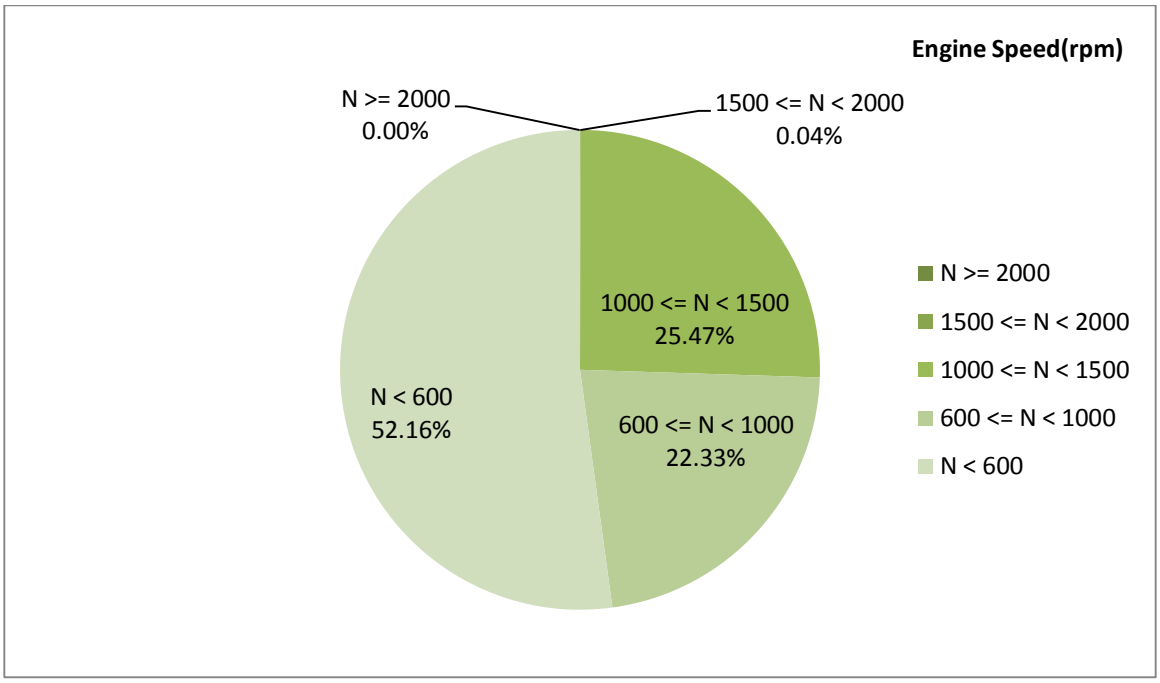


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
257.07	23.65	755

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
313.85	46.5	983

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
486-50	252-0	1920-304

Detailed Pressure Analysis

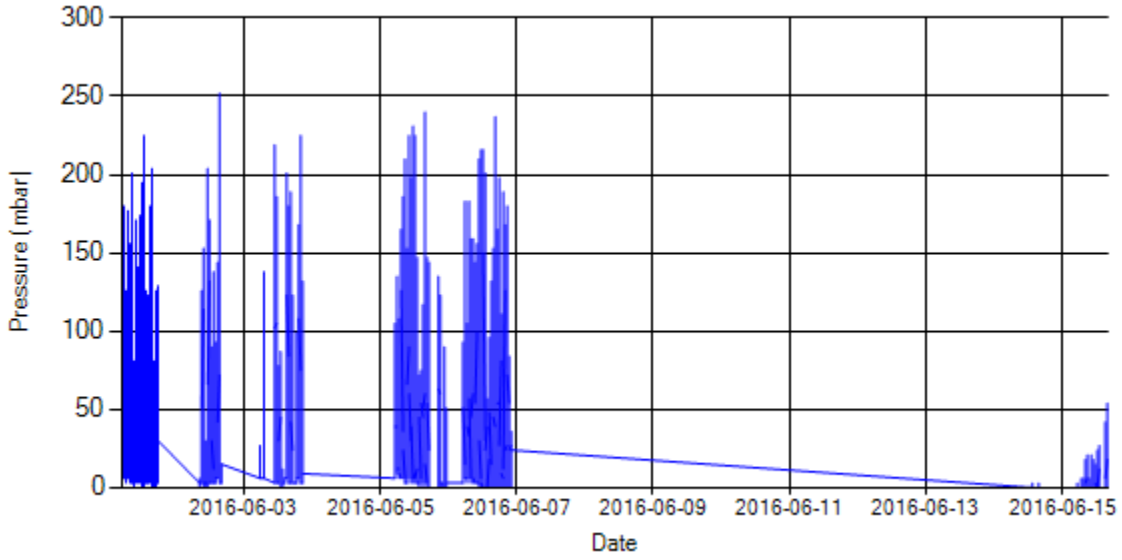


Figure 4- Pressure distribution over the period

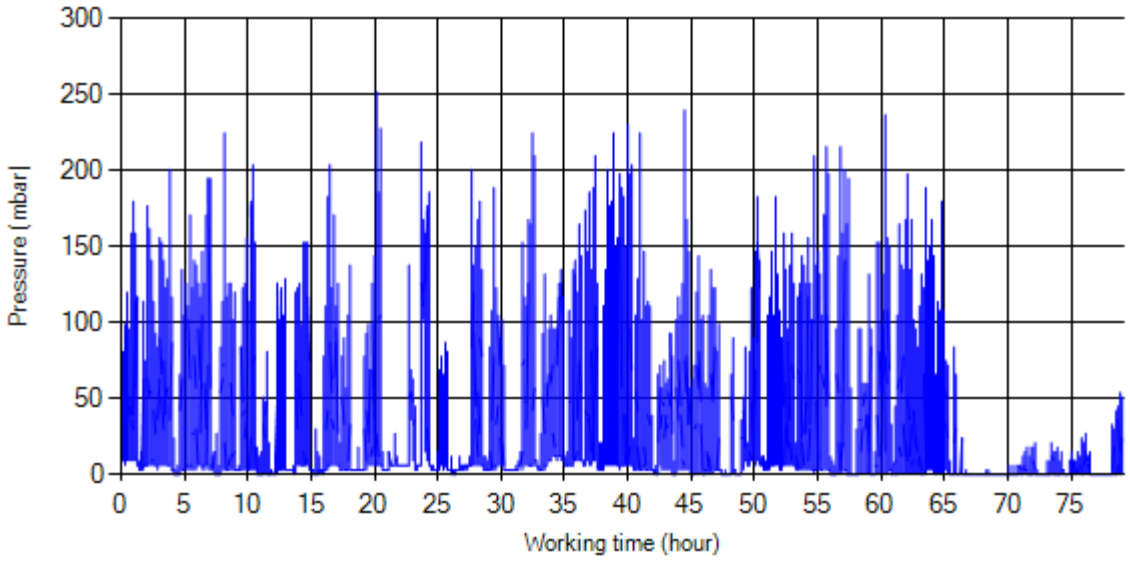


Figure 5- Pressure vs. working hours

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

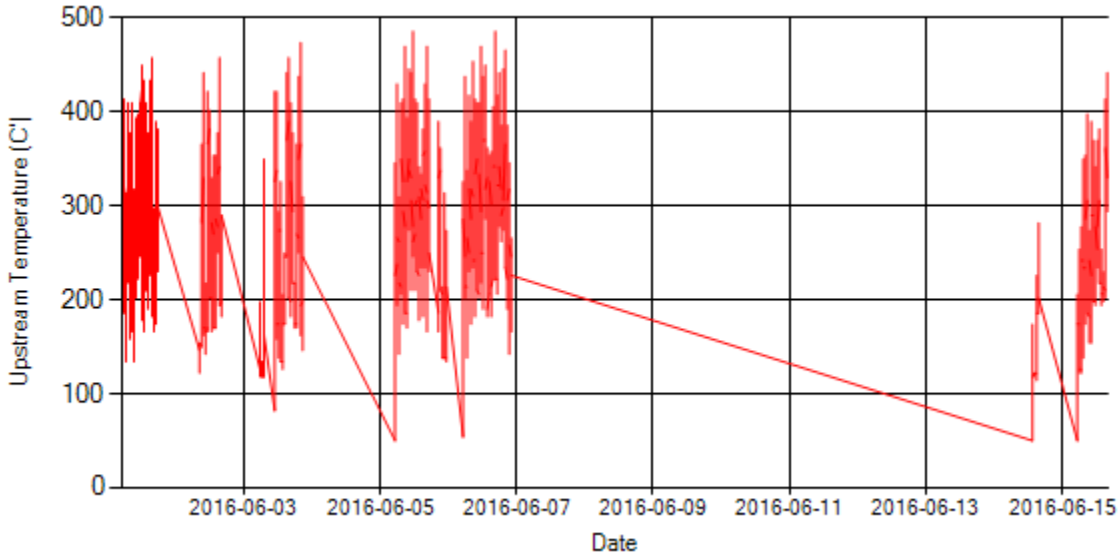


Figure 6- Temperature distribution over the period

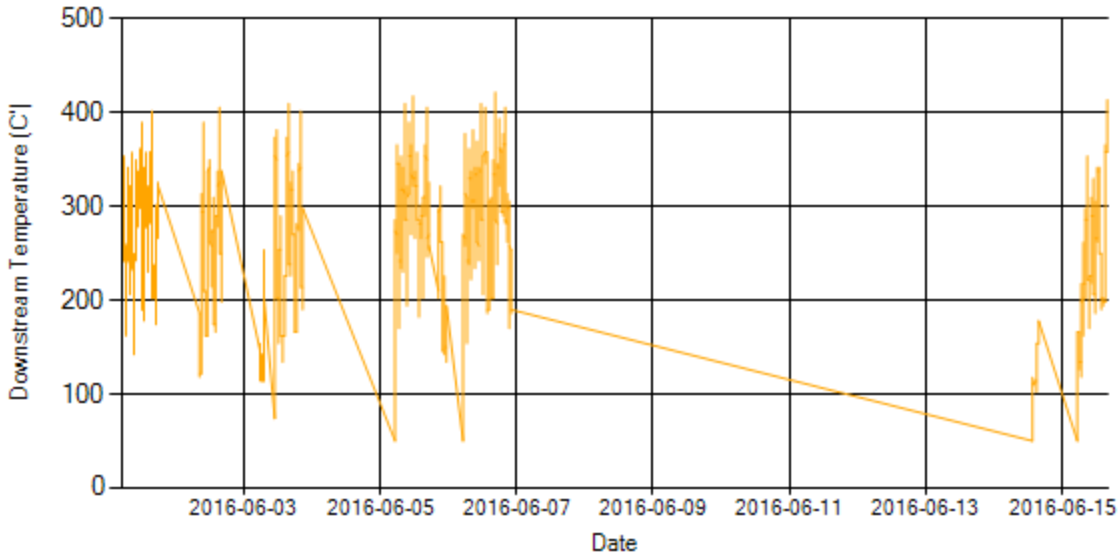


Figure 7- Temperature distribution over the period

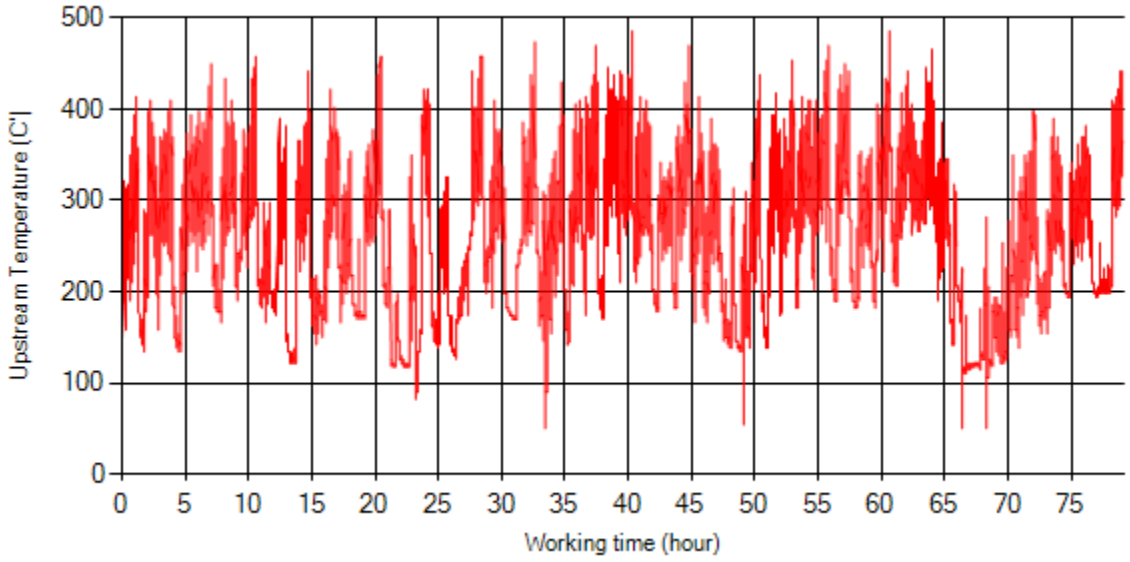


Figure 8- Temperature vs. working hours

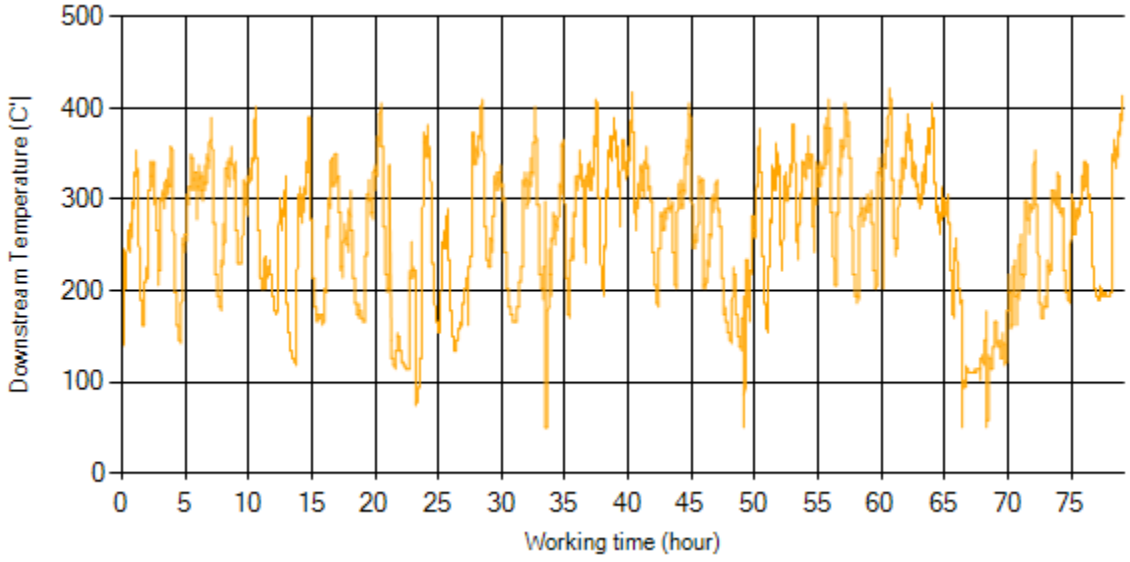


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

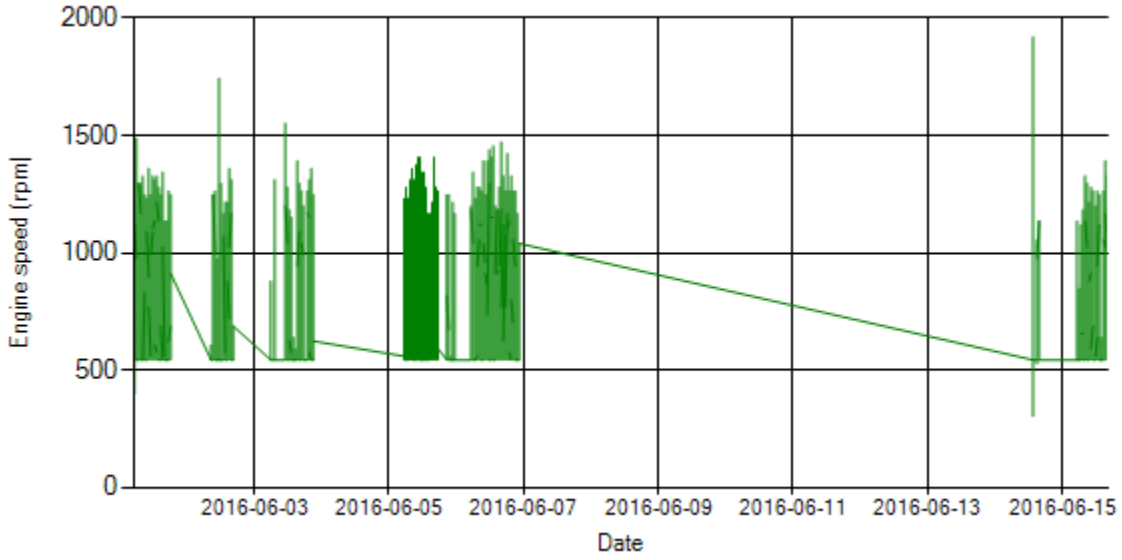


Figure 10- Engine speed distribution over the period

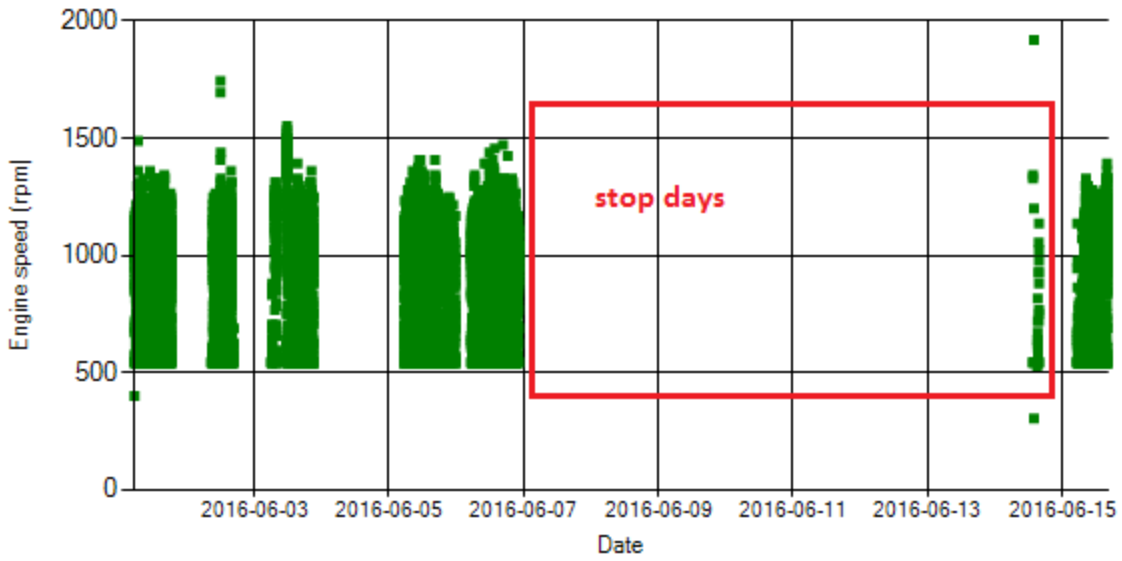


Figure 11- Engine speed diagram for calculating CPK's working days

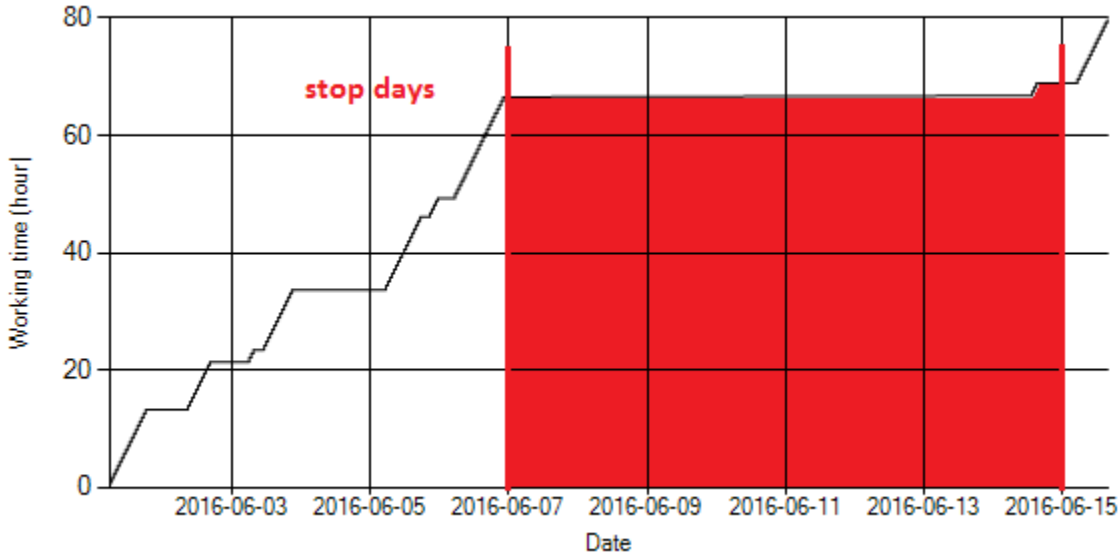


Figure 12- Time diagram for calculating CPK's working days

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

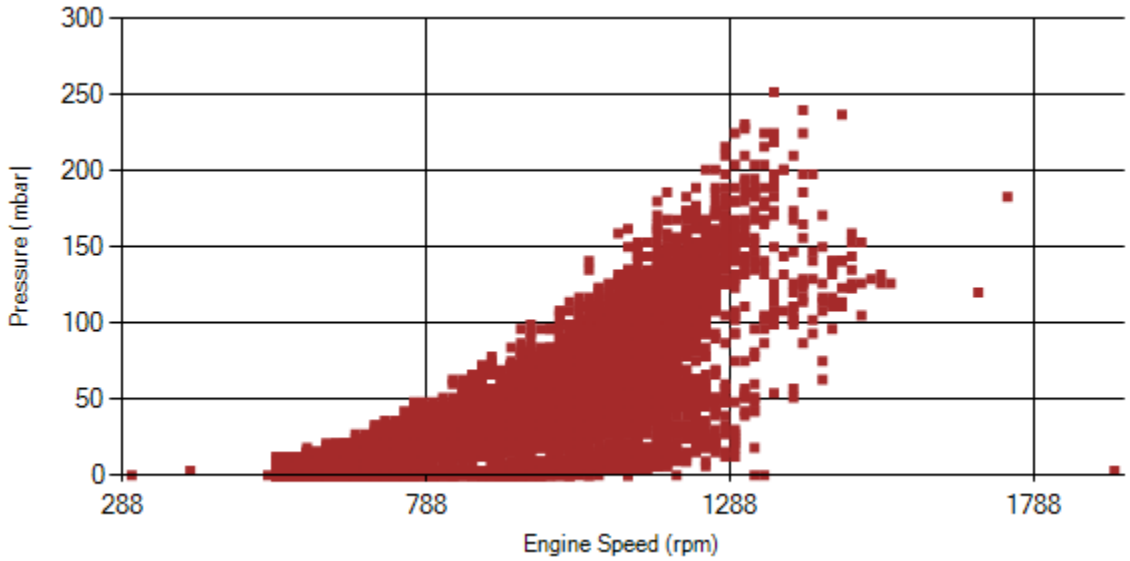


Figure 13- Pressure against engine speed

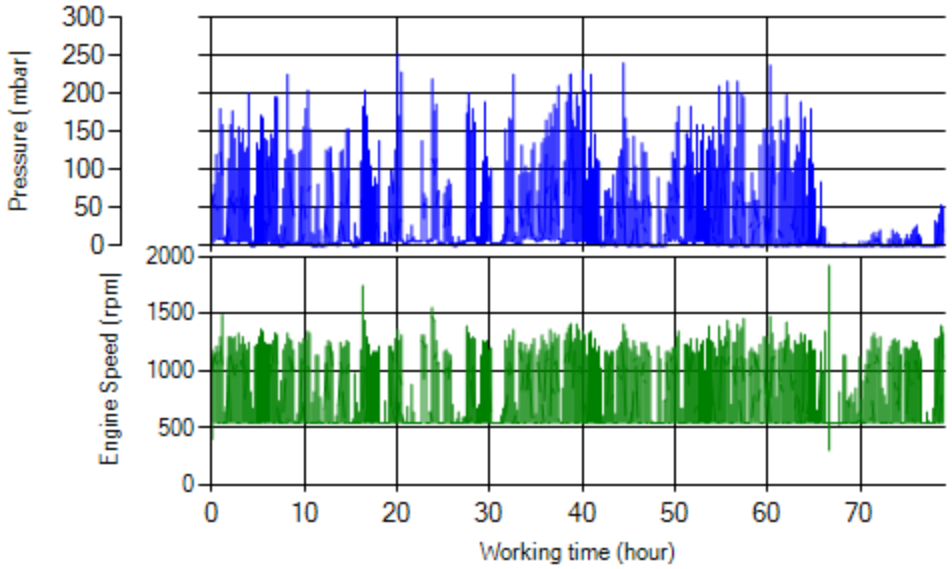


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

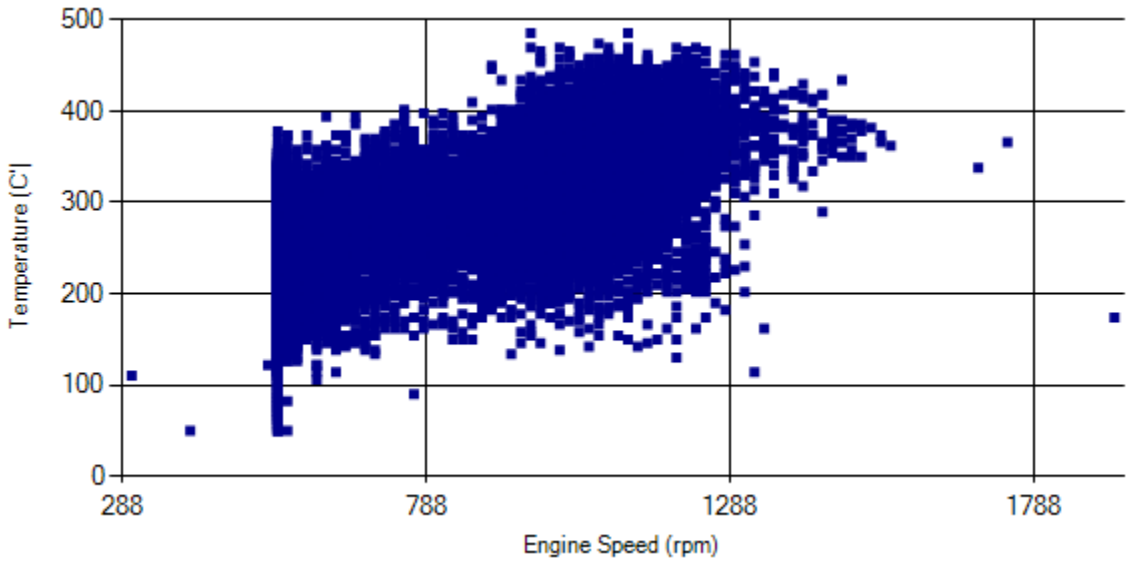


Figure 15- Temperature against engine speed

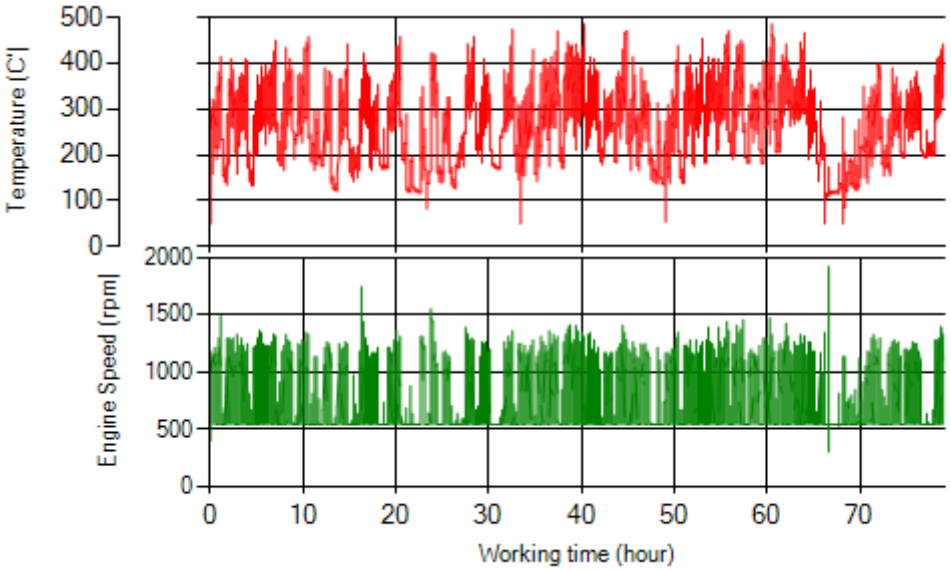


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 0.08% of total working time pressure is above 200 mbar and 0.66% above 150 mbar during this period.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed 12.4% 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/Jun/2016 – 30/Jun/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.

*. Filter was working without additive because of pump problem, so cleaning was unavoidable after only 13 days form new core installation. It is worth to mention that, additive pump was replaced with new one.

Table 3- Fuel and Additive Consumption Information

Bus mileage (from DPF installation date)	68132 km
Bus mileage over the period	2649 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	179 hours 10 minutes
Average working hours per day (including stop days)	11 hours 56 minutes
Bus average speed	14.8 km/hr
idle speed time to all working time ration	54.12 %
Total Bus fuel consumption over the period	1483 lit
Fuel consumption per hour	8.28 lit/hr
Average fuel consumption	0.56 lit/km
Total Bus additive consumption over the period	0.704 lit
Average additive consumption	265.9 cc/km
Additive consumption to fuel ration	475 cc/1000lit

Temperature, Pressure and Engine Speed Overview

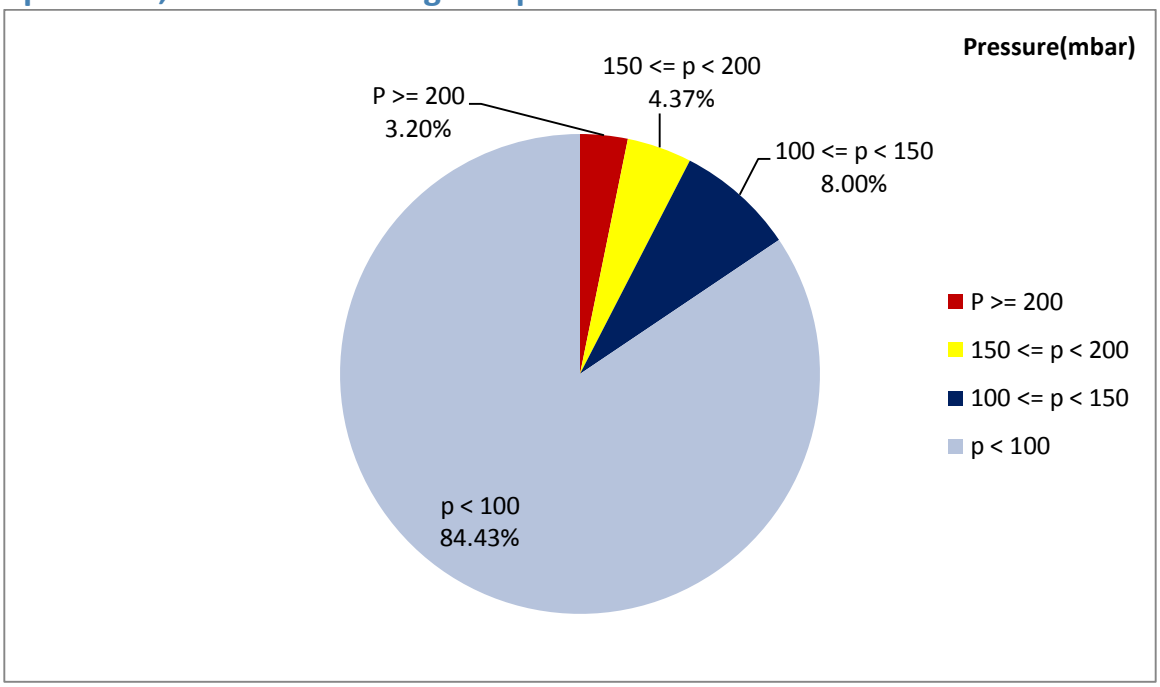


Figure 1- Pressure distribution over the working hours

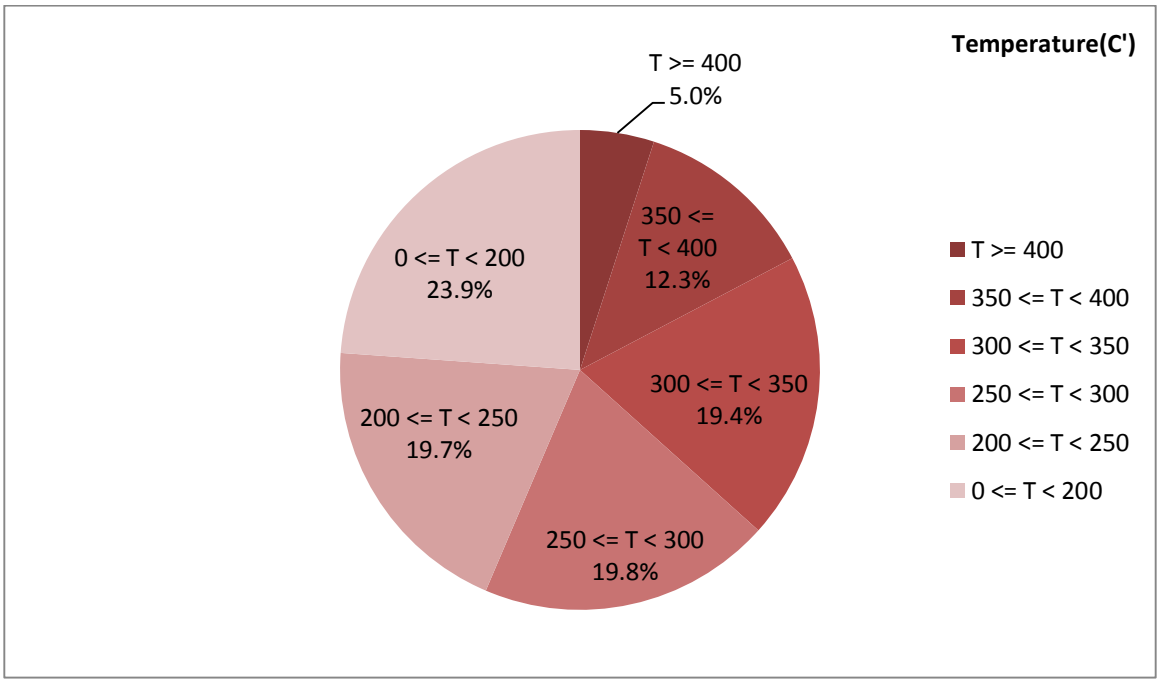


Figure 2-Temperature distribution over the working hours

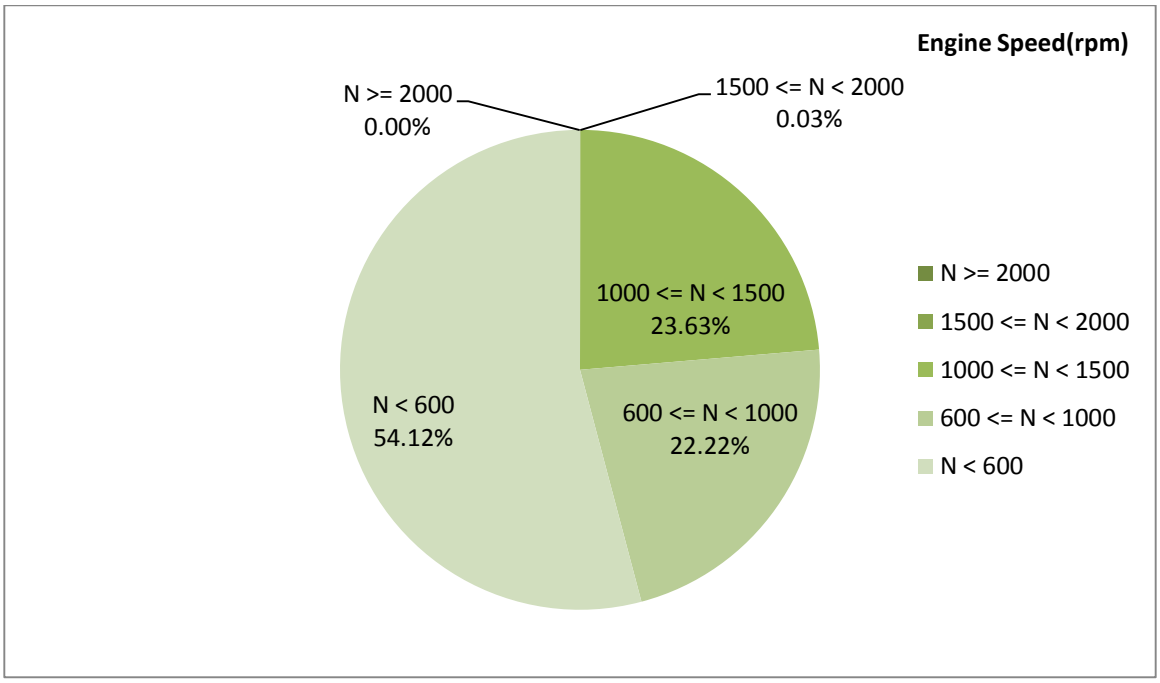


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
268.94	52.79	744

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
329.81	89.38	977

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
602-50	576-0	1824-304

Notice: This high-pressure distribution was due to additive pump problem.

Detailed Pressure Analysis

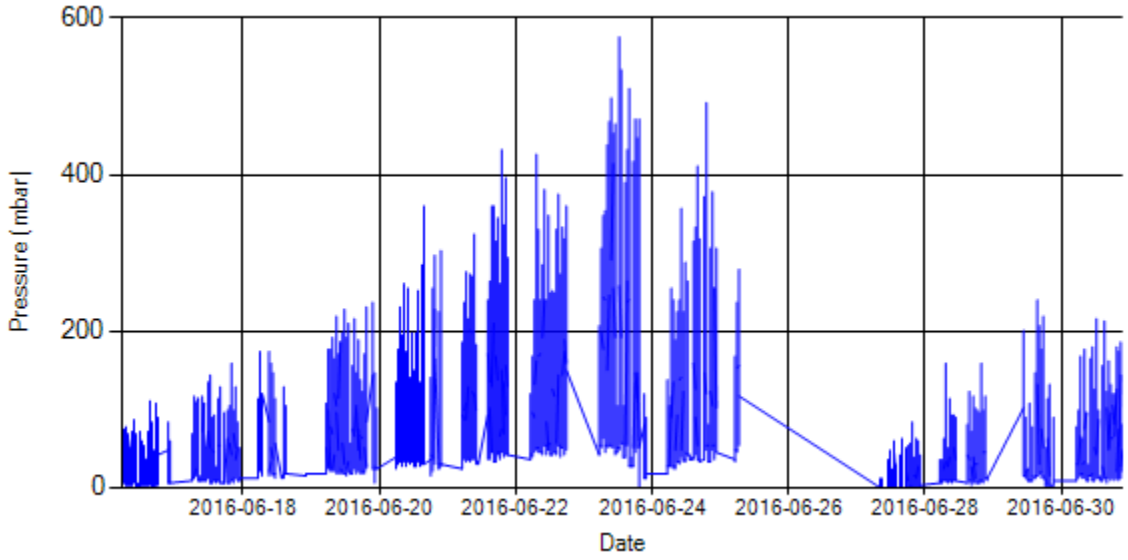


Figure 4- Pressure distribution over the period

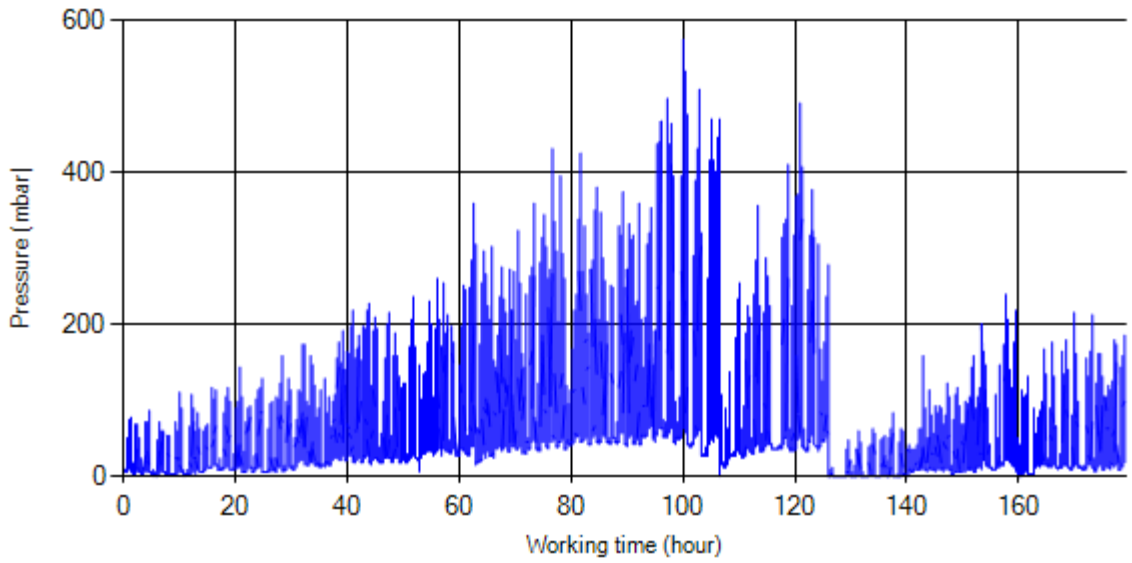


Figure 5- Pressure vs. working hours

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

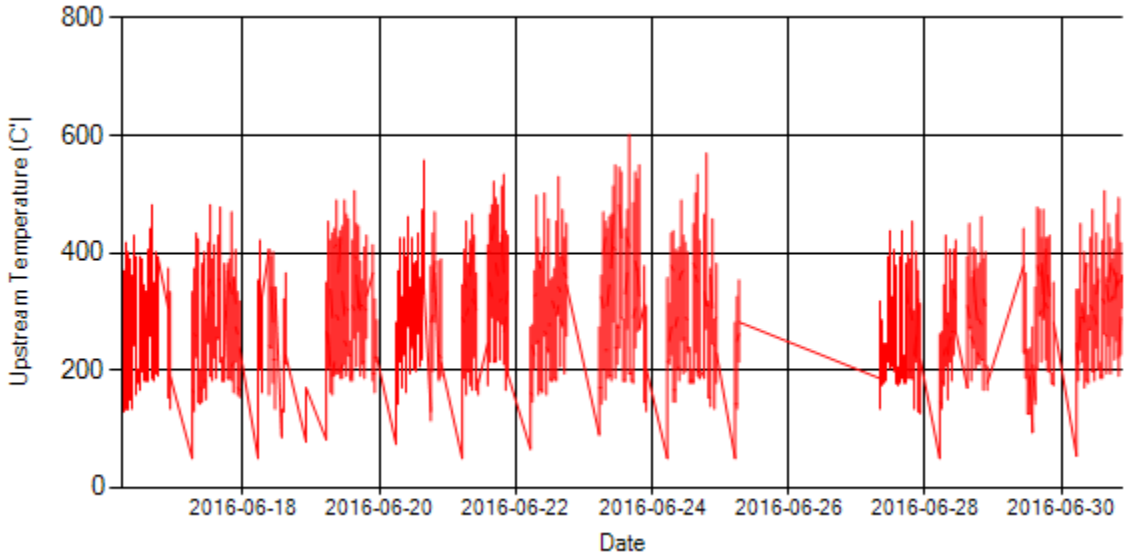


Figure 6- Temperature distribution over the period

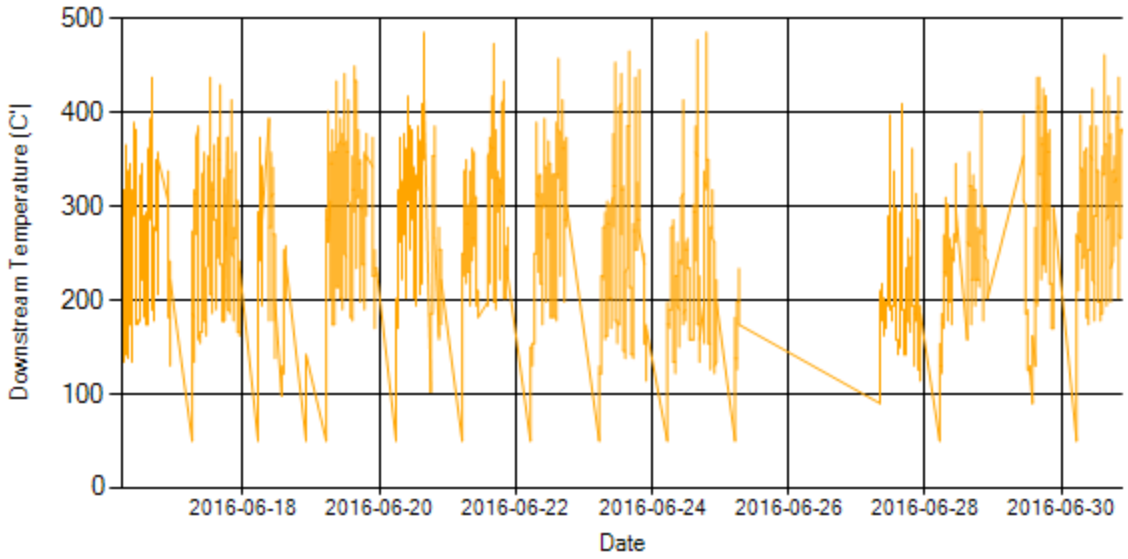


Figure 7- Temperature distribution over the period

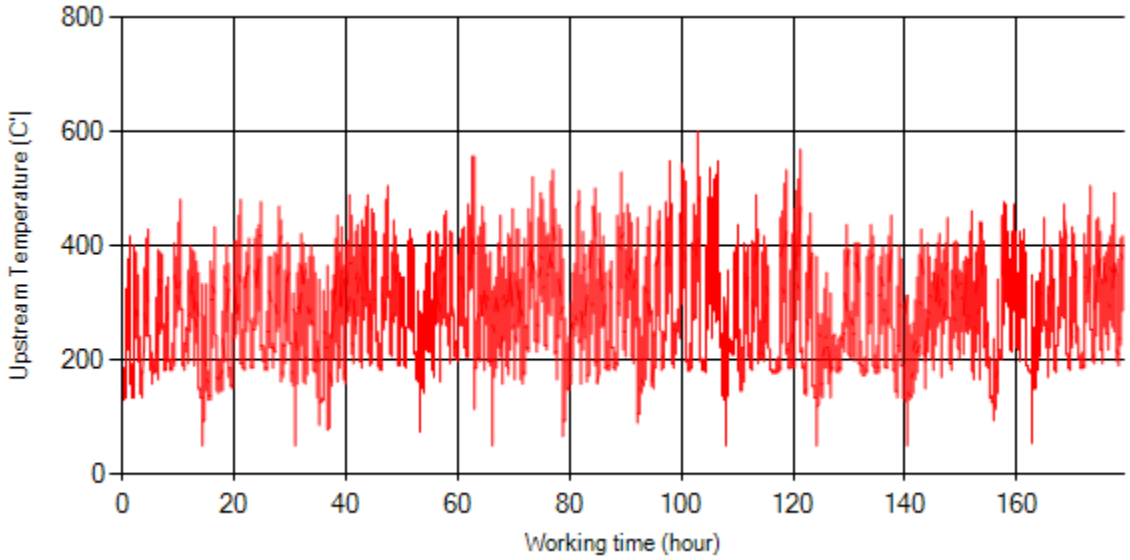


Figure 8- Temperature vs. working hours

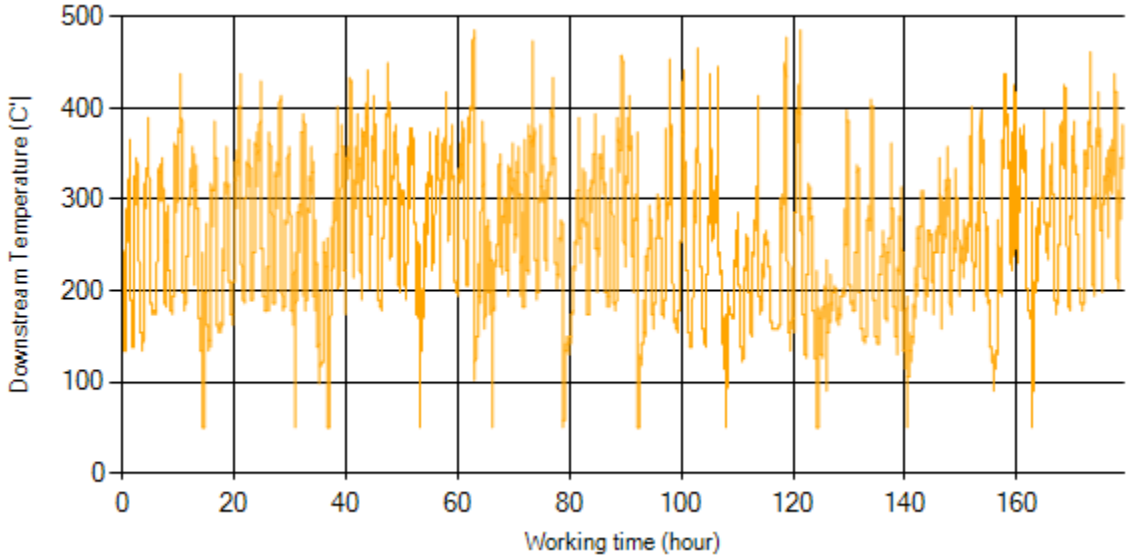


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

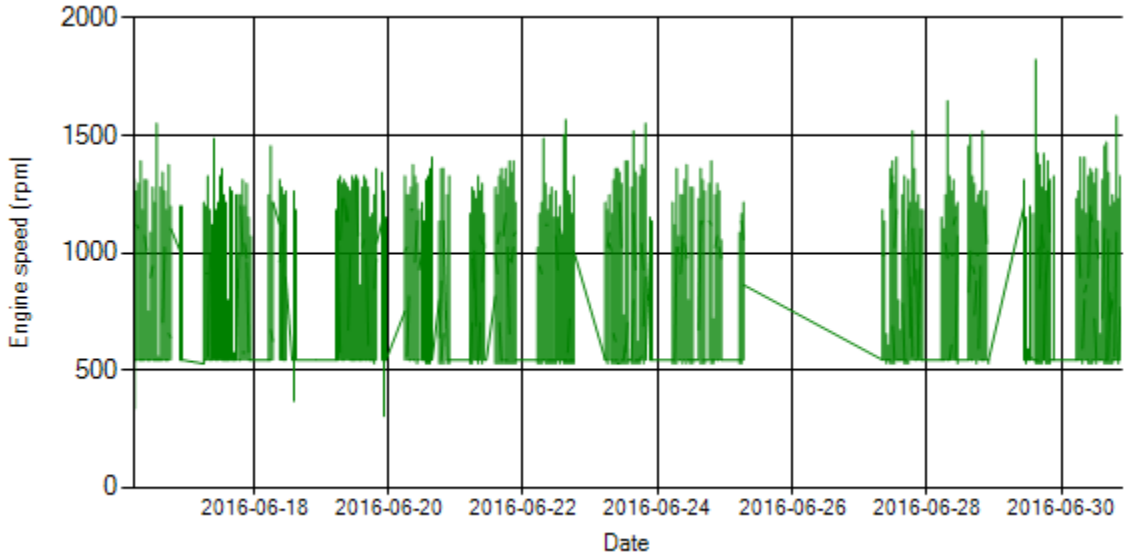


Figure 10- Engine speed distribution over the period

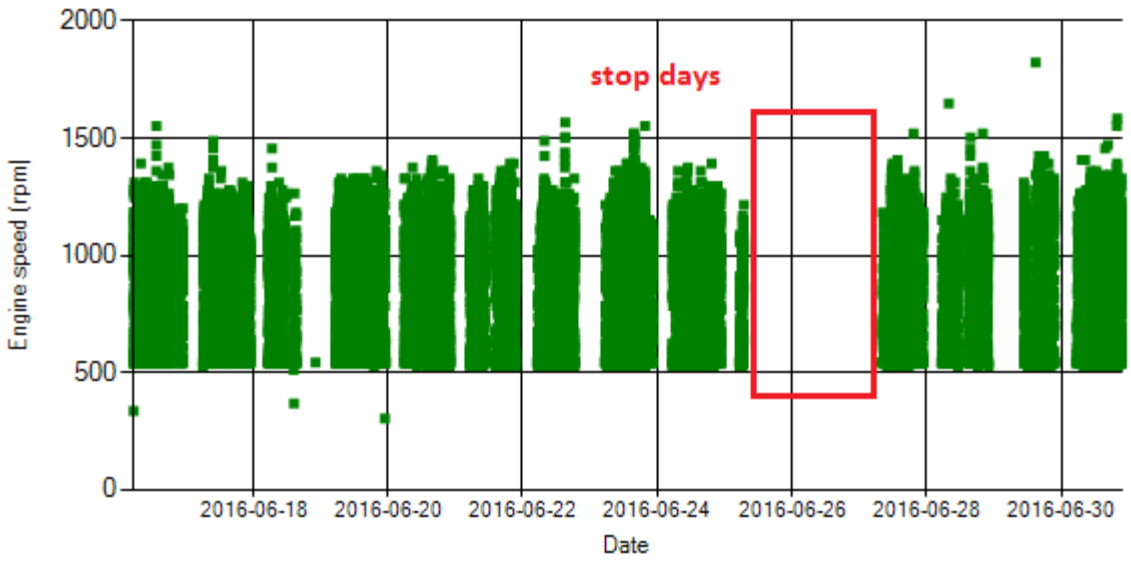


Figure 11- Engine speed diagram for calculating CPK's working days

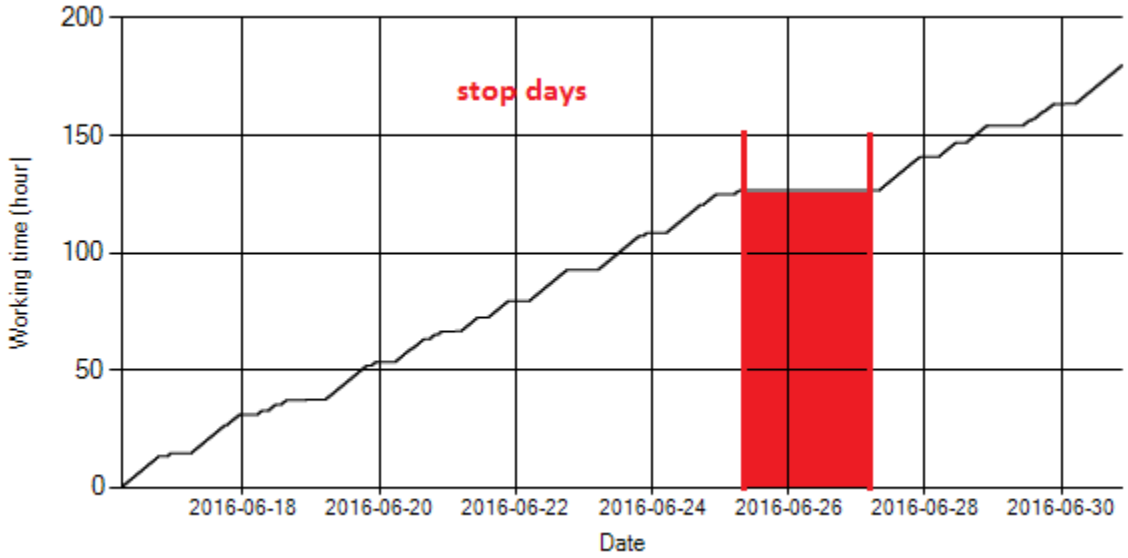


Figure 12- Time diagram for calculating CPK's working days

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 2 days.

Pressure-Engine Speed diagrams

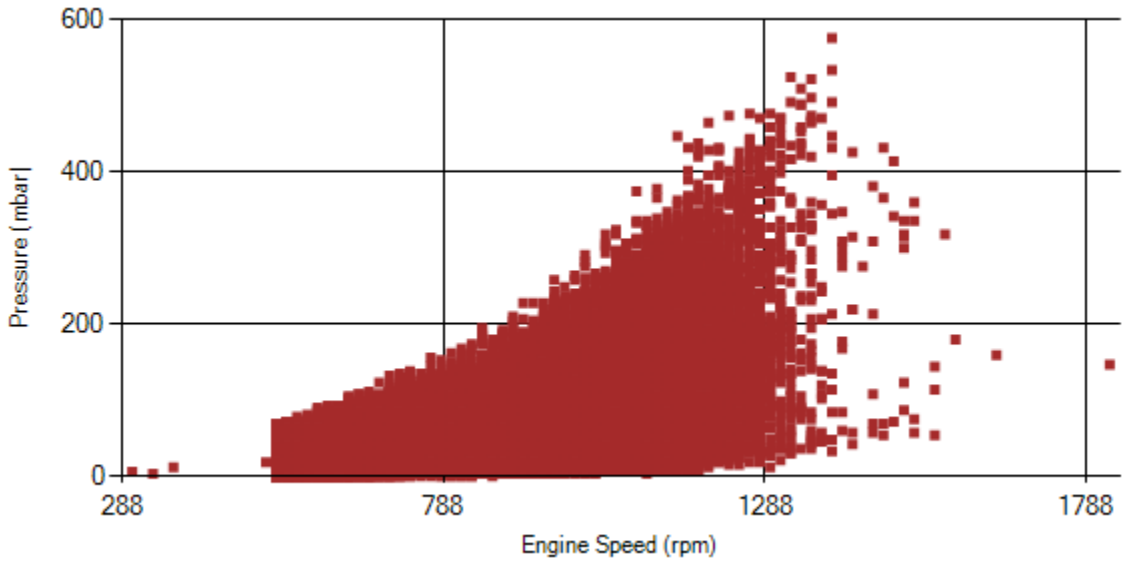


Figure 13- Pressure against engine speed

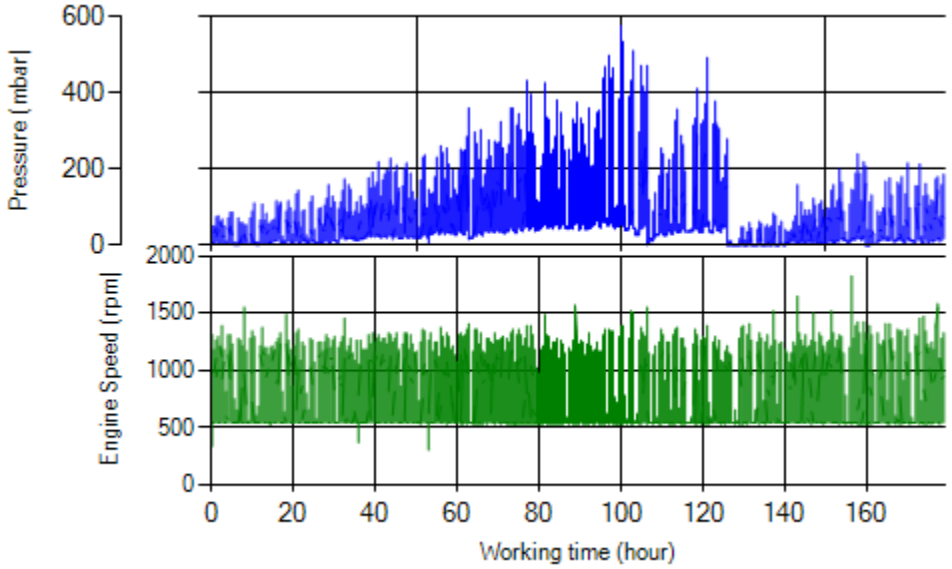


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

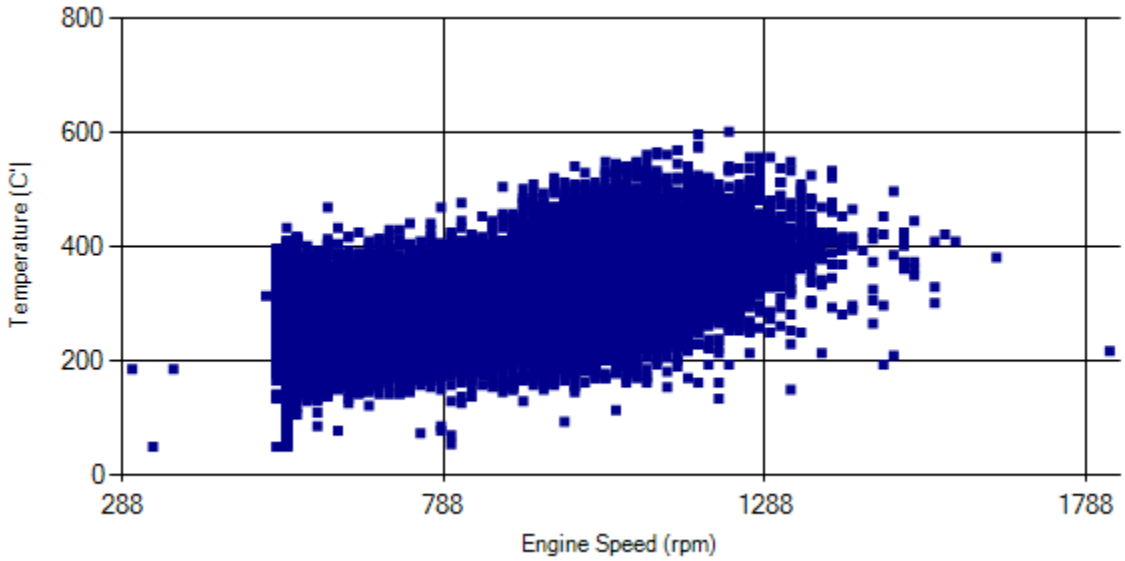


Figure 15- Temperature against engine speed

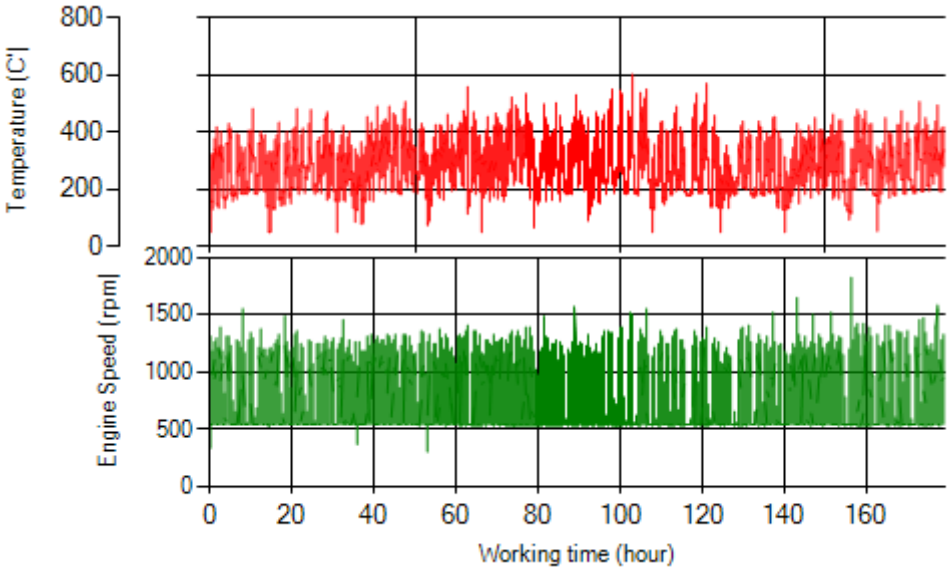


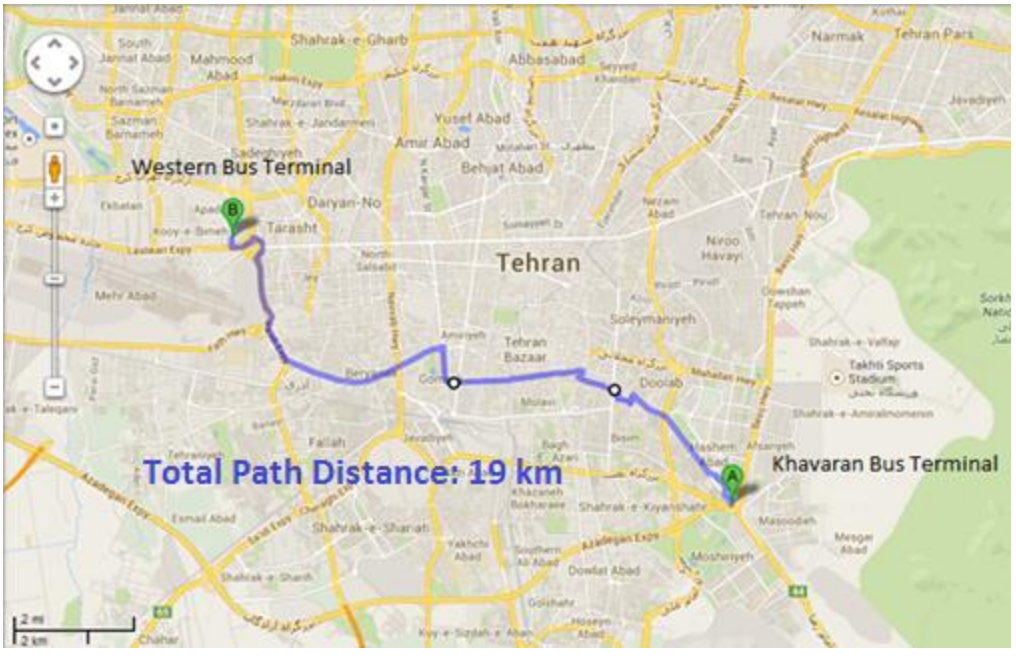
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 3.20% of total working time pressure is above 200 mbar and 7.57% above 150 mbar during this period.
- Figure 2 displays flow temperature distribution for DPF's upstream. It can be obviously observed 17.3% of total working time temperature is above 350℃.
- These high pressure and temperature distribution were due to additive pump problem.

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/Jun/2016 - 15/Jun/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.

Notice: Bus was stationary during this period.

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/Jun/2016 - 30/Jun/2016 (fifteen days)
K value - DPF upstream	1.8 [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)	10242 km
Bus mileage over the period	2719 km
Working days over the period	15 days
Stop days	0 day
Data logger working days	15 days
Working hours over the period	187 hours 31 minutes
Average working hours per day (including stop days)	12 hours 30 minutes
Bus average speed	14.5 km/hr
idle speed time to all working time ration	54.78 %
Total Bus fuel consumption over the period	1577 lit
Fuel consumption per hour	8.4 lit/hr
Average fuel consumption	0.58 lit/km

Temperature, Pressure and Engine Speed Overview

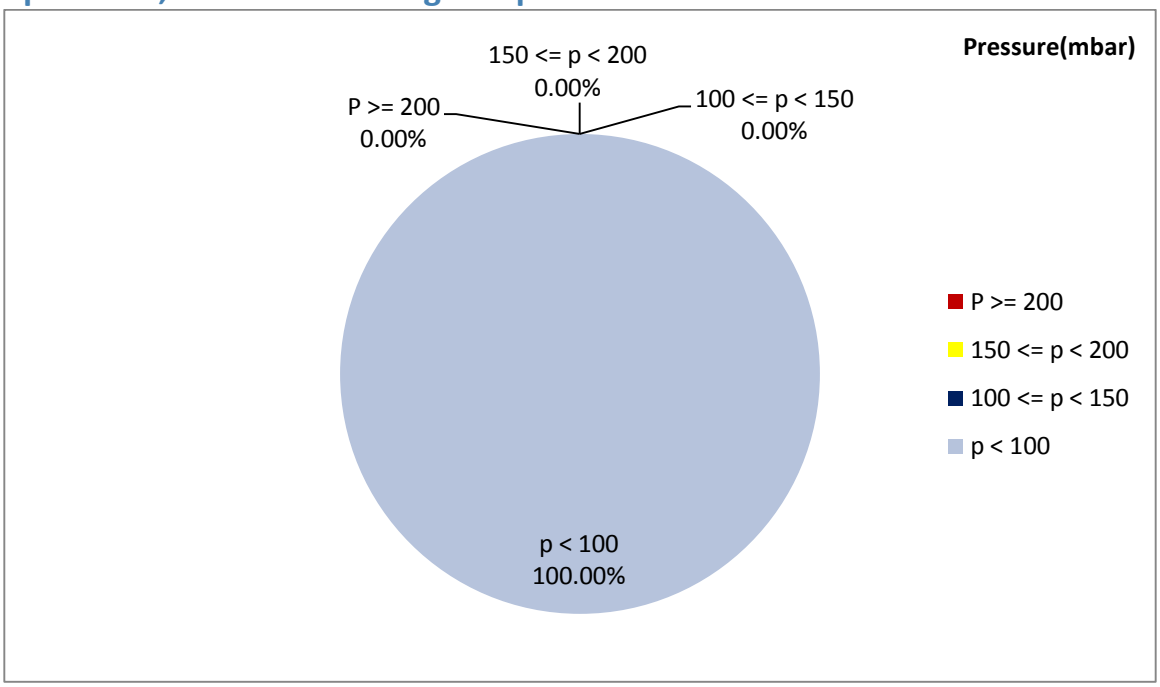


Figure 1- Pressure distribution over the working hours

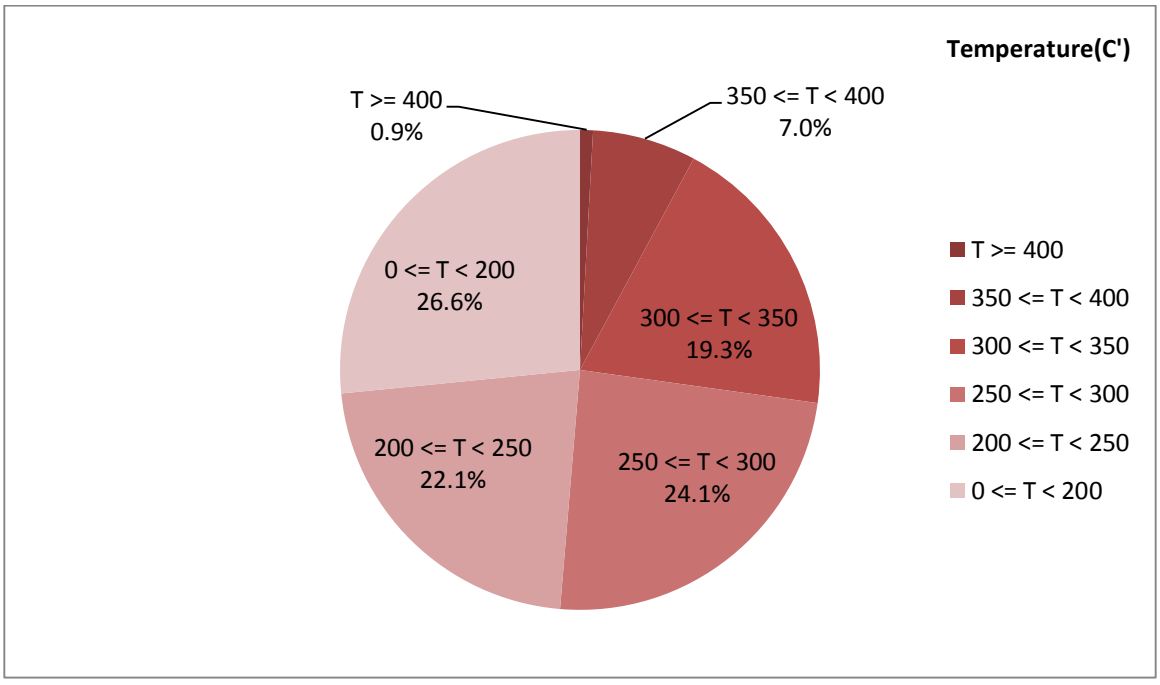


Figure 2-Temperature distribution over the working hours

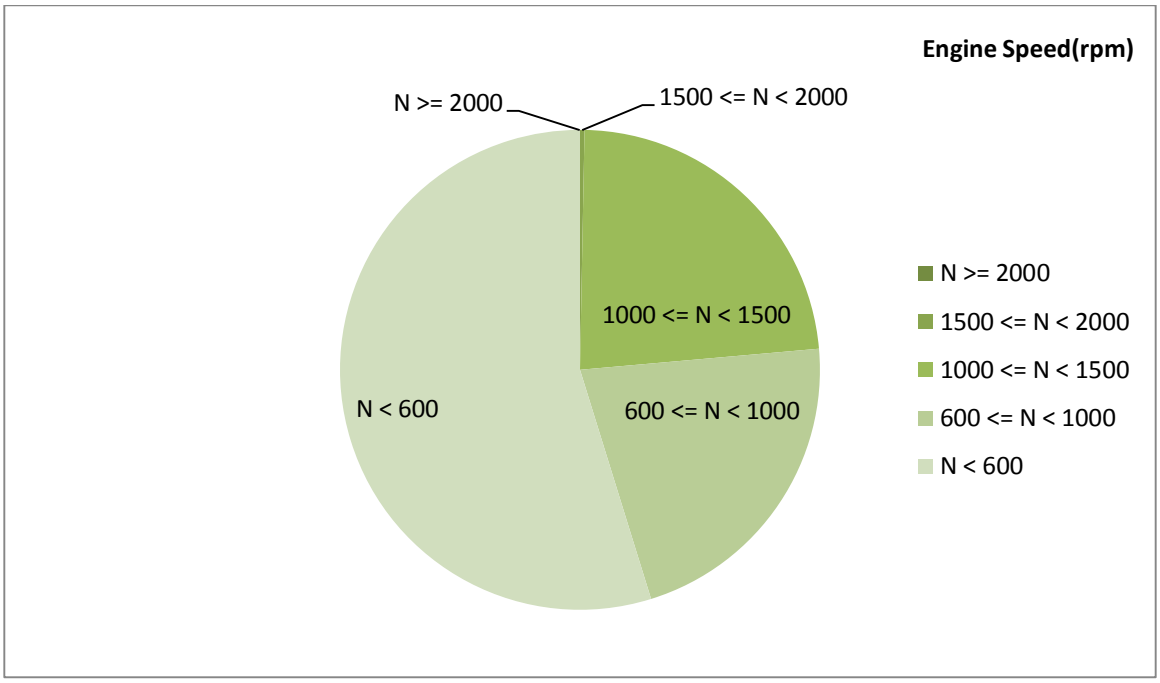


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
251.55	0.67	745

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
304	1.47	988

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
462-70	39-0	2032-256

Detailed Pressure Analysis

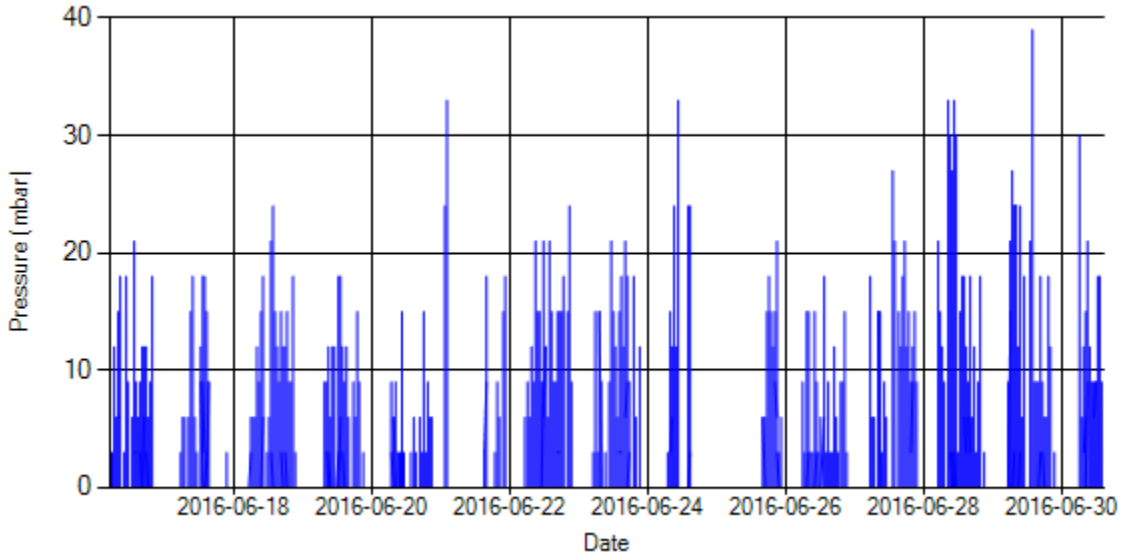


Figure 4- Pressure distribution over the period

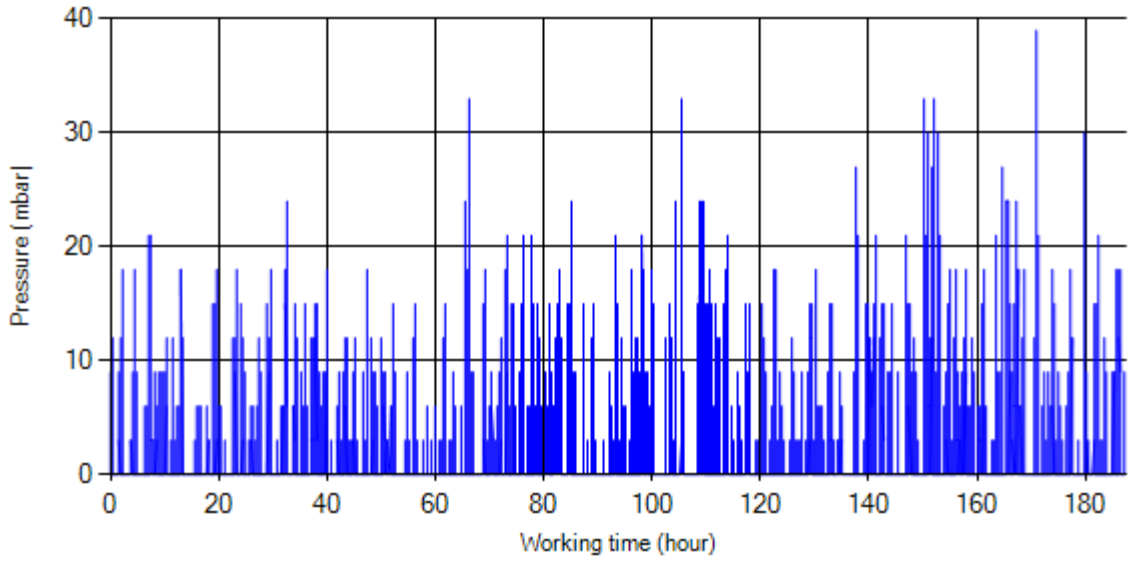


Figure 5- Pressure vs. working hours

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

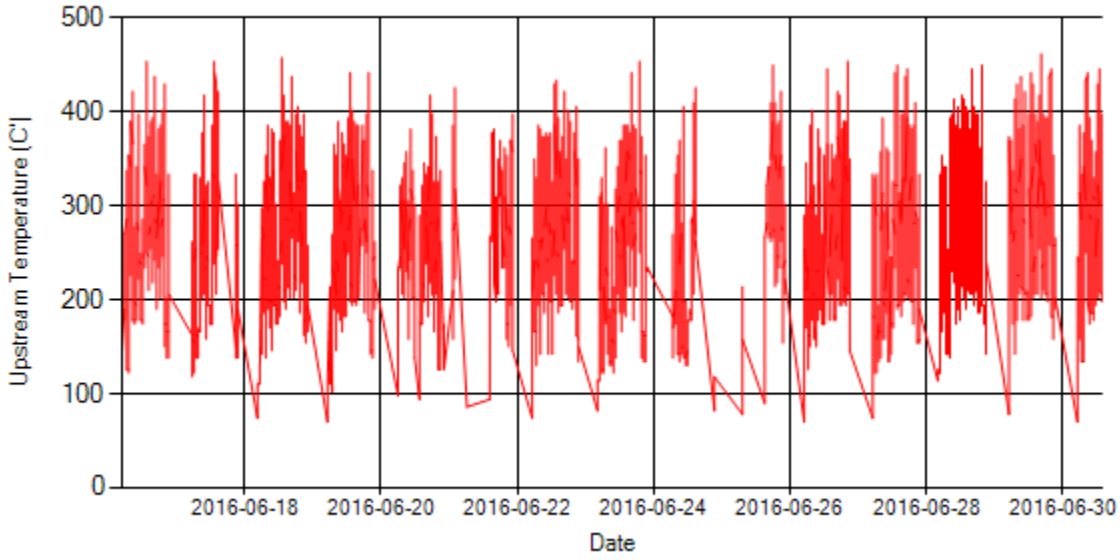


Figure 6- Temperature distribution over the period

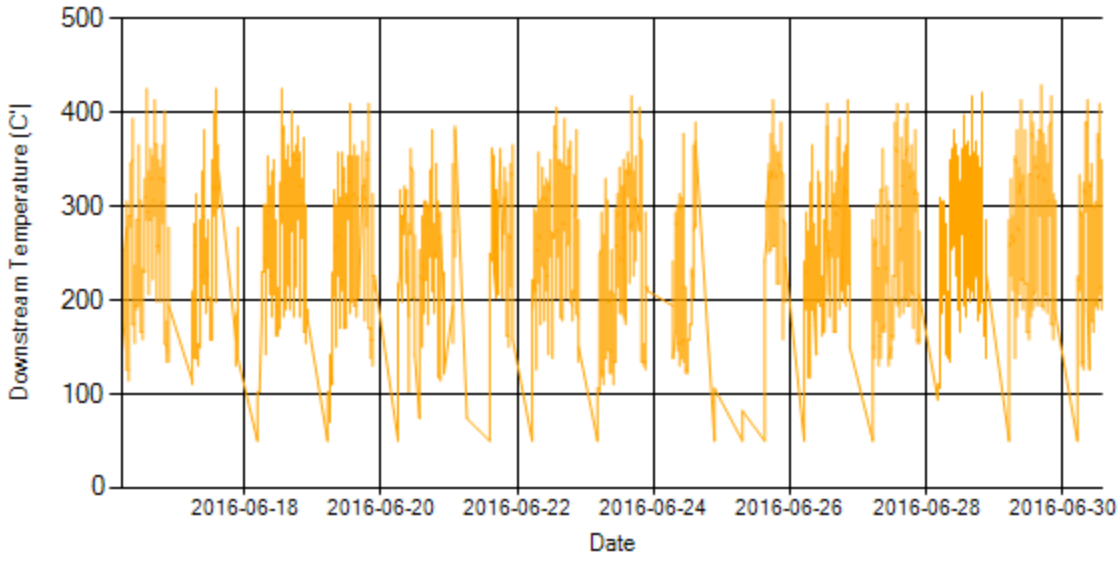


Figure 7- Temperature distribution over the period

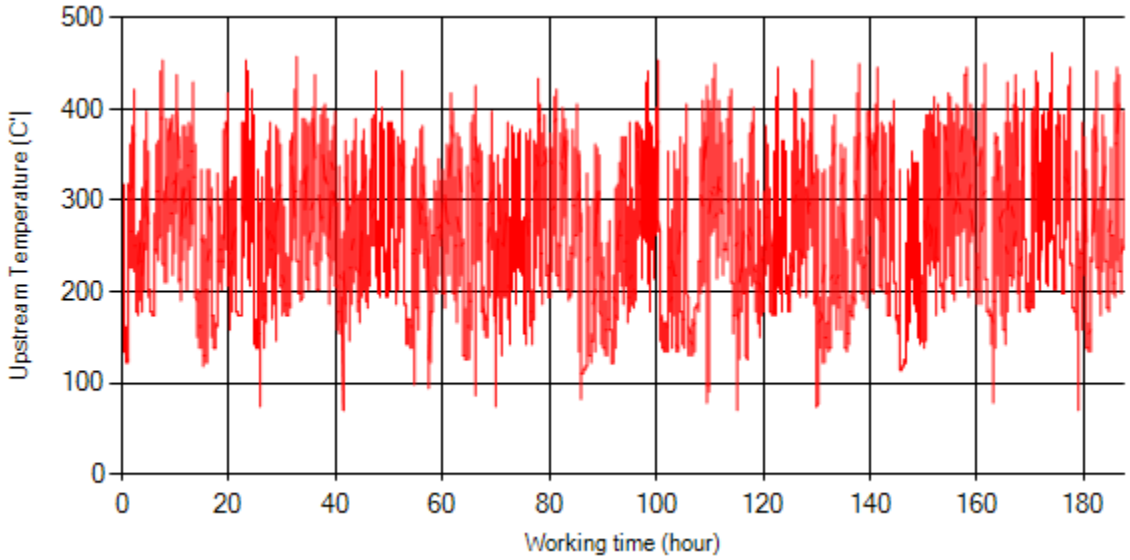


Figure 8- Temperature vs. working hours

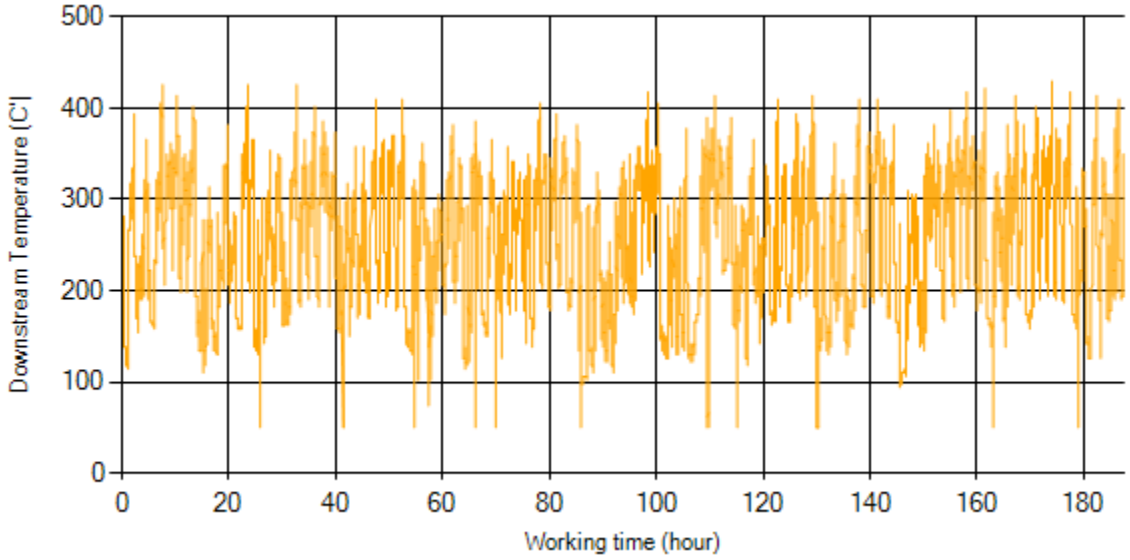


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

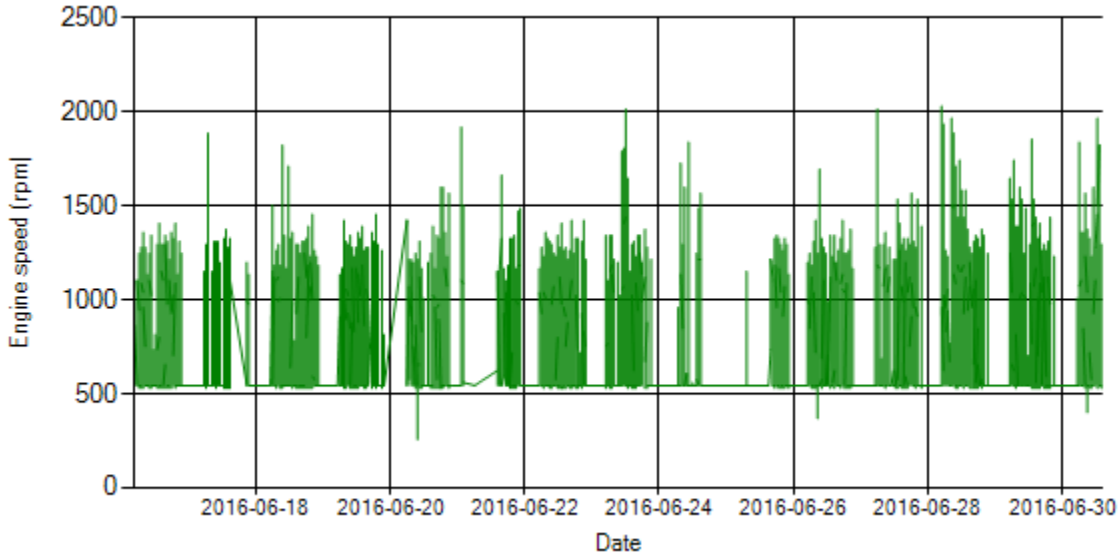


Figure 10- Engine speed distribution over the period

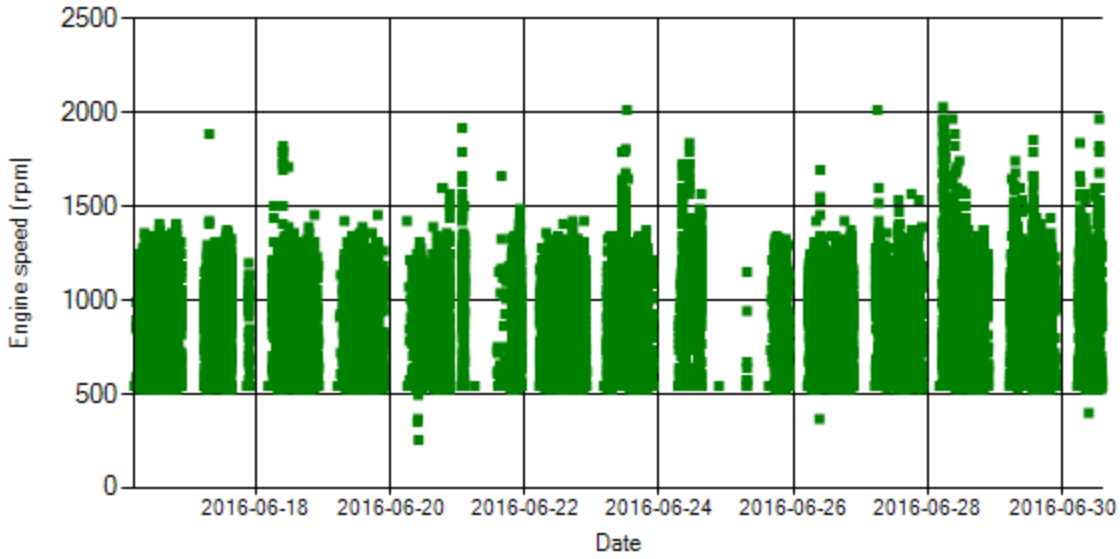


Figure 11- Engine speed diagram for calculating CPK's working days

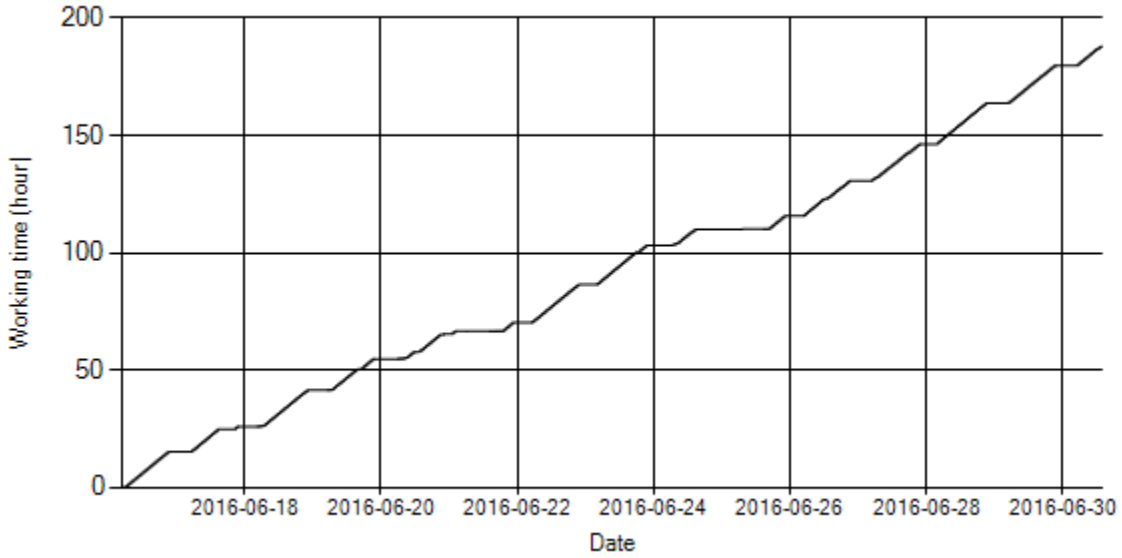


Figure 12- Time diagram for calculating CPK's working days

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

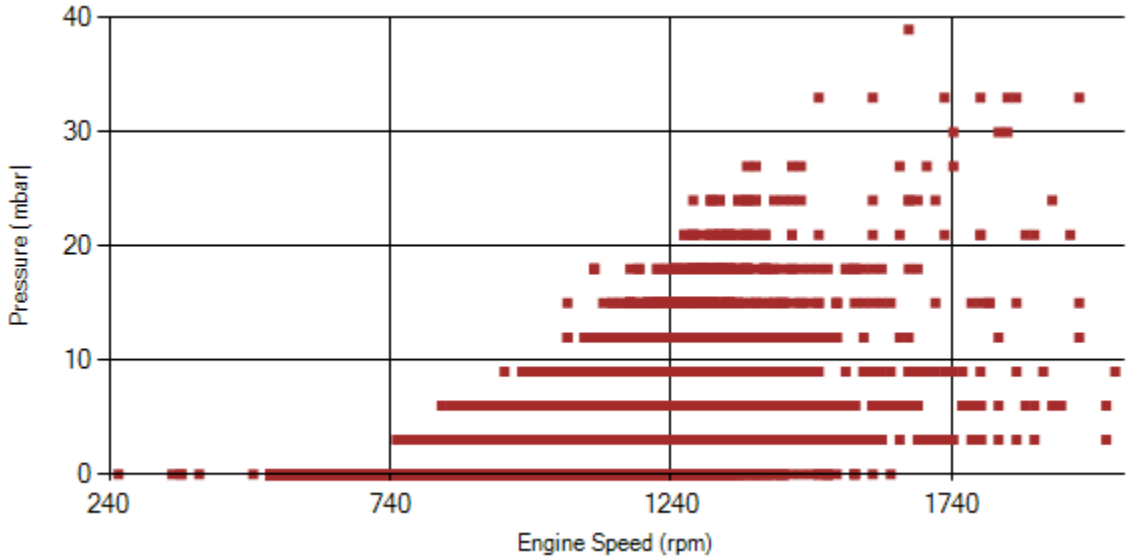


Figure 13- Pressure against engine speed

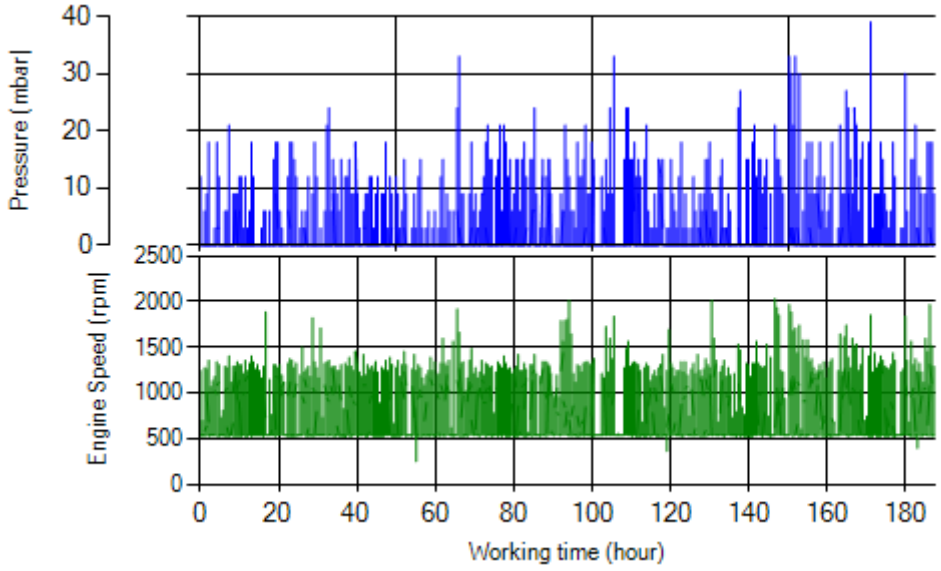


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

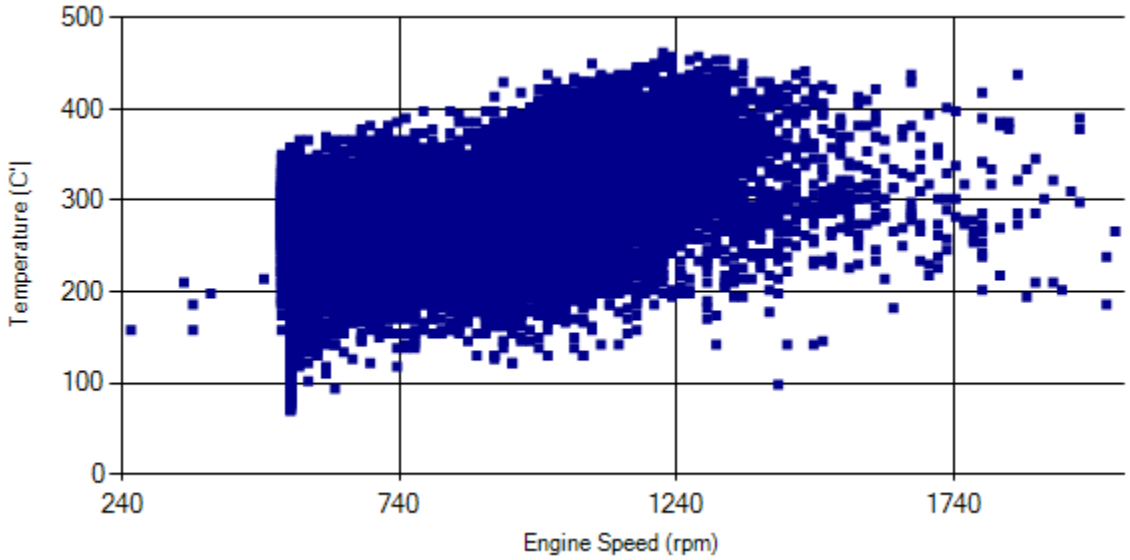


Figure 15- Temperature against engine speed

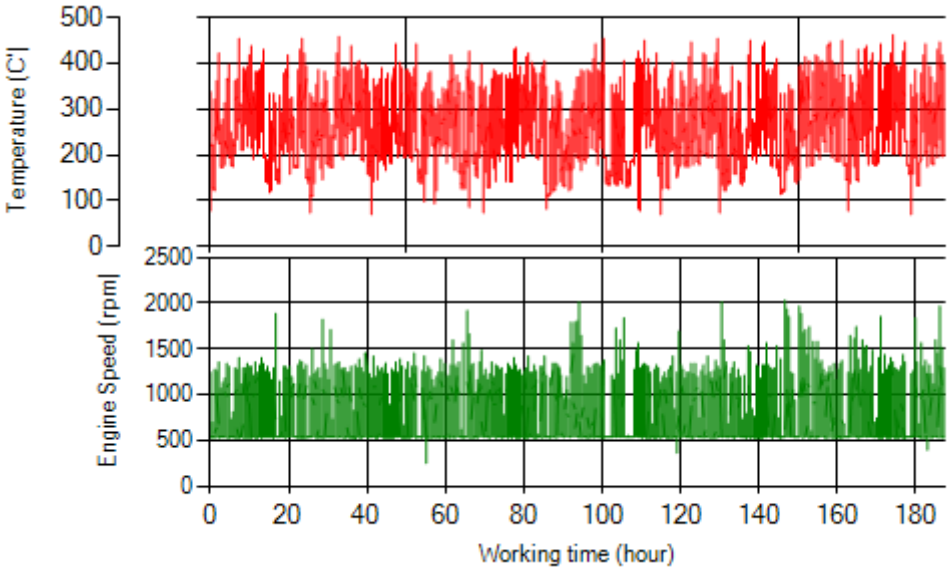


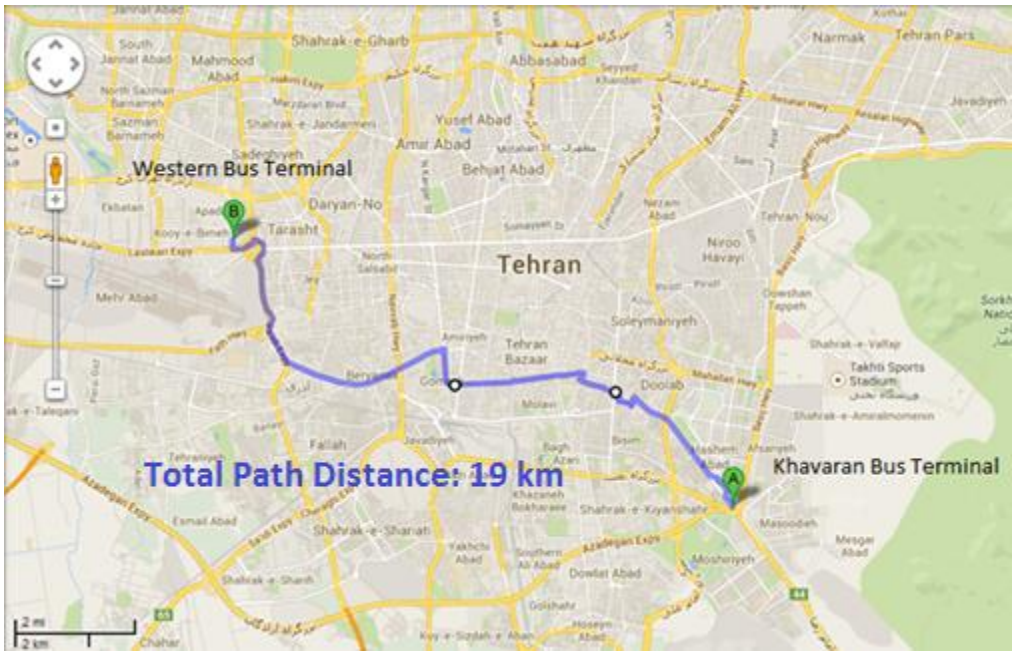
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 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 7.9% of total working-time temperature is above 350 ℃ and 51.3% 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: DPF2016061/1 Date: 4/Jul/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/Jun/2016 – 15/Jun/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	3965 km
Working days over the period	15 days
Stop days	0 day
Data logger working days	15 days
Working hours over the period	236 hours 4 minutes
Average working hours per day (including stop days)	15 hours 44 minutes
Bus average speed	16.8 km/hr
idle speed time to all working time ration	28.41 %
Total Bus fuel consumption over the period	1824 lit
Fuel consumption per hour	7.72 lit/hr
Average fuel consumption	0.46 lit/km

Temperature, Pressure and Engine Speed Overview

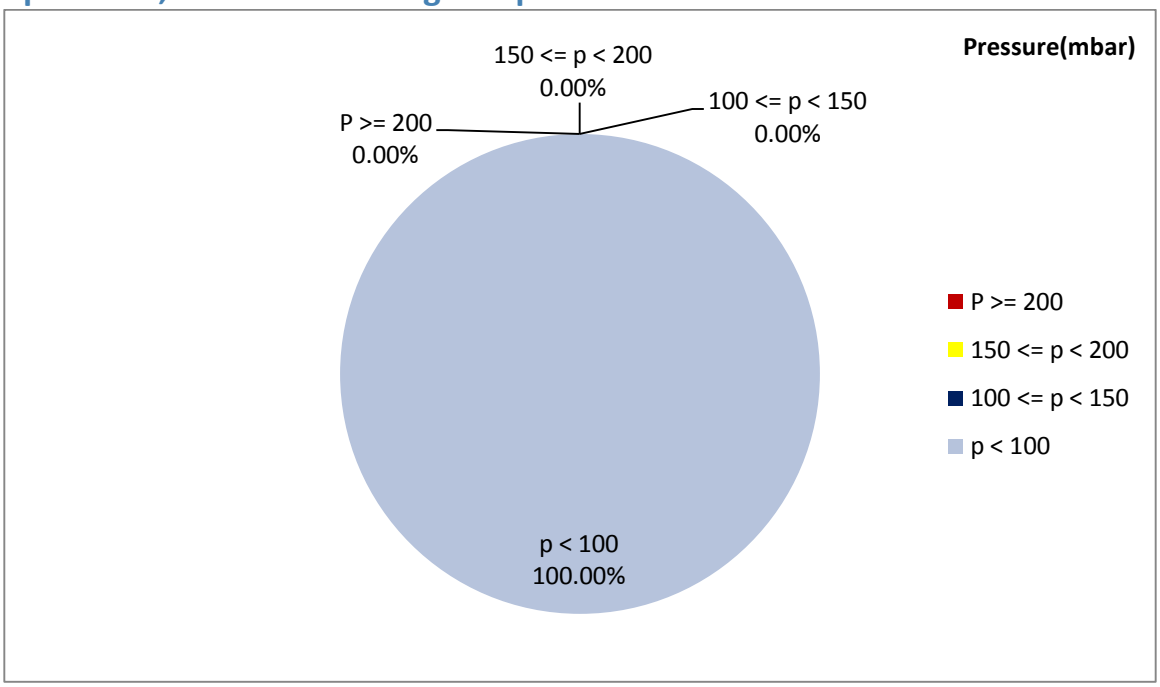


Figure 1- Pressure distribution over the working hours

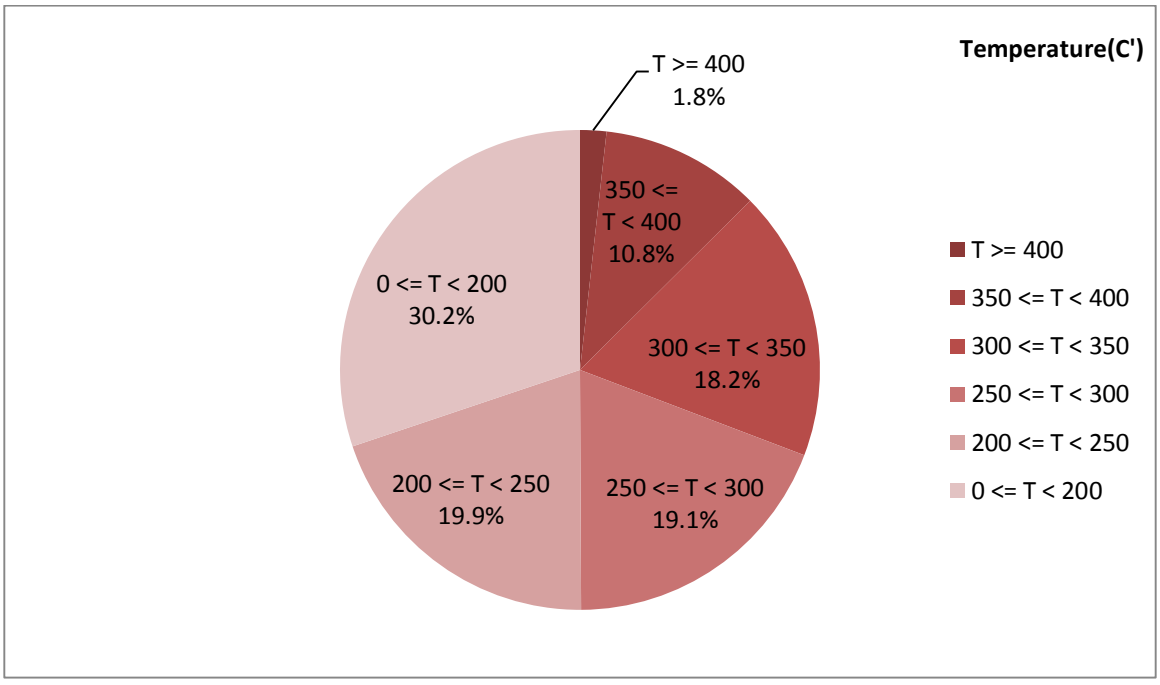


Figure 2-Temperature distribution over the working hours

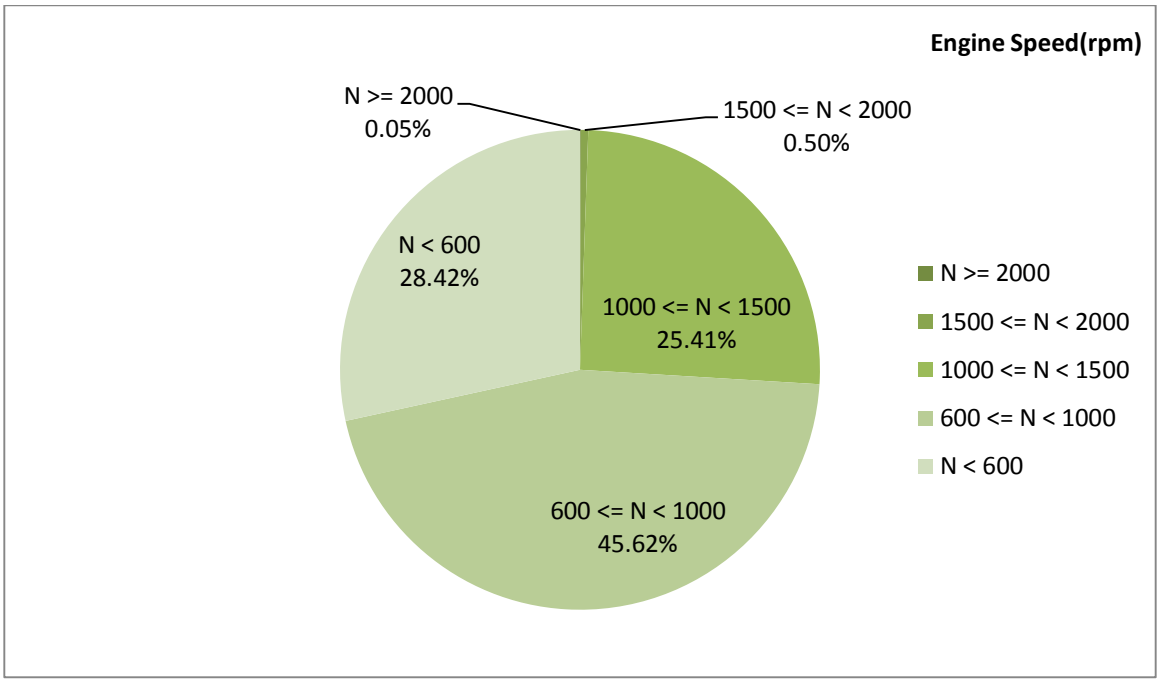


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
253.7	1.48	818

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
276.54	2.07	925

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
478-50	66-0	2144-304

Detailed Pressure Analysis

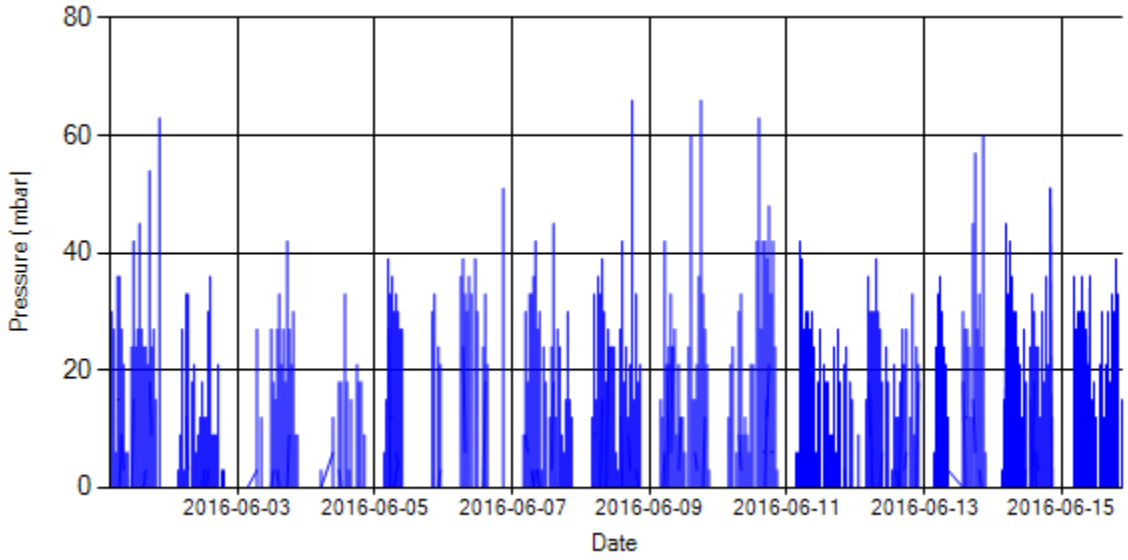


Figure 4- Pressure distribution over the period

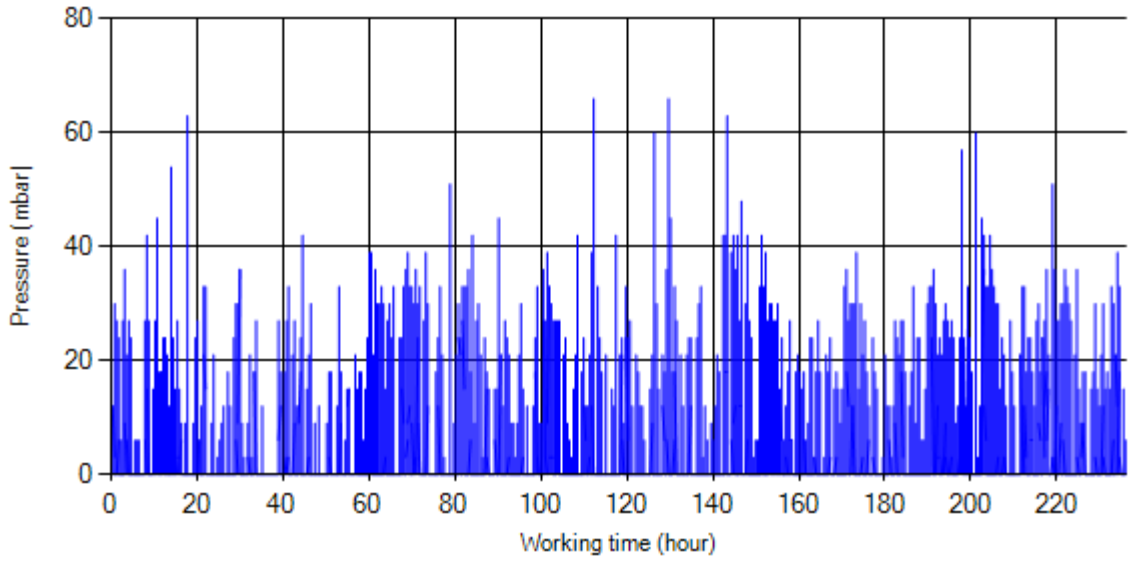


Figure 5- Pressure vs. working hours

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

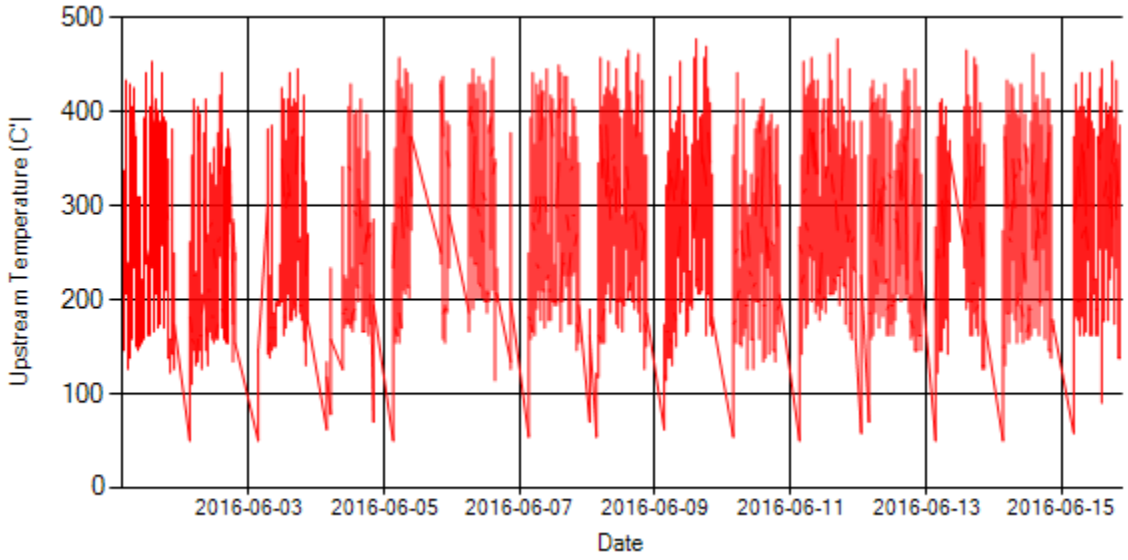


Figure 6- Temperature distribution over the period

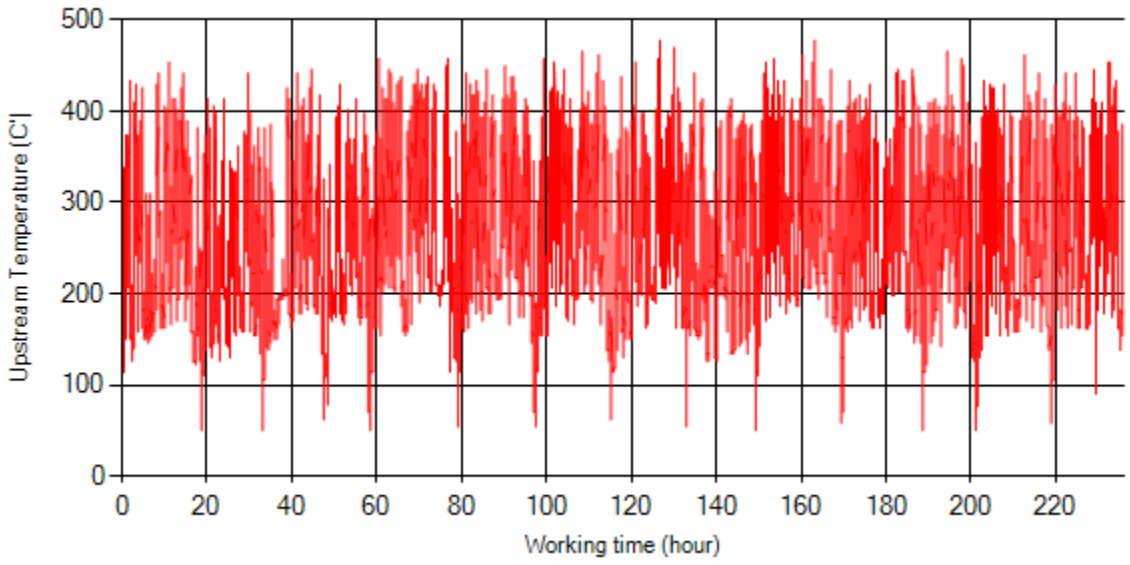


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

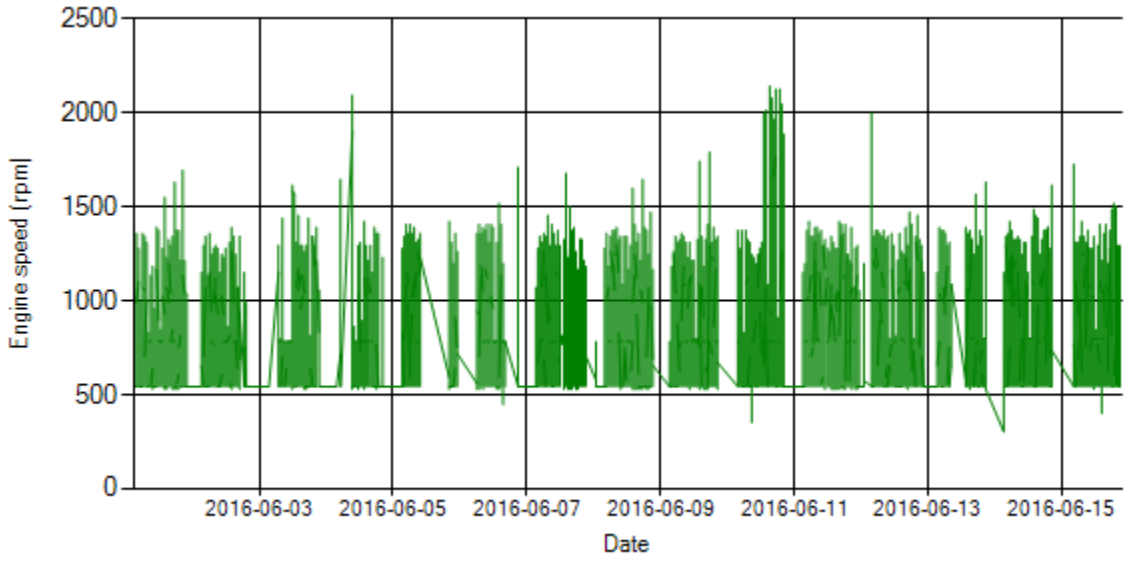


Figure 8- Engine speed distribution over the period

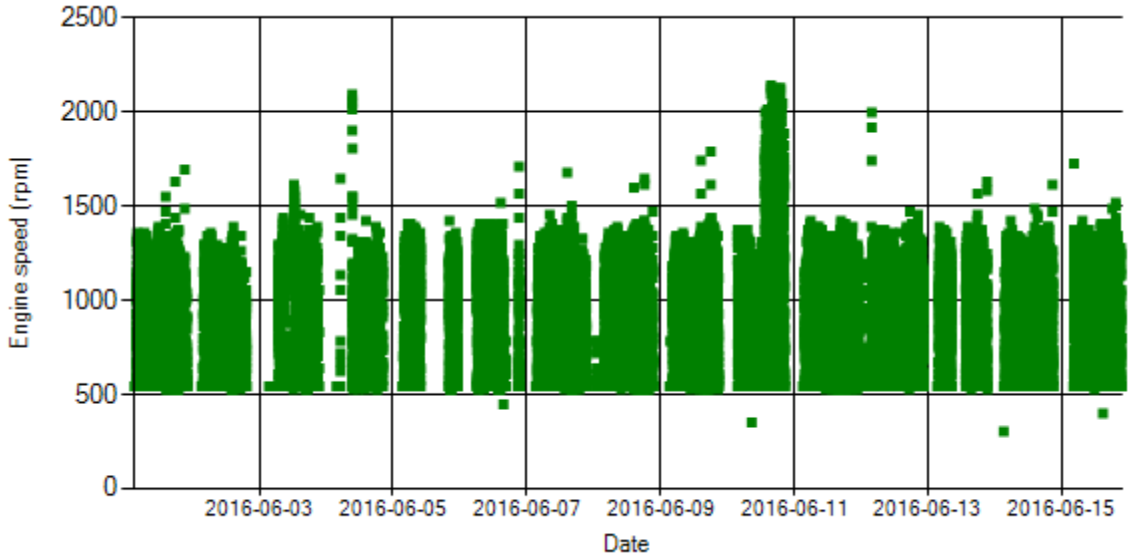


Figure 9- Engine speed diagram for calculating CPK's working days

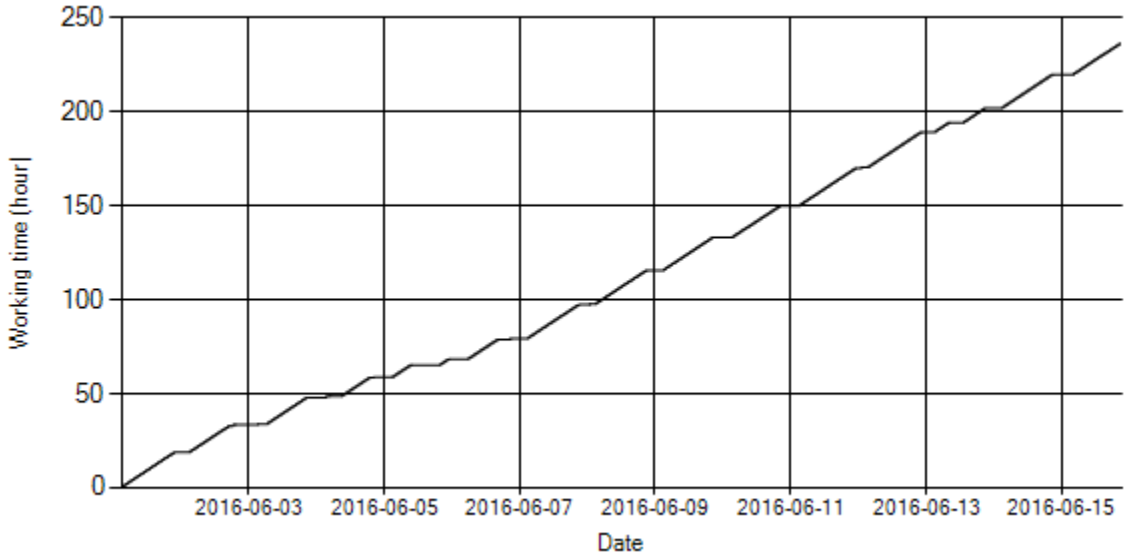


Figure 10- Time diagram for calculating CPK's working days

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 working all days of the period.

Pressure-Engine Speed diagrams

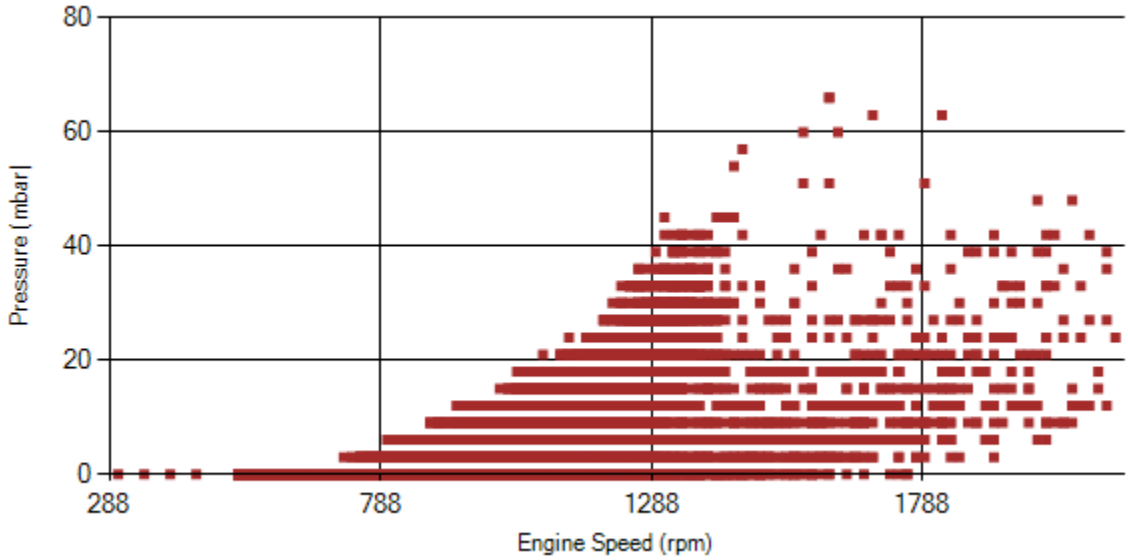


Figure 11- Pressure against engine speed

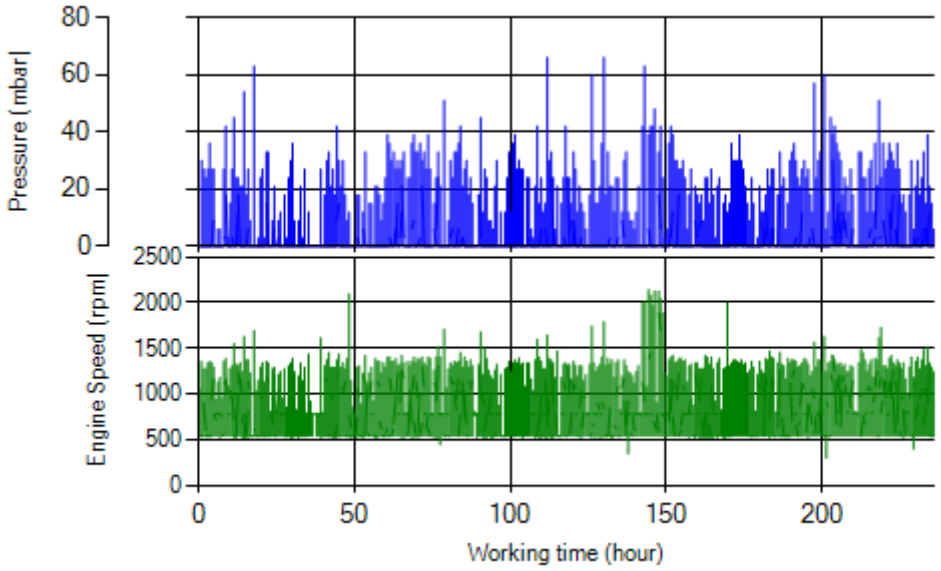


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

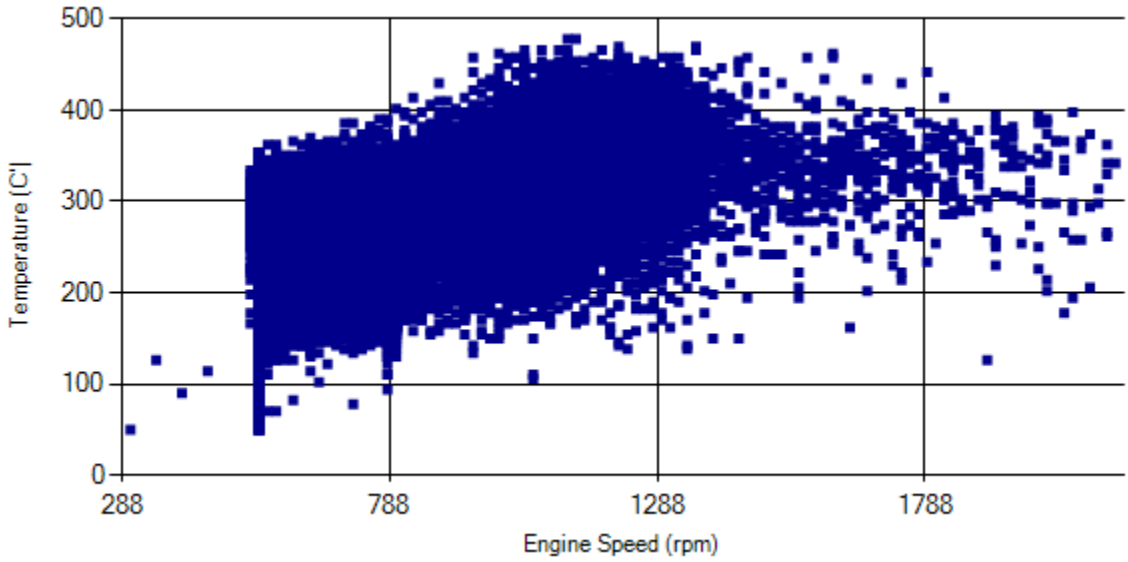


Figure 13- Temperature against engine speed

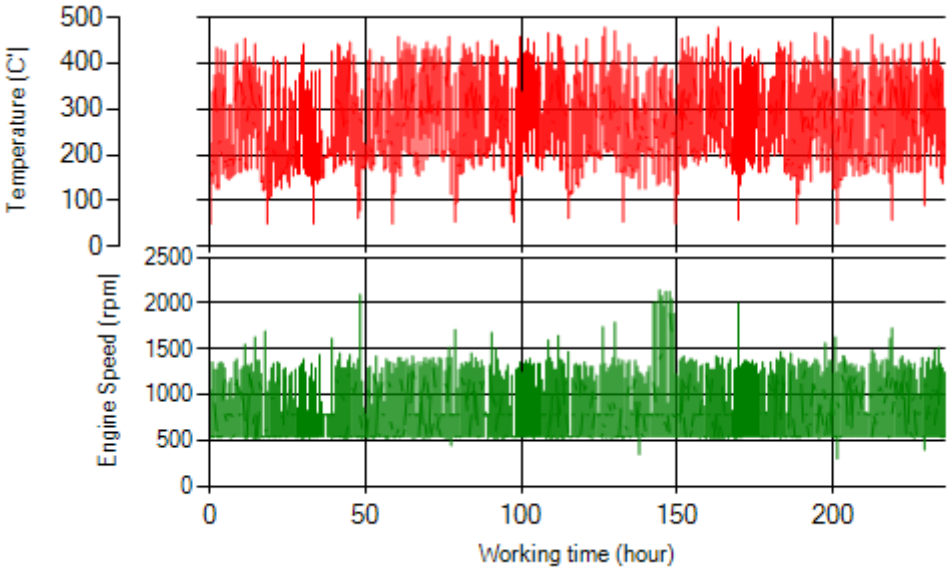


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

Notice: System was working over this period without DPF.

ASA Azmoon Sanat Arvin	Document Number: DPF2016062/1 Date: 6/Jul/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/Jun/2016 – 30/Jun/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	3988 km
Working days over the period	15 days
Stop days	0 day
Data logger working days	15 days
Working hours over the period	236 hours 4 minutes
Average working hours per day (including stop days)	15 hours 44 minutes
Bus average speed	16.9 km/hr
idle speed time to all working time ration	26.13 %
Total Bus fuel consumption over the period	1795 lit
Fuel consumption per hour	7.6 lit/hr
Average fuel consumption	0.45 lit/km

Temperature, Pressure and Engine Speed Overview

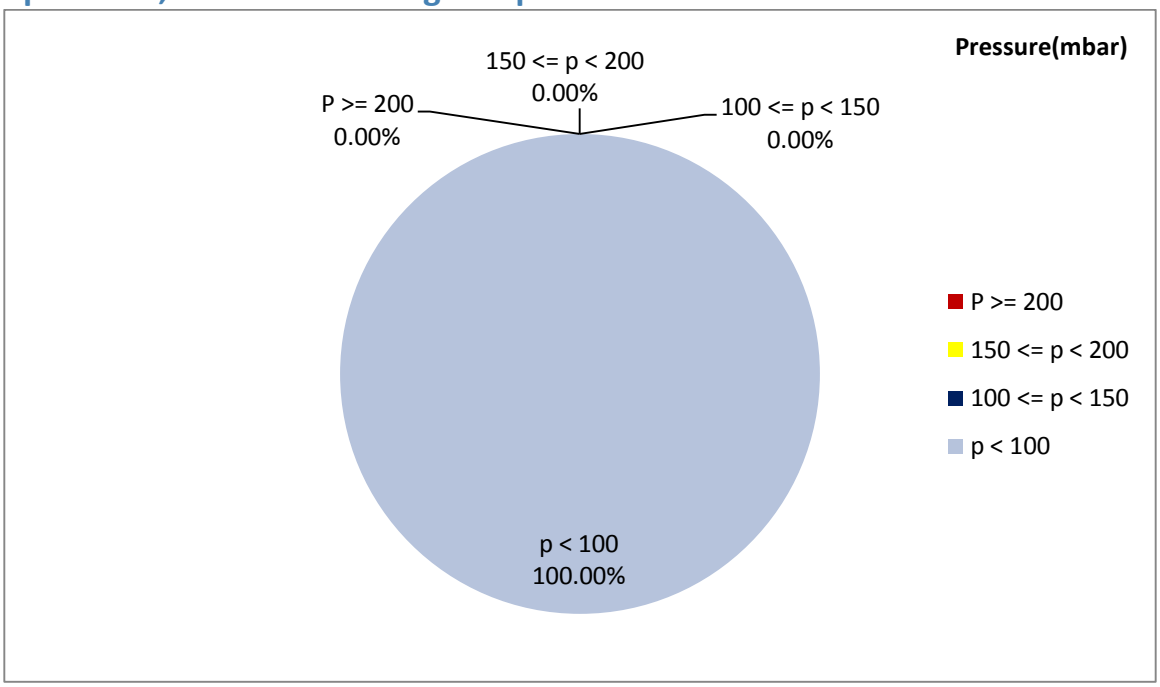


Figure 1- Pressure distribution over the working hours

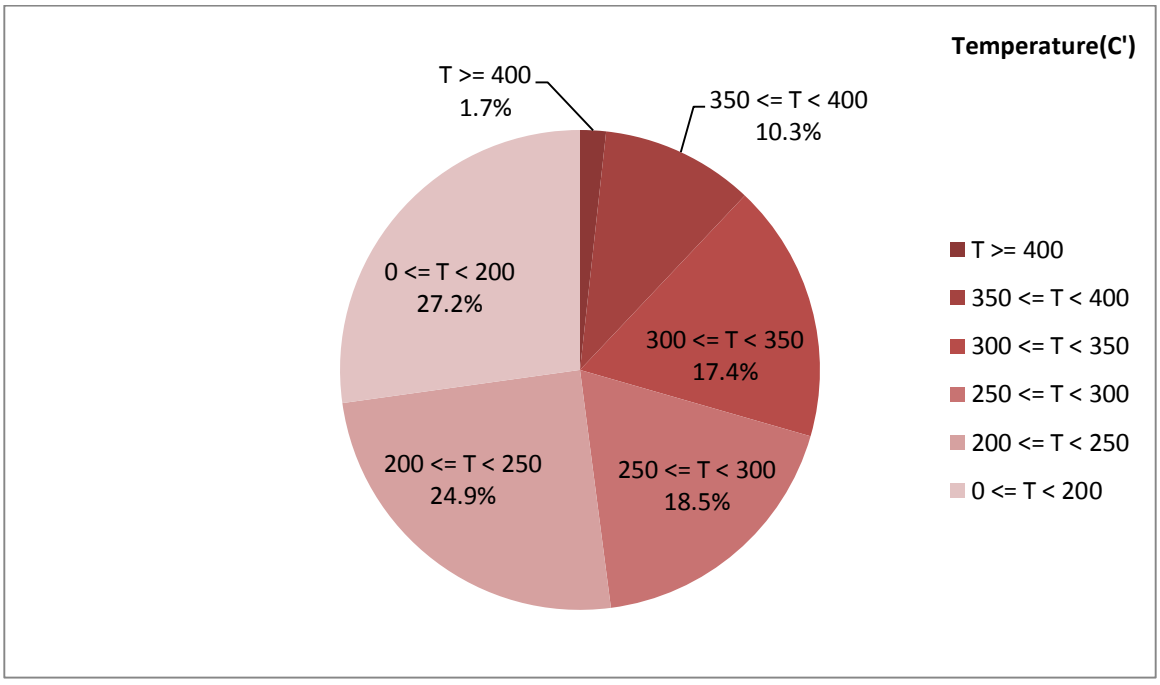


Figure 2-Temperature distribution over the working hours

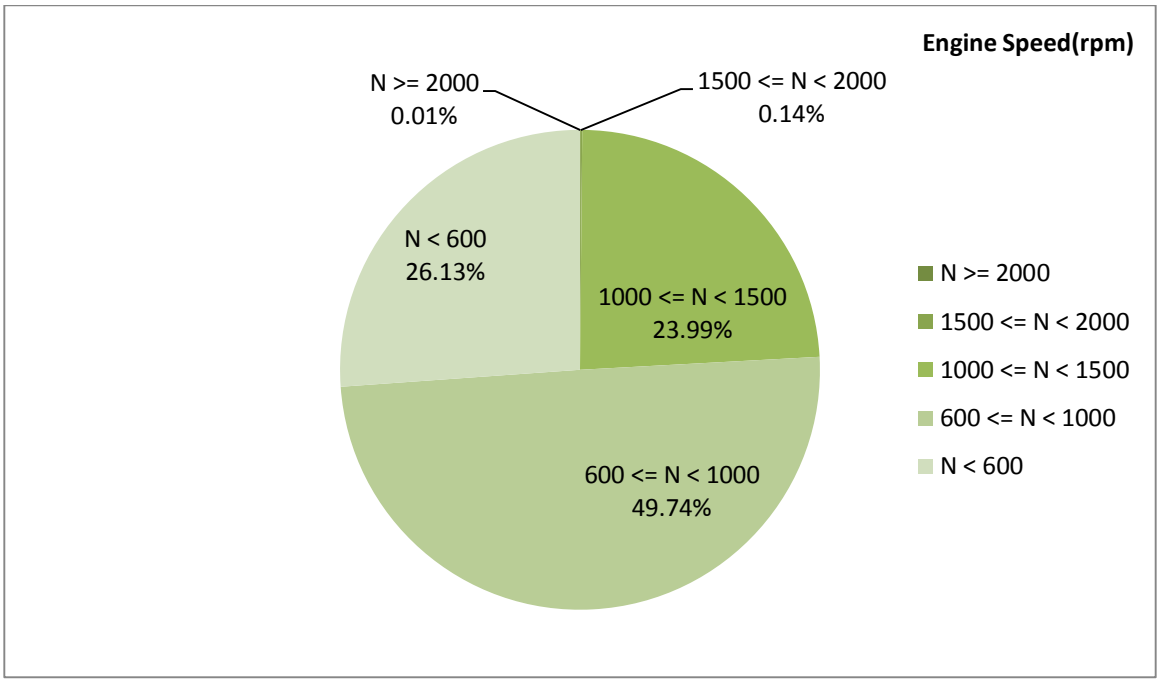


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
251.05	1.14	816

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
273.12	1.55	911

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
486-50	72-0	2064-288

Detailed Pressure Analysis

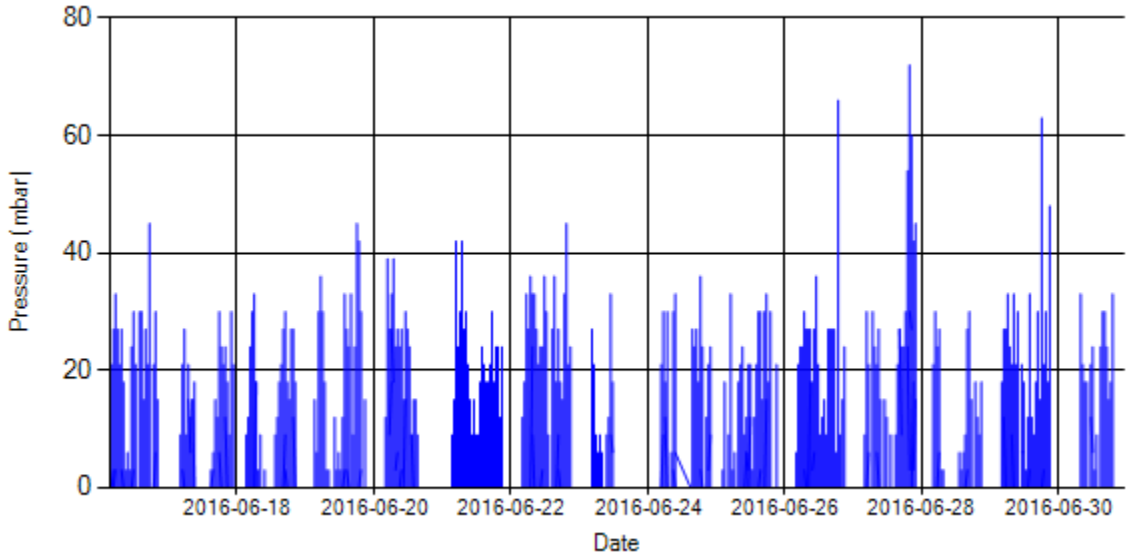


Figure 4- Pressure distribution over the period

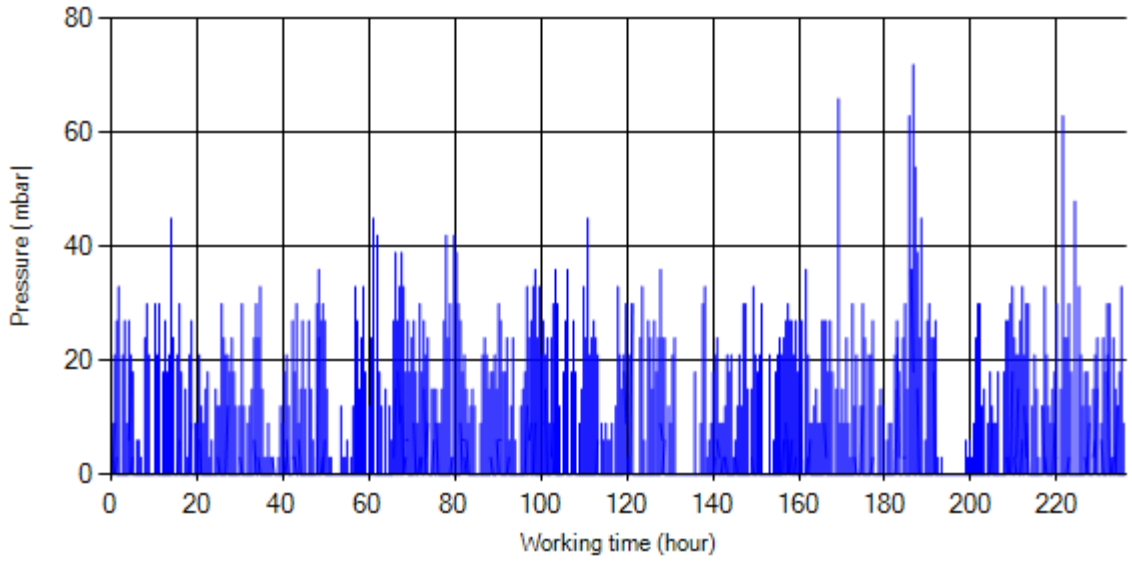


Figure 5- Pressure vs. working hours

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

Detailed Temperature Analysis

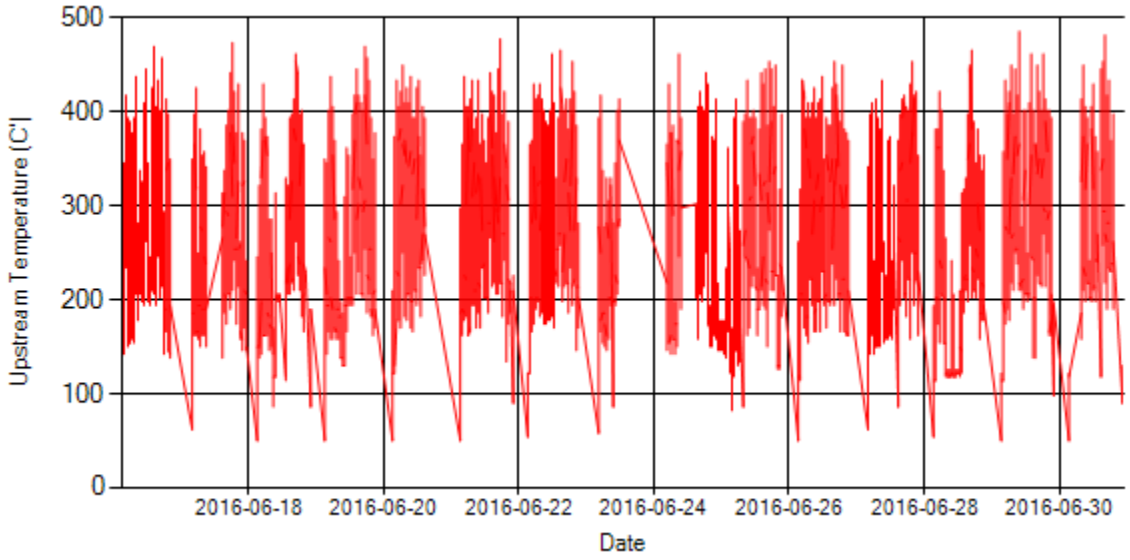


Figure 6- Temperature distribution over the period

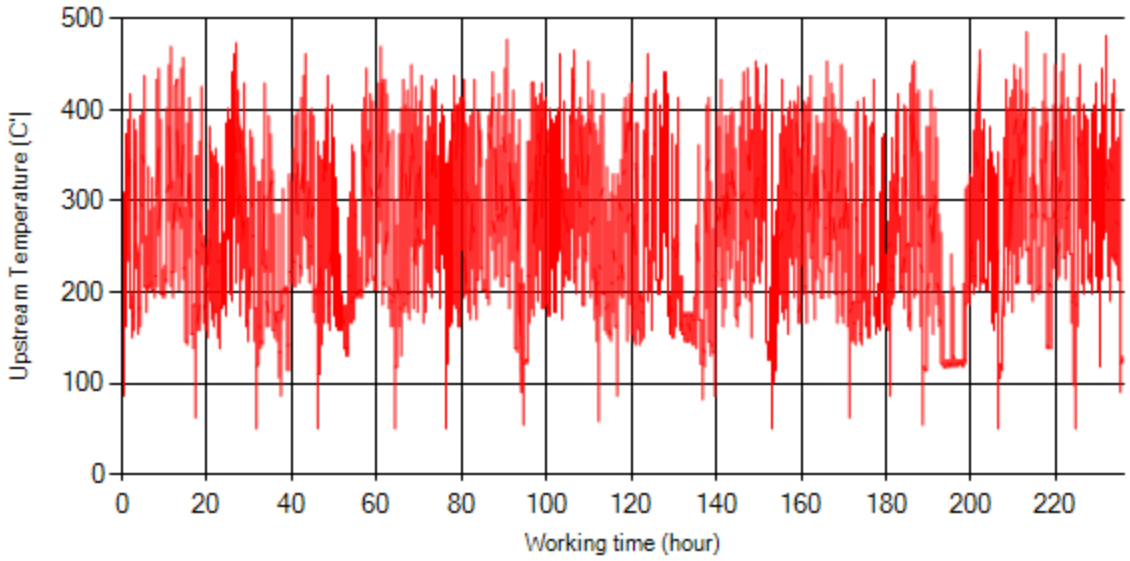


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

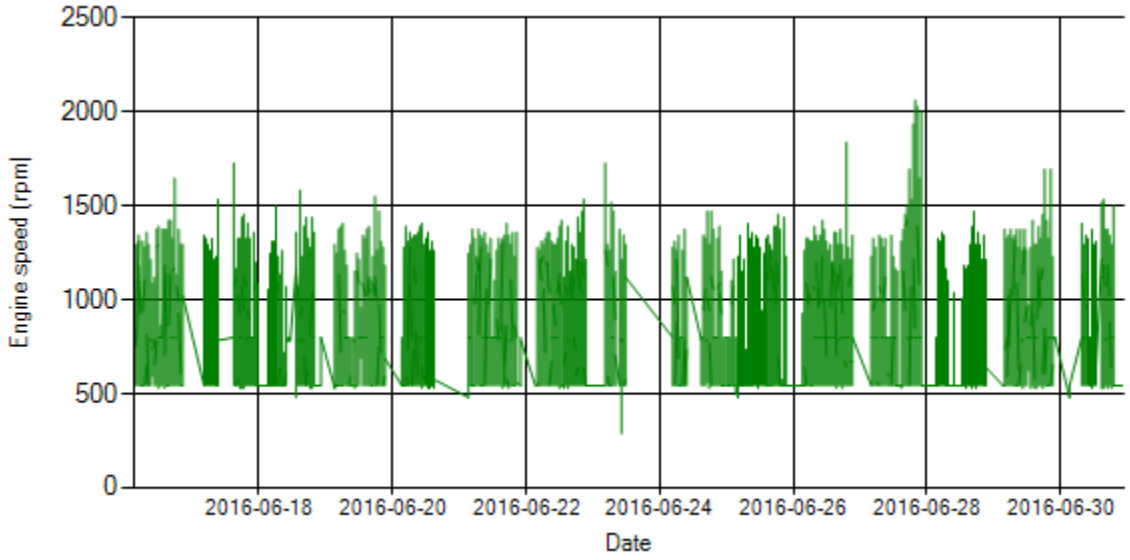


Figure 8- Engine speed distribution over the period

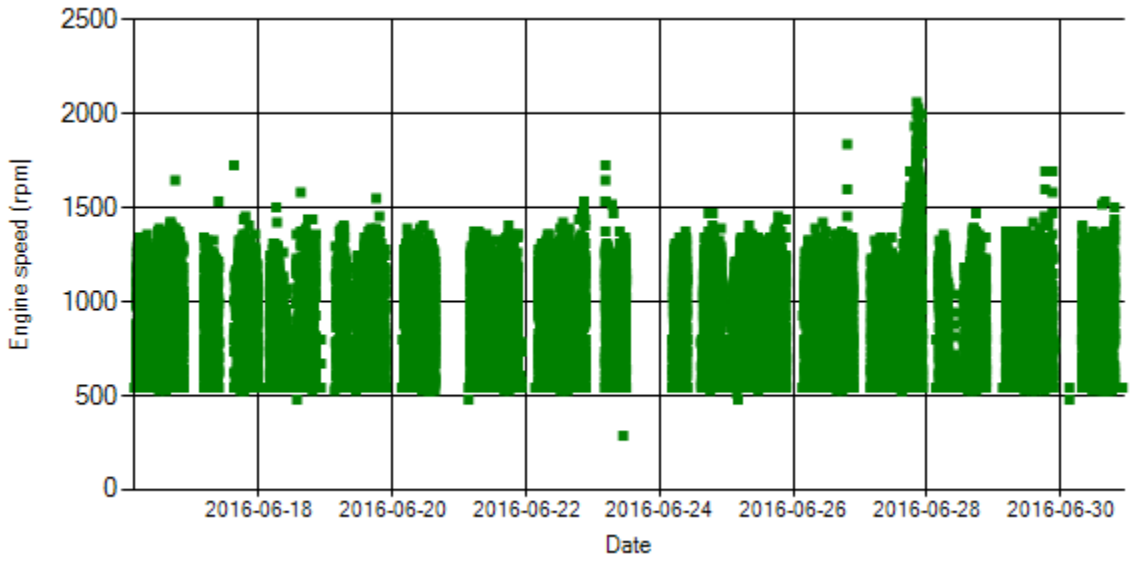


Figure 9- Engine speed diagram for calculating CPK's working days

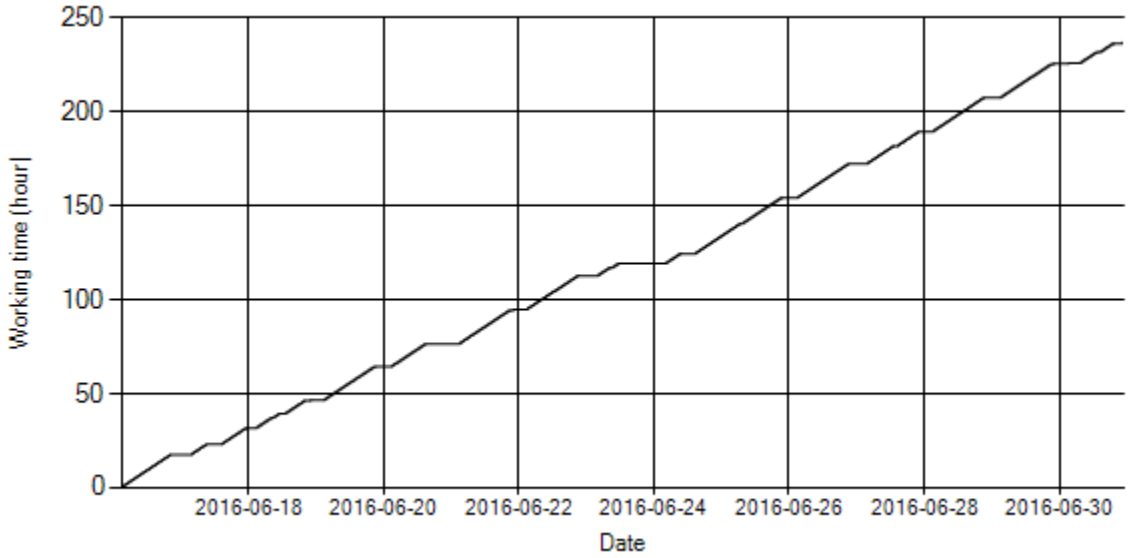


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 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

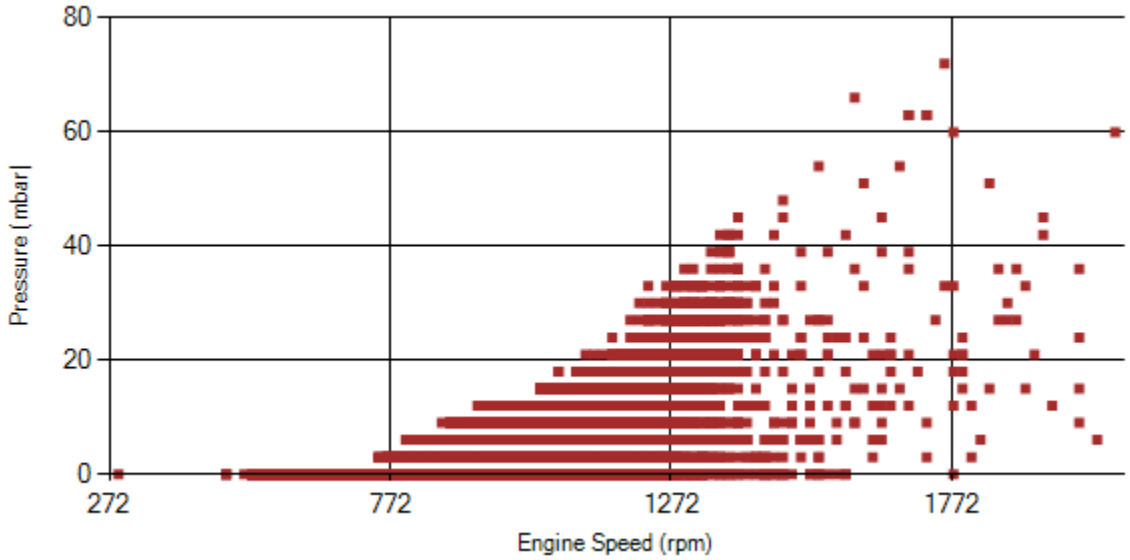


Figure 11- Pressure against engine speed

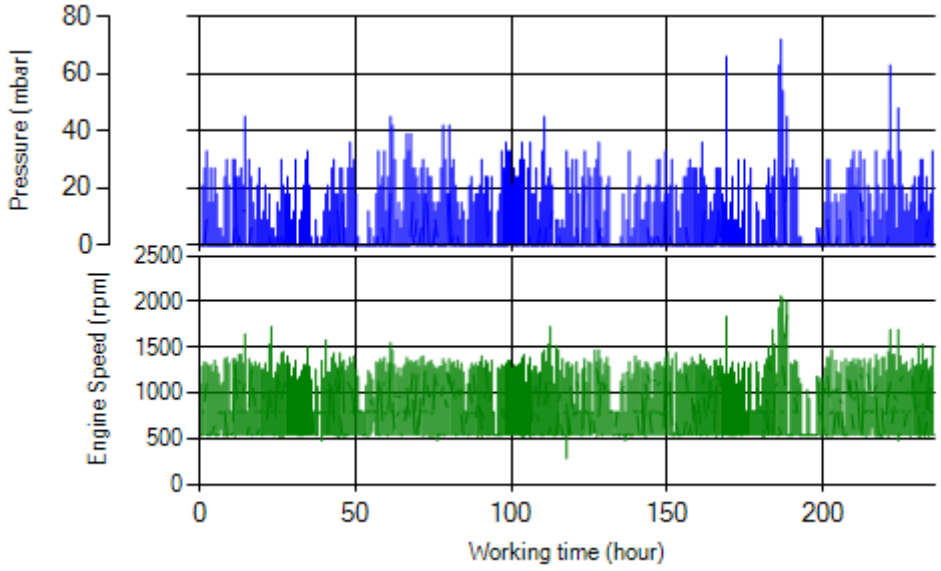


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

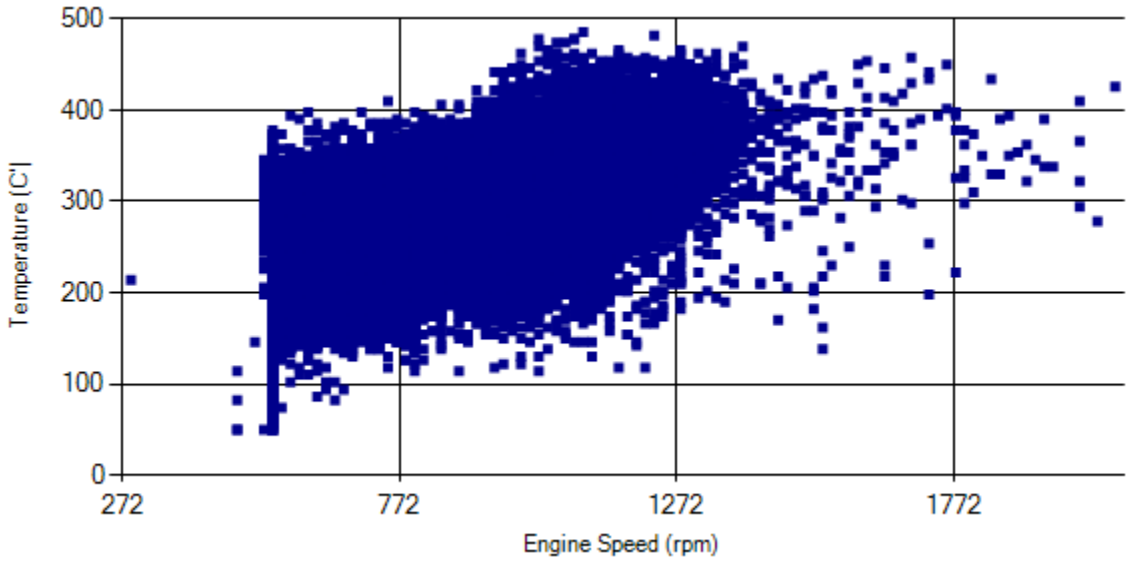


Figure 13- Temperature against engine speed

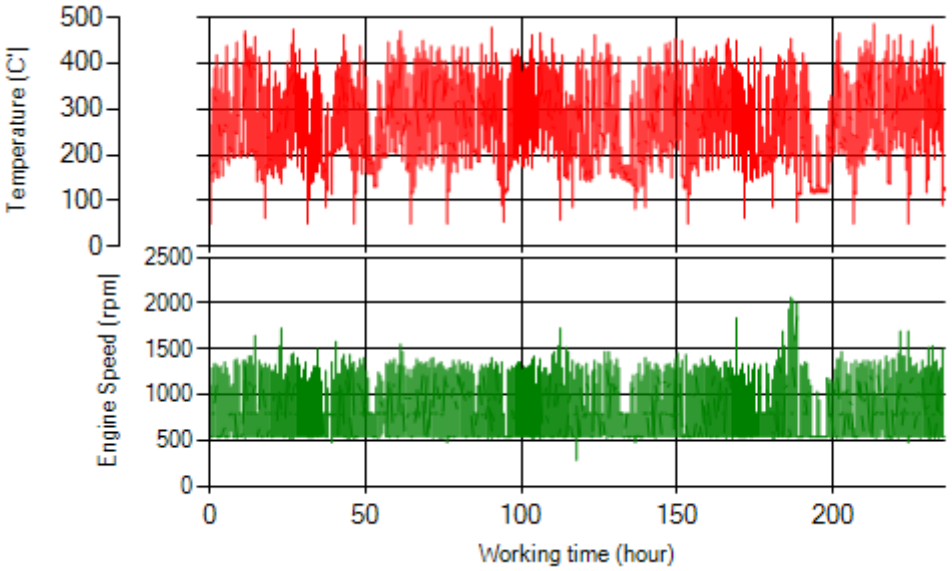
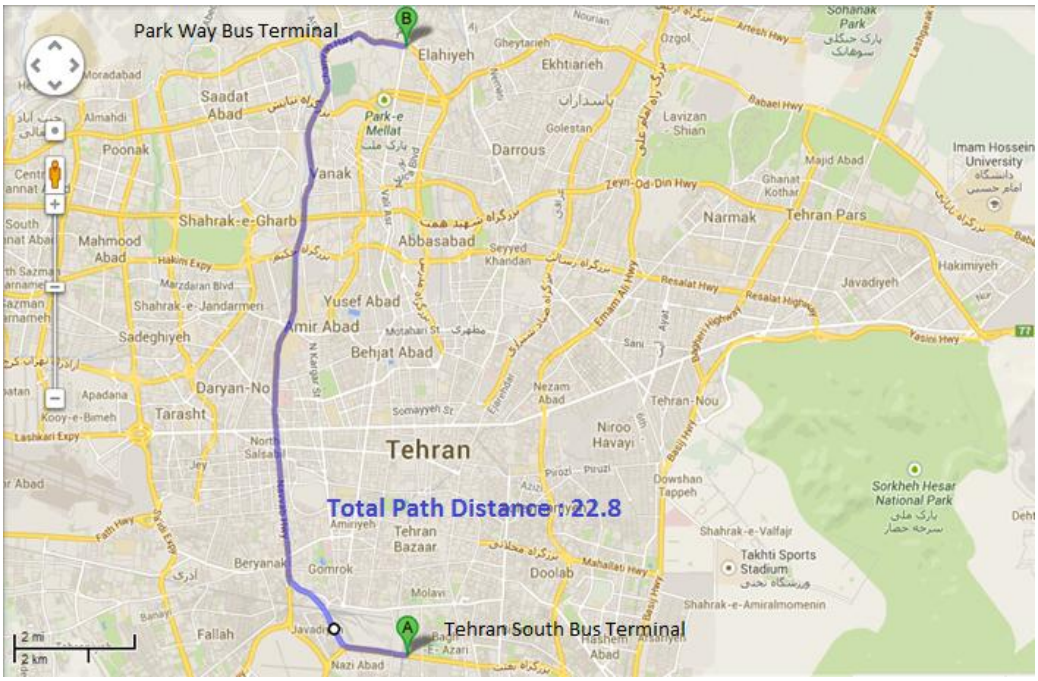


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

Notice: System was working over this period without DPF.

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



ASA Azmoon Sanat Arvin	Document Number: DPF2016061/1 Date: 5/Jul/2016

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/Jun/2016 – 15/Jun/2016 (sixteen days)
K value - DPF upstream	2.00 [1/m]
K value – DPF downstream	0.02 [1/m]

Table 2- DPF Maintenance History

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

Notice: Due to data logger problem, no data was available during 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/Jun/2016 – 30/Jun/2016 (fifteen days)
K value - DPF upstream	2.00 [1/m]
K value – DPF downstream	0.02 [1/m]

Table 2- DPF Maintenance History

Filter maintenance date	DPF core was cleaned on Jun 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)	82530 km
Bus mileage over the period	1211 km
Working days over the period	8 days
Stop days	7 days
Data logger working days	8 days
Working hours over the period	74 hours 38 minutes
Average working hours per day (including stop days)	5 hours 44 minutes
Bus average speed	16.2 km/hr
idle speed time to all working time ration	32.87 %
Total Bus fuel consumption over the period	727 lit
Fuel consumption per hour	9.72 lit/hr
Average fuel consumption	0.6 lit/km
Total Bus additive consumption over the period	0.348 lit
Average additive consumption	288 cc/km
Additive consumption to fuel ration	480 cc/1000lit

Temperature, Pressure and Engine Speed Overview

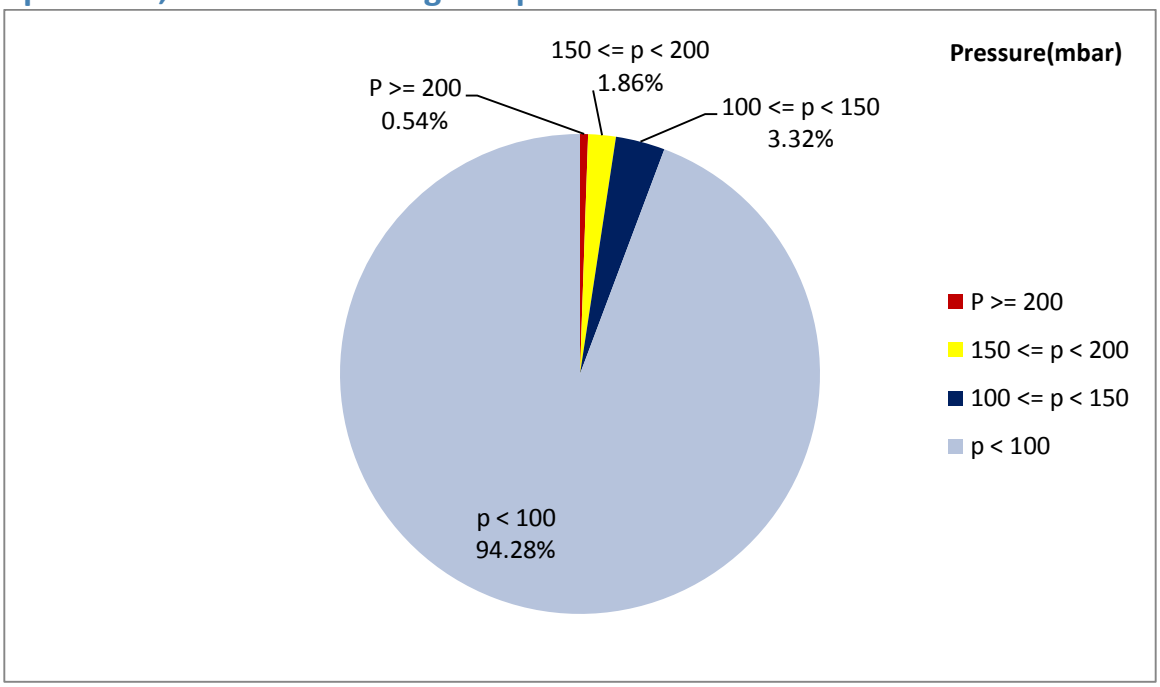


Figure 1- Pressure distribution over the working hours

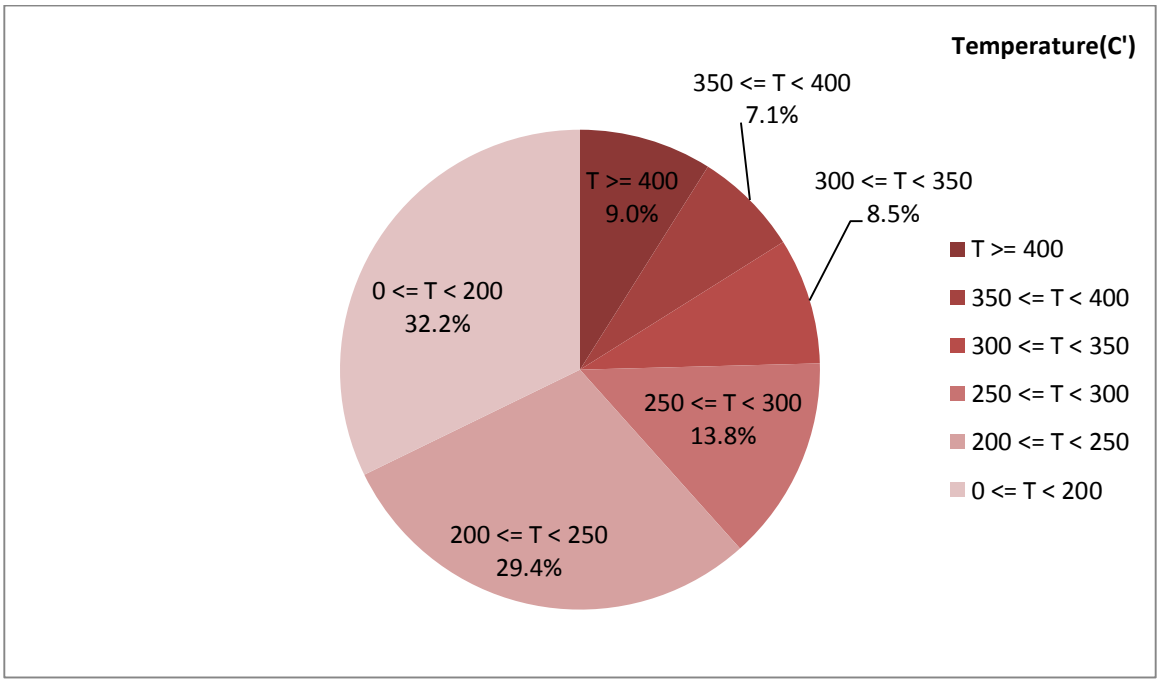


Figure 2-Temperature distribution over the working hours

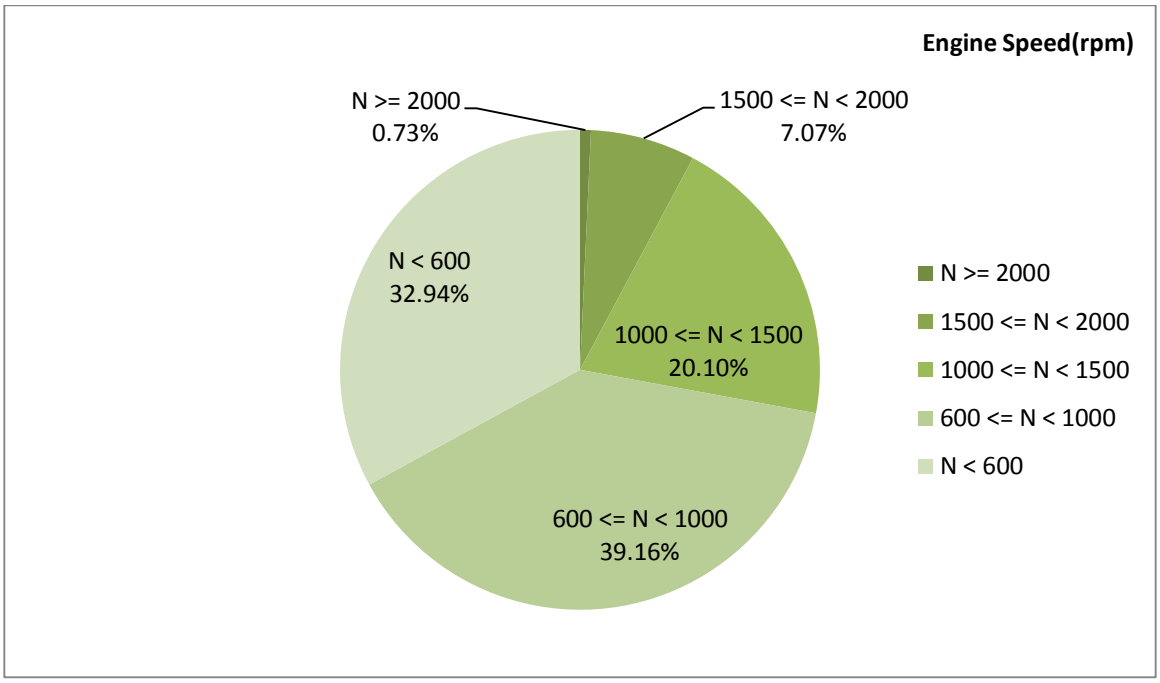


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
247.41	25.46	870

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
277.58	35.28	1028

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
538-50	234-0	2160-256

Detailed Pressure Analysis

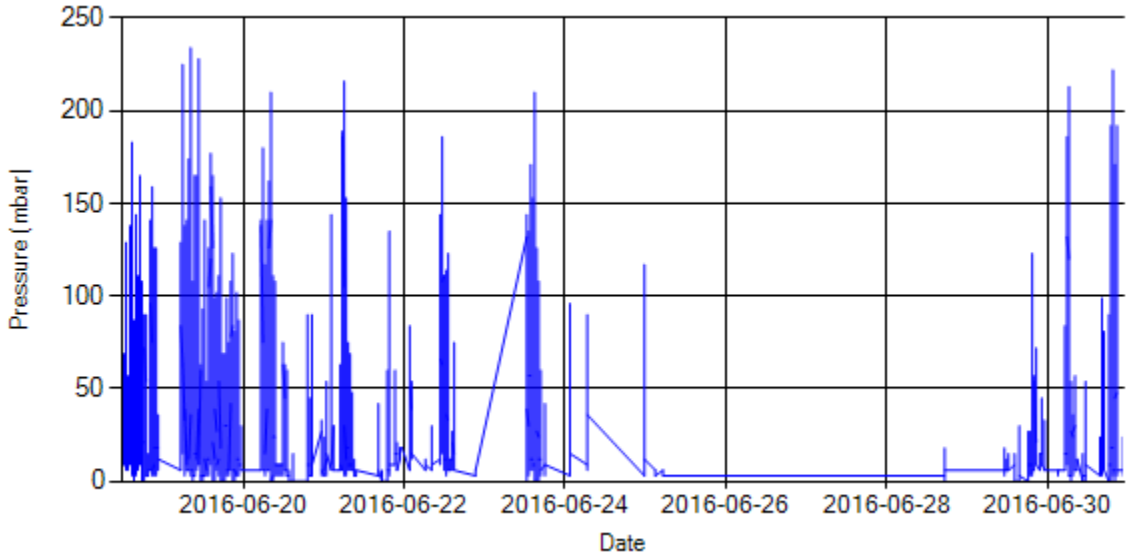


Figure 4- Pressure distribution over the period

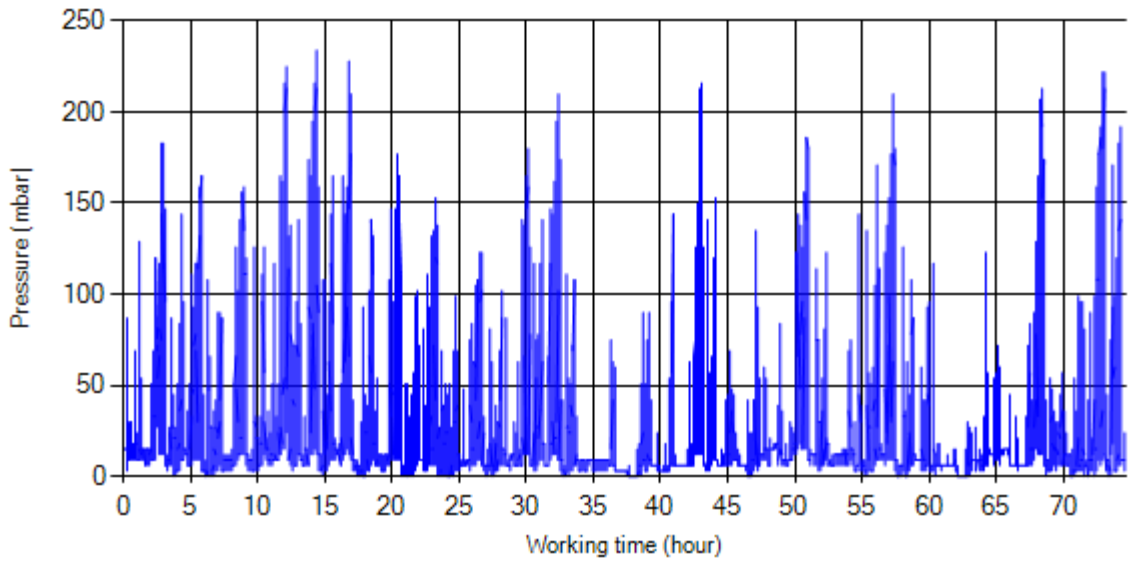


Figure 5- Pressure vs. working hours

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

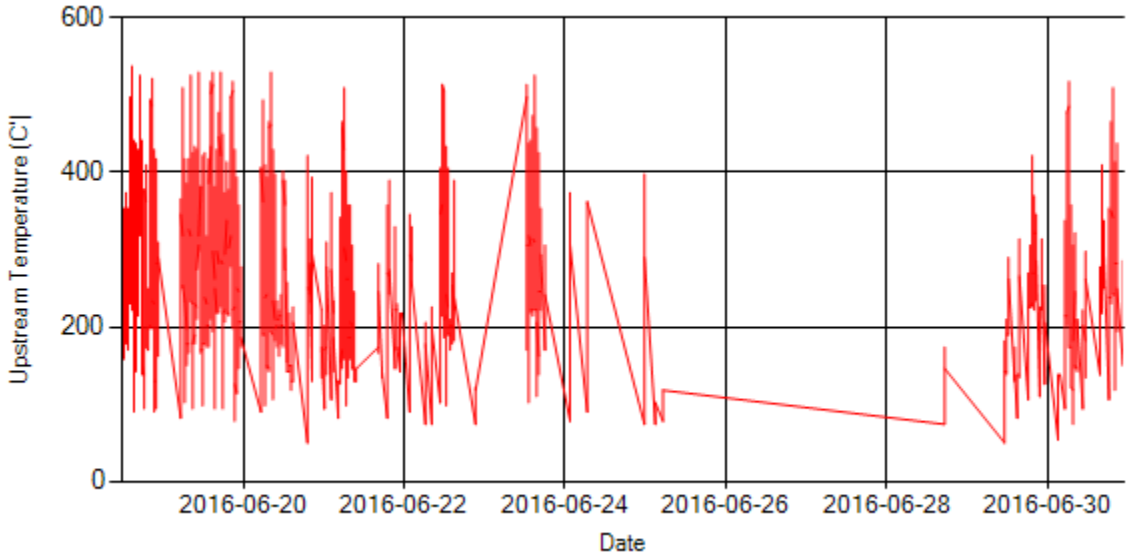


Figure 6- Temperature distribution over the period

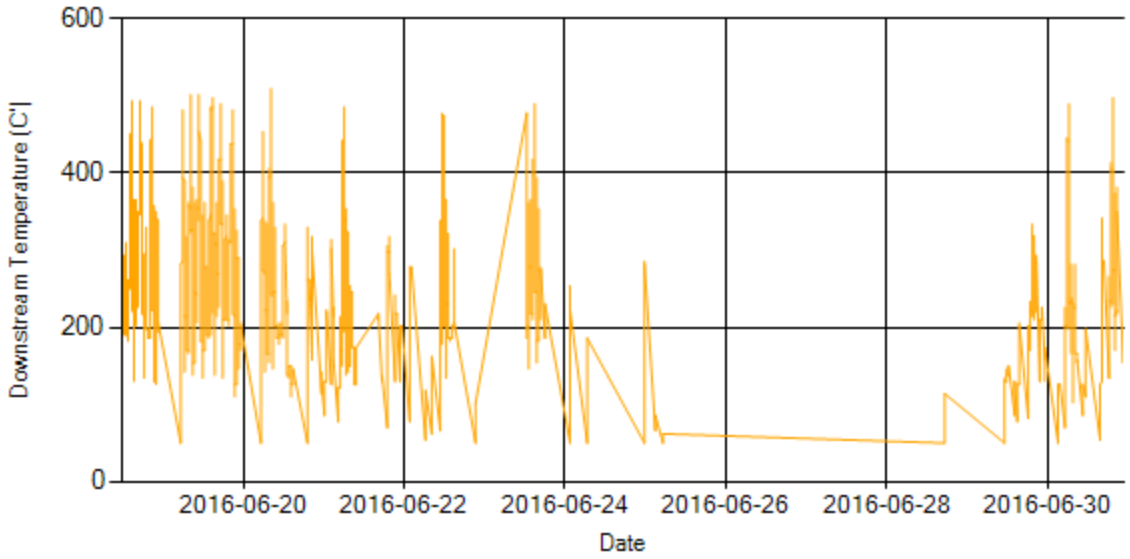


Figure 7- Temperature distribution over the period

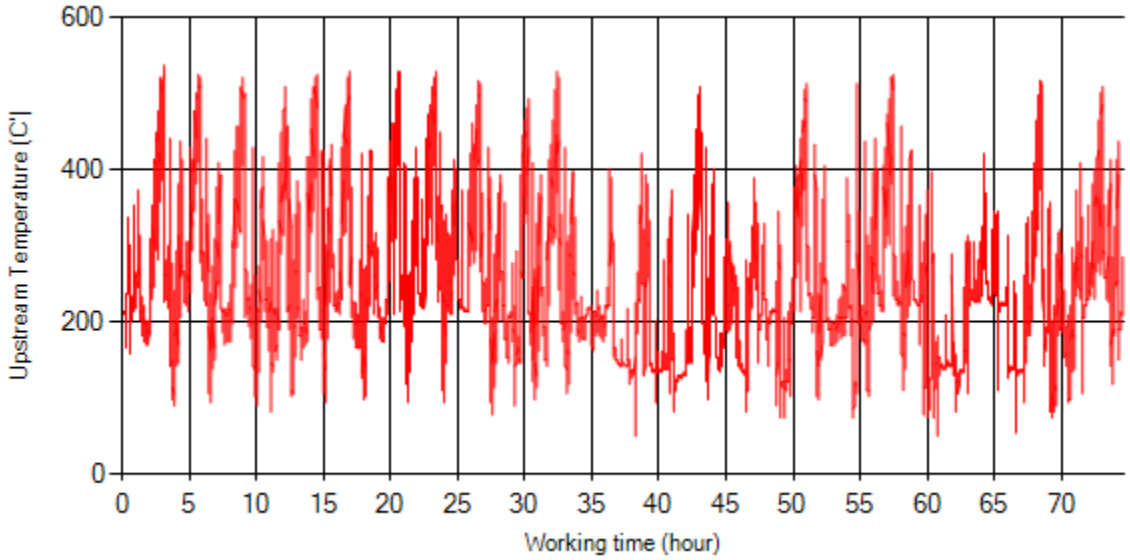


Figure 8- Temperature vs. working hours

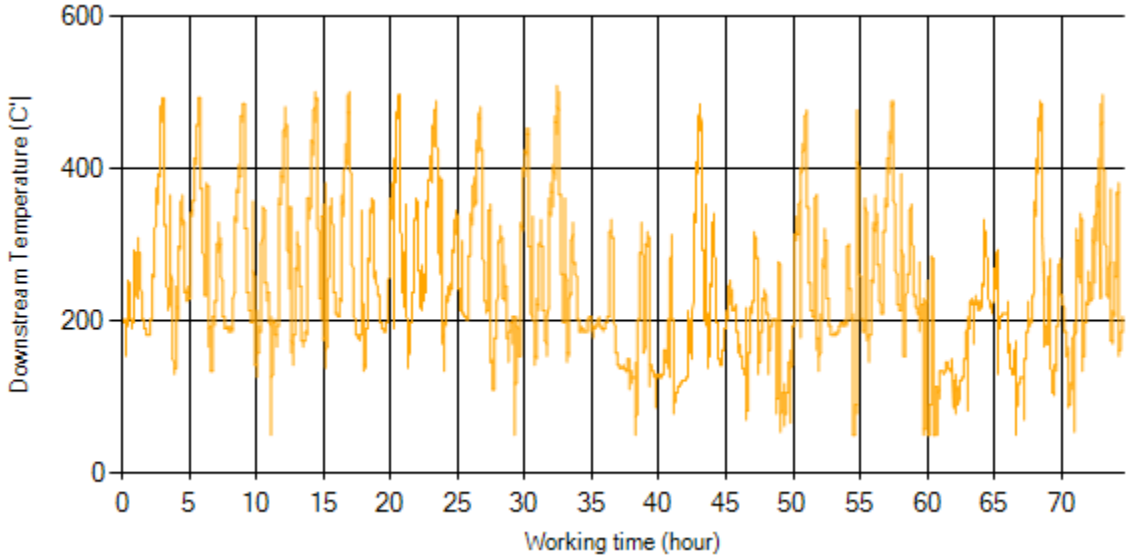


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

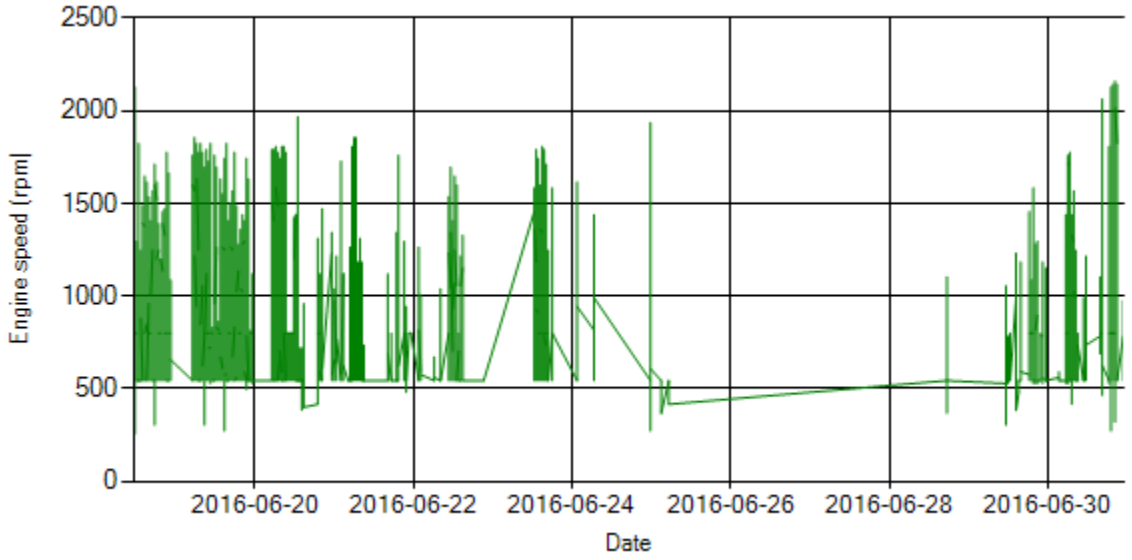


Figure 10- Engine speed distribution over the period

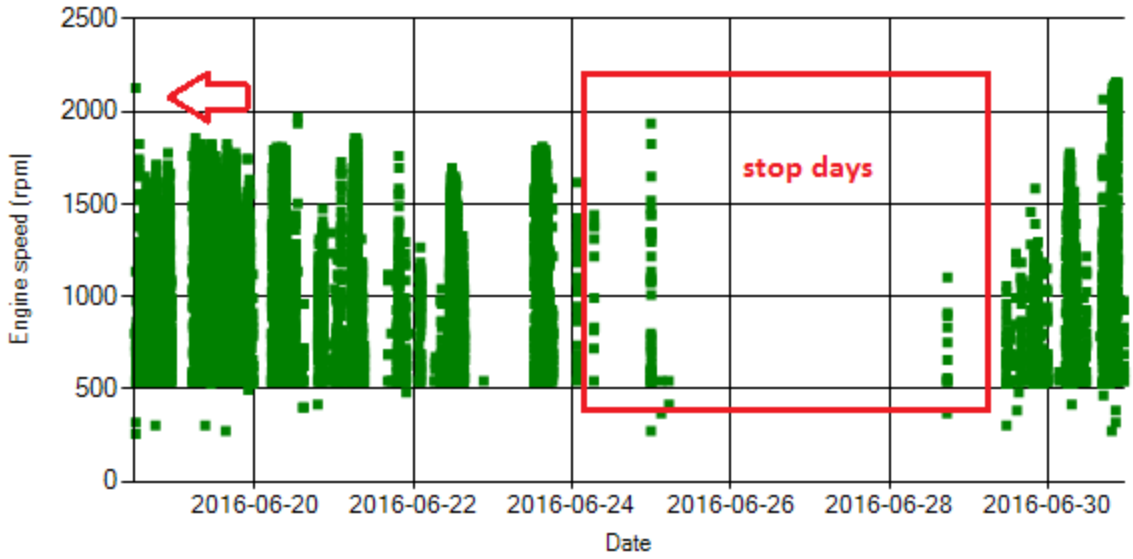


Figure 11- Engine speed diagram for calculating CPK's working days

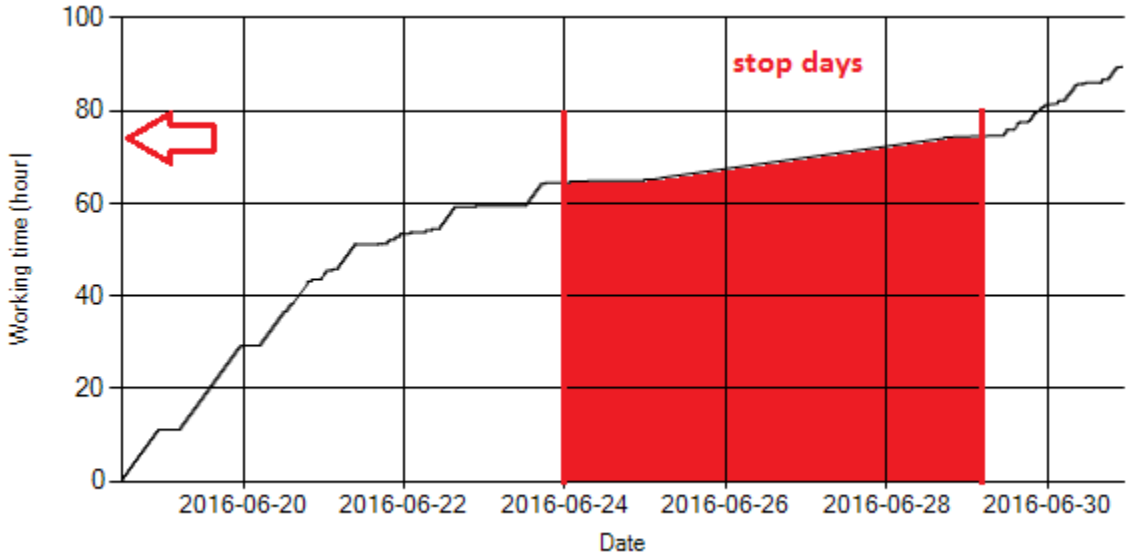


Figure 12- Time diagram for calculating CPK's working days

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

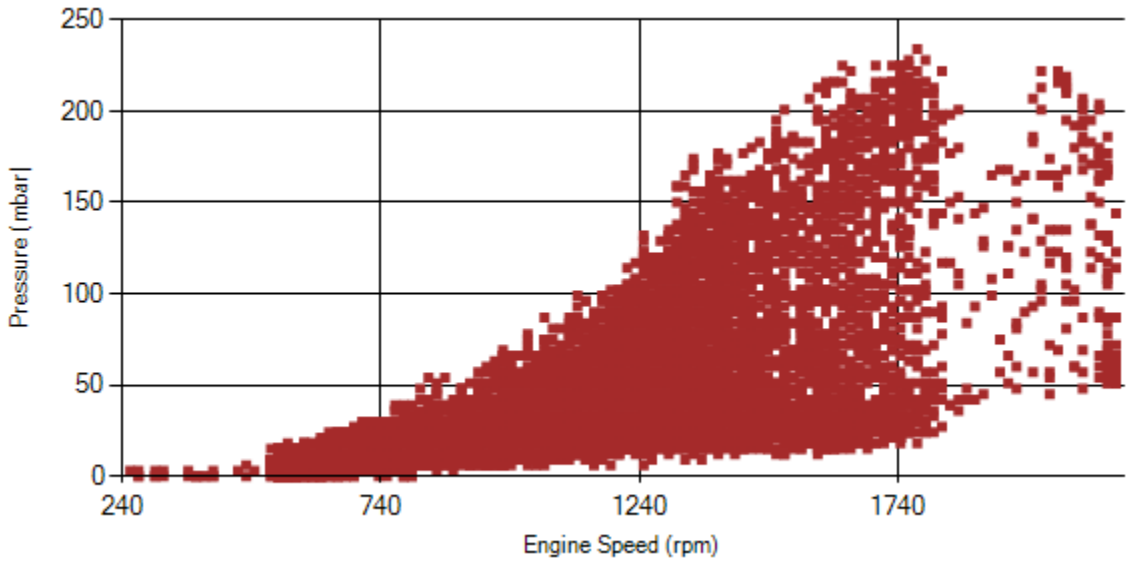


Figure 13- Pressure against engine speed

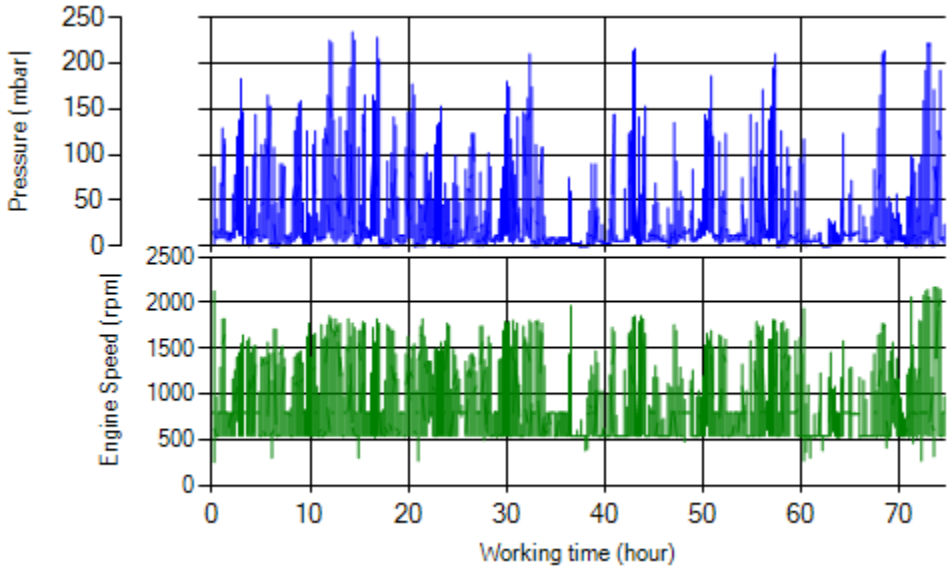


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

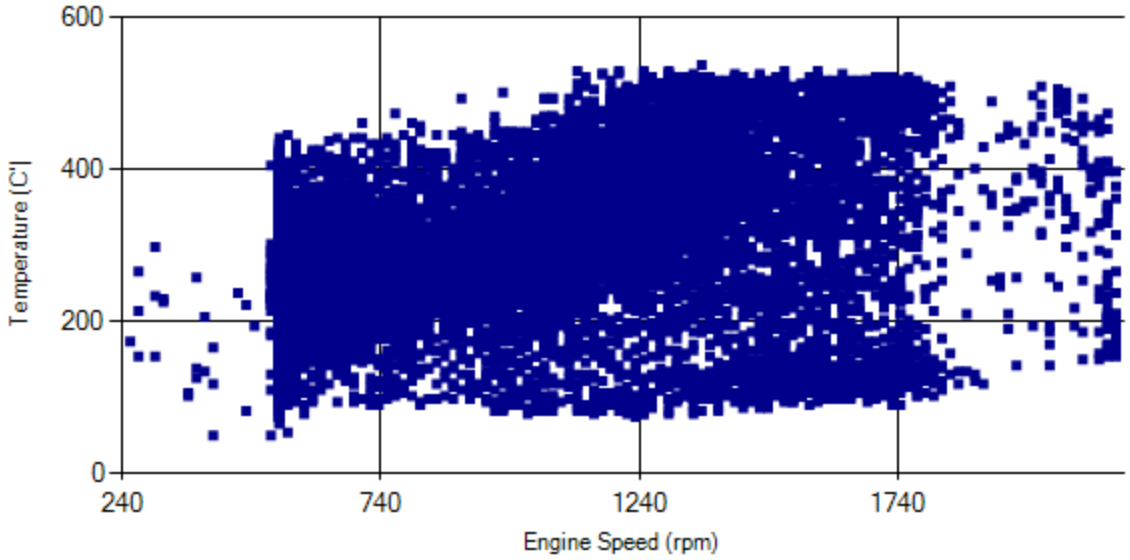


Figure 15- Temperature against engine speed

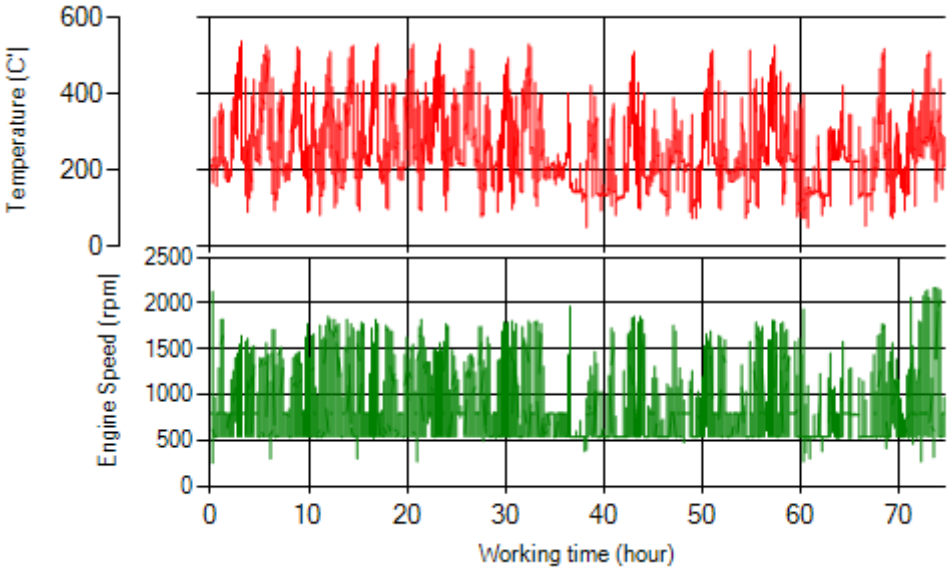


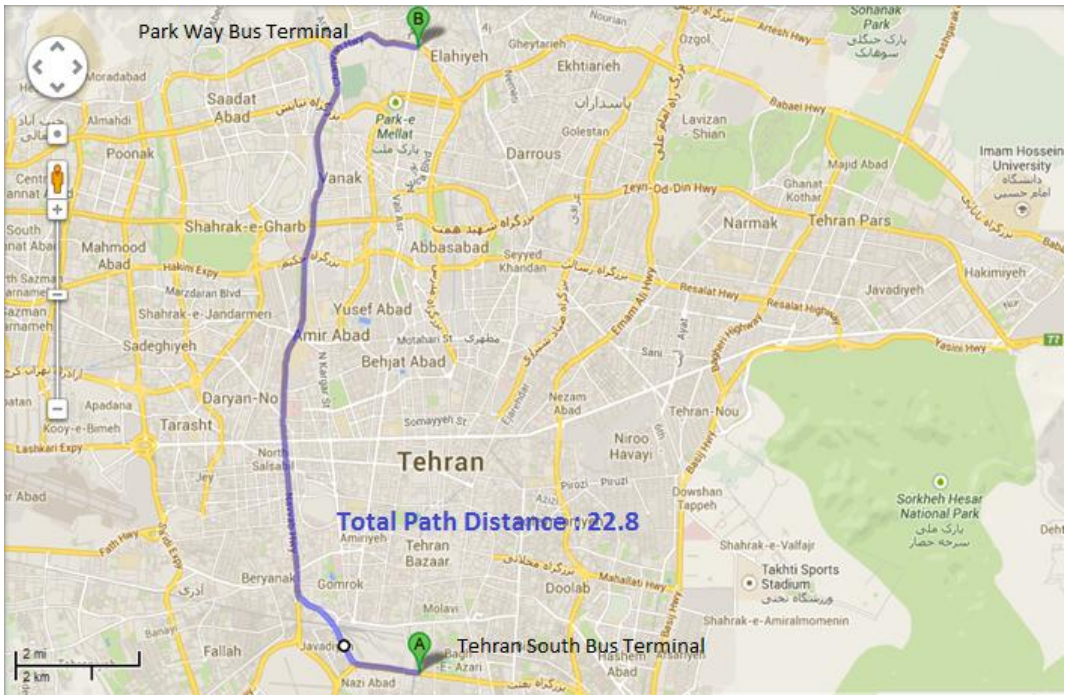
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 0.54% of working time pressure was above 200 mbar and 2.4% of working time was above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 9% of total working time temperature is above 400 ℃ and 16.1% above 350℃.
- Considering available data DPF operation was good during the period.

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

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

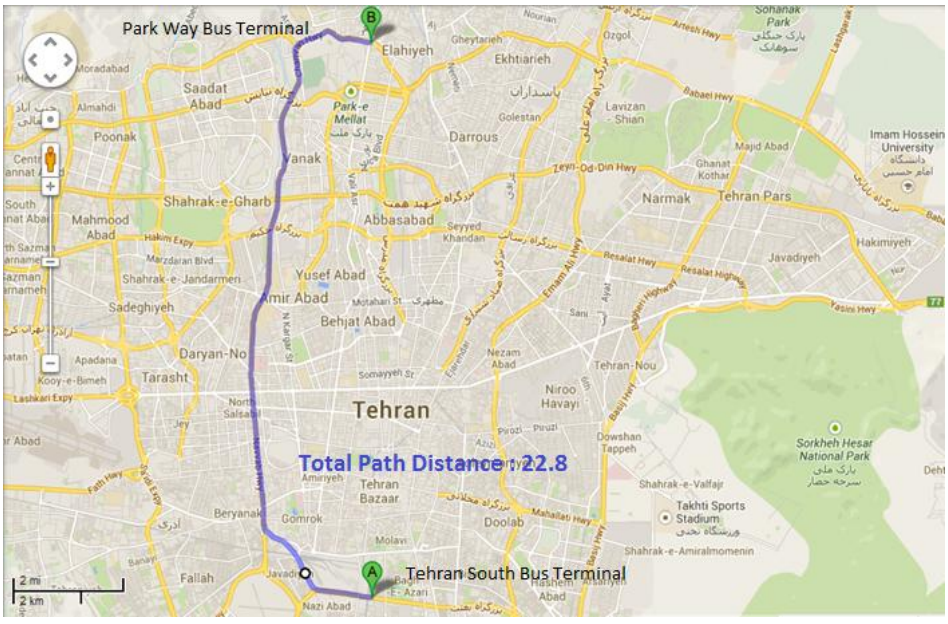
Vehicle plate number	78515
CPK data logger number	LN: 001490, DN: 1954, Sim Number +98000000000
Bus line	Number 4 (south to north bus line)
Bus Terminals	Tehran South Bus Terminal - Park Way Bus Terminal
Total path distance	22.8 km
DPF producer company	Dinex_01 (passive system with FBC)
Installation date	22/Oct/2014
Report period	01/Jun/2016 – 30/Jun/2016 (thirty days)
K value - DPF upstream	- [1/m]
K value – DPF downstream	- [1/m]

Table 2- DPF Maintenance History

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

Notice: Bus has been stopped from 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: DPF2016061/1 Date: 5/Jul/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/Jun/2016 – 15/Jun/2016 (fifteen days)
K value	1.90
K value	0.02

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.
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)	88292 km
Bus mileage over the period	3077 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	186 hours 34 minutes
Average working hours per day (including stop days)	12 hours 26 minutes
Bus average speed	16.5 km/hr
idle speed time to all working time ration	24.73 %
Total Bus fuel consumption over the period	1661 lit
Fuel consumption per hour	8.9 lit/hr
Average fuel consumption	0.54 lit/km
Total Bus additive consumption over the period	0.788 lit
Average additive consumption	256 cc/km
Additive consumption to fuel ration	475 cc/1000lit

Temperature, Pressure and Engine Speed Overview

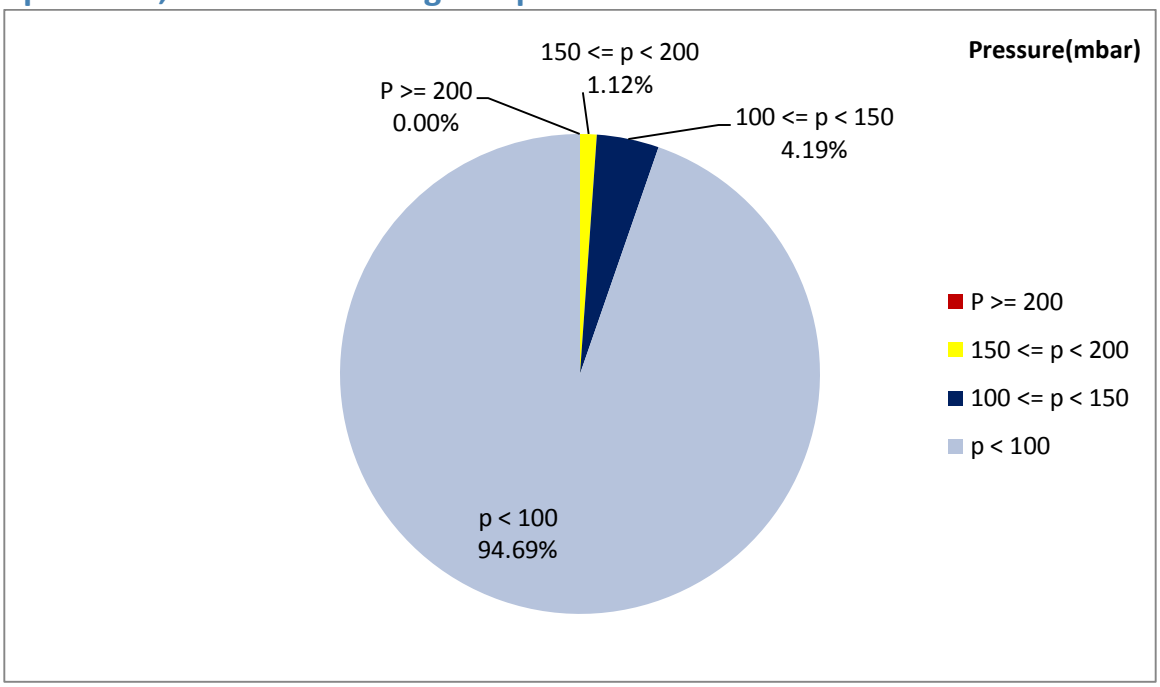


Figure 1- Pressure distribution over the working hours

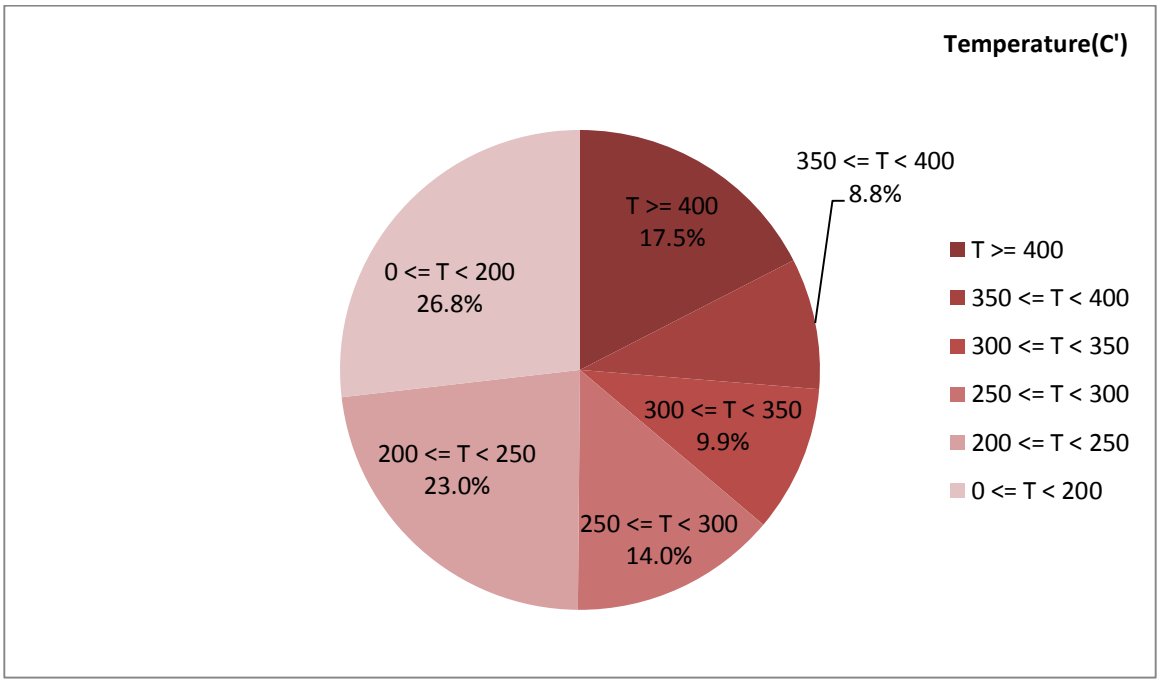


Figure 2-Temperature distribution over the working hours

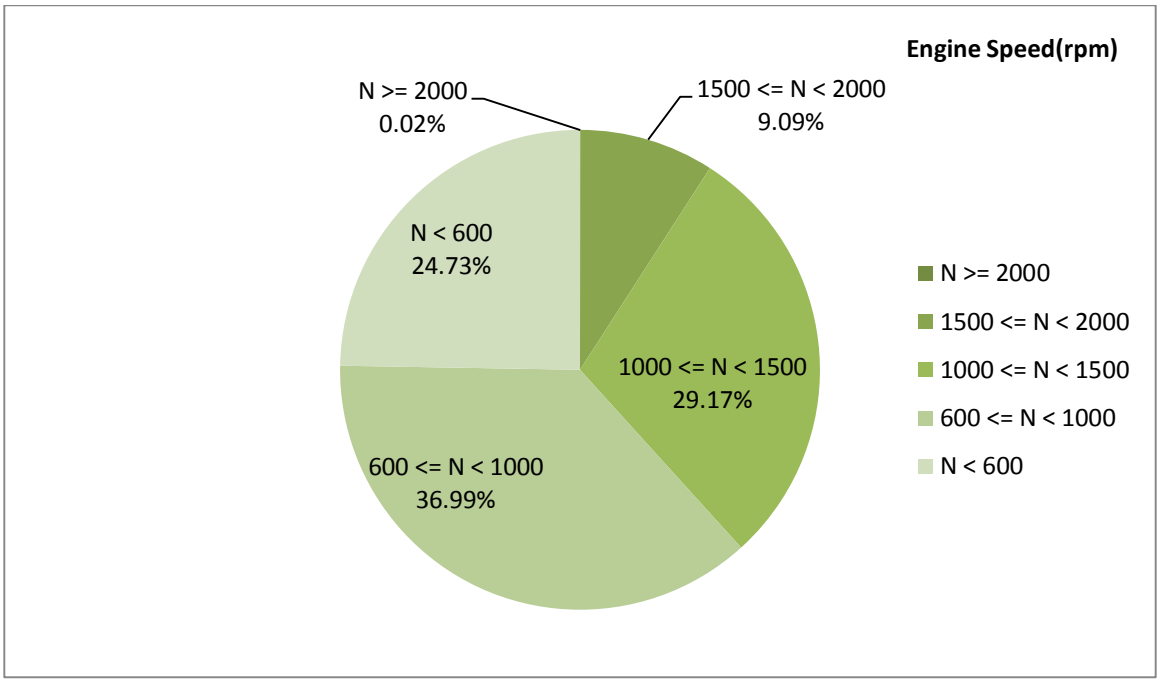


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
281.7	26.85	934

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
305.05	33.75	1061

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
650-50	198-0	2112-368

Detailed Pressure Analysis

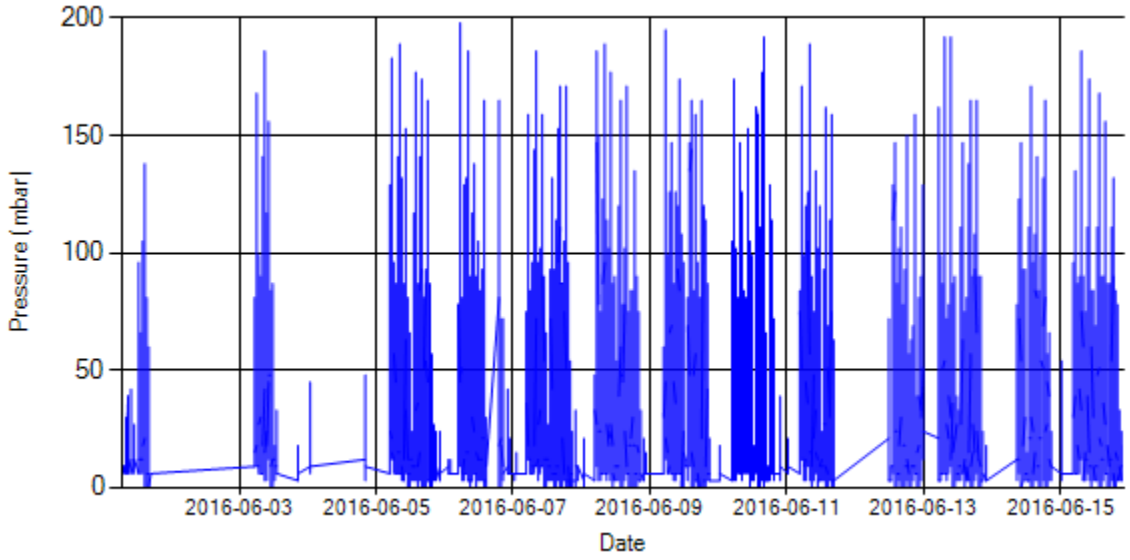


Figure 4- Pressure distribution over the period

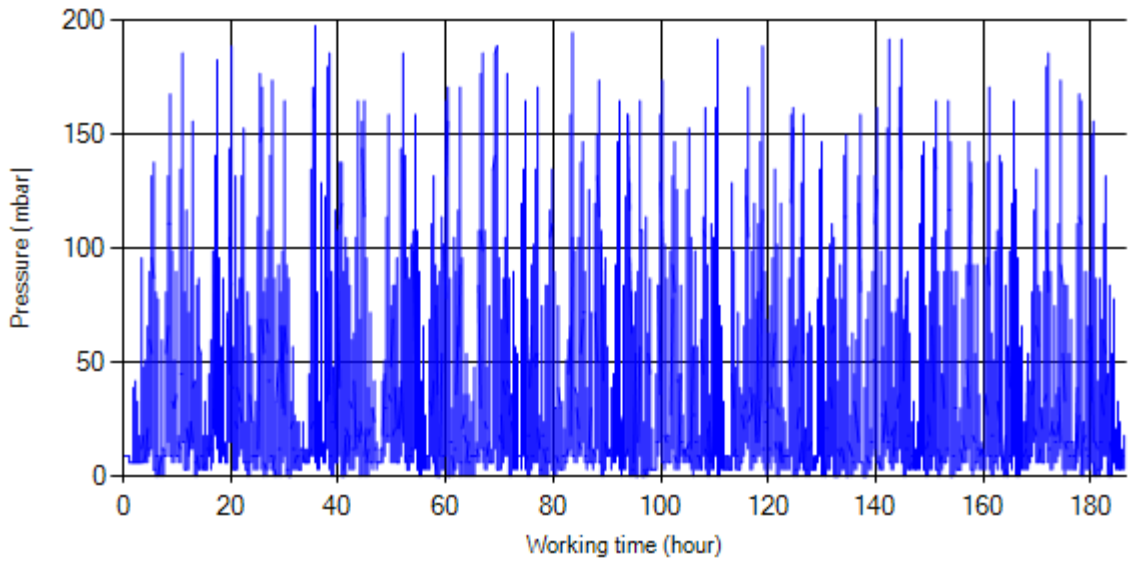


Figure 5- Pressure vs. working hours

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

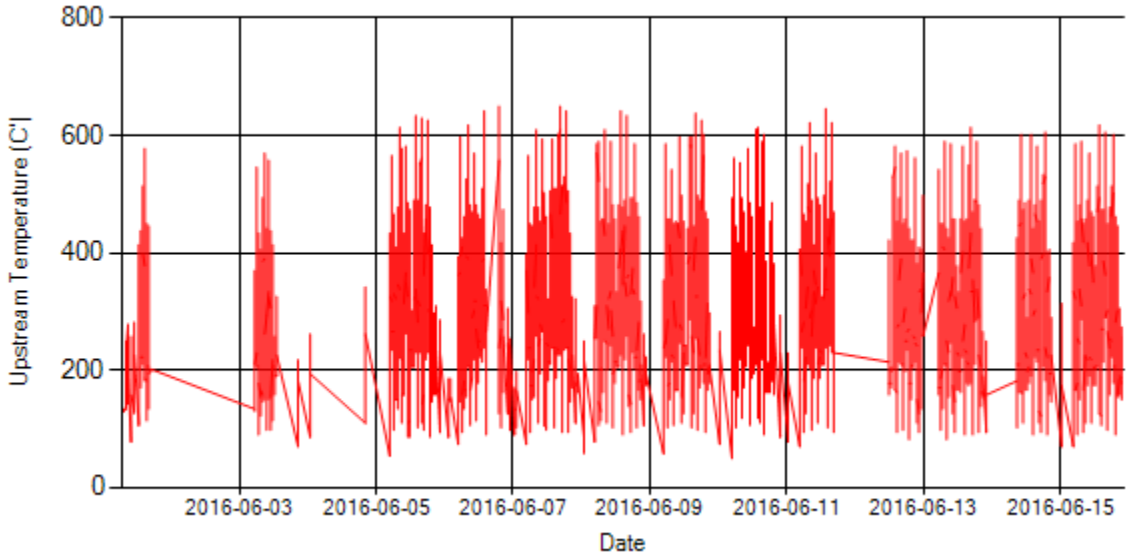


Figure 6- Temperature distribution over the period

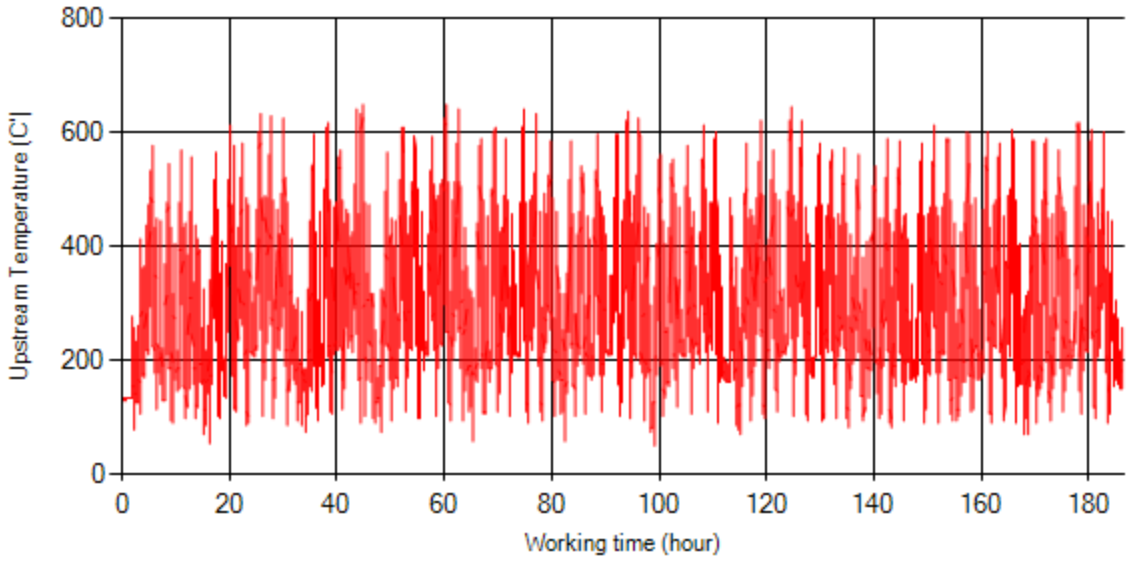


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

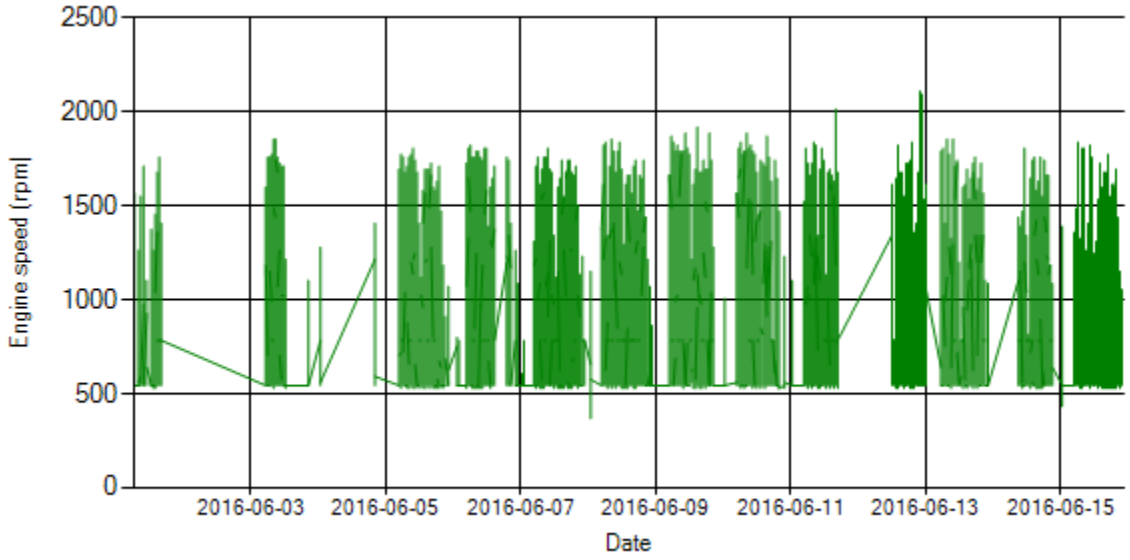


Figure 8- Engine speed distribution over the period

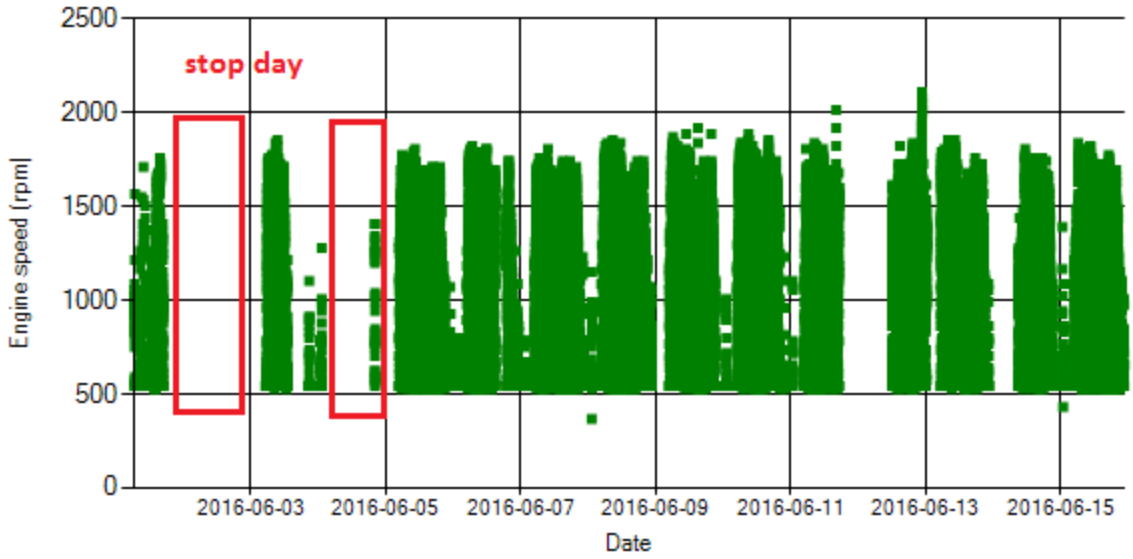


Figure 9- Engine speed diagram for calculating CPK's working days

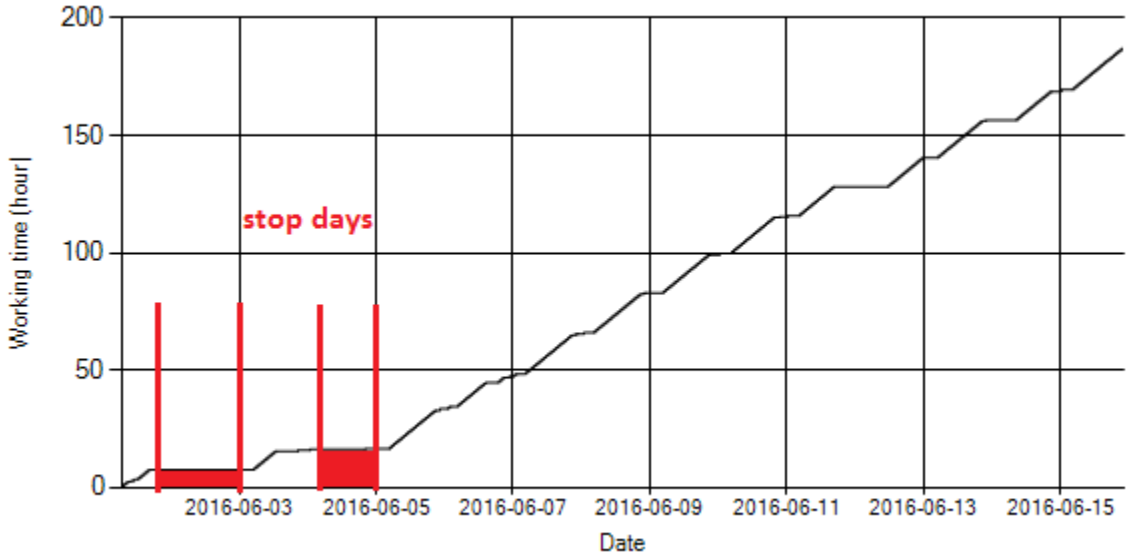


Figure 10- Time diagram for calculating CPK's working days

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

Pressure-Engine Speed diagrams

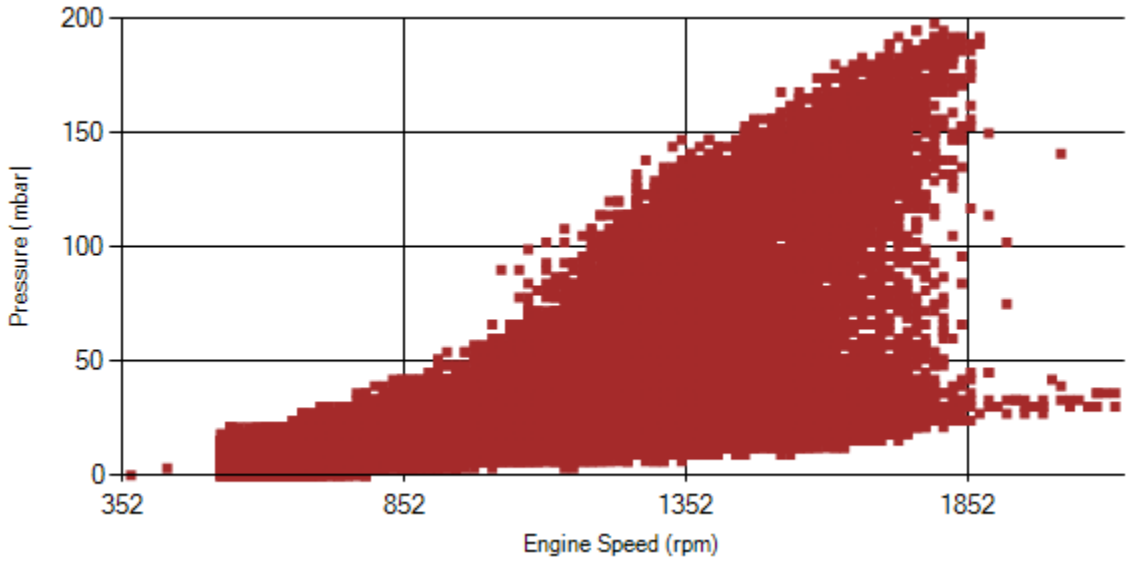


Figure 11- Pressure against engine speed

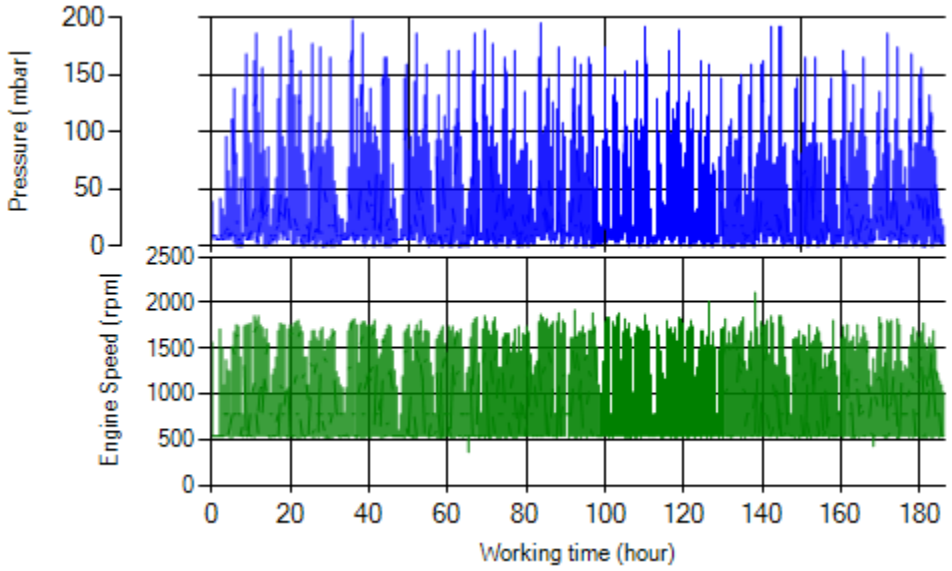


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

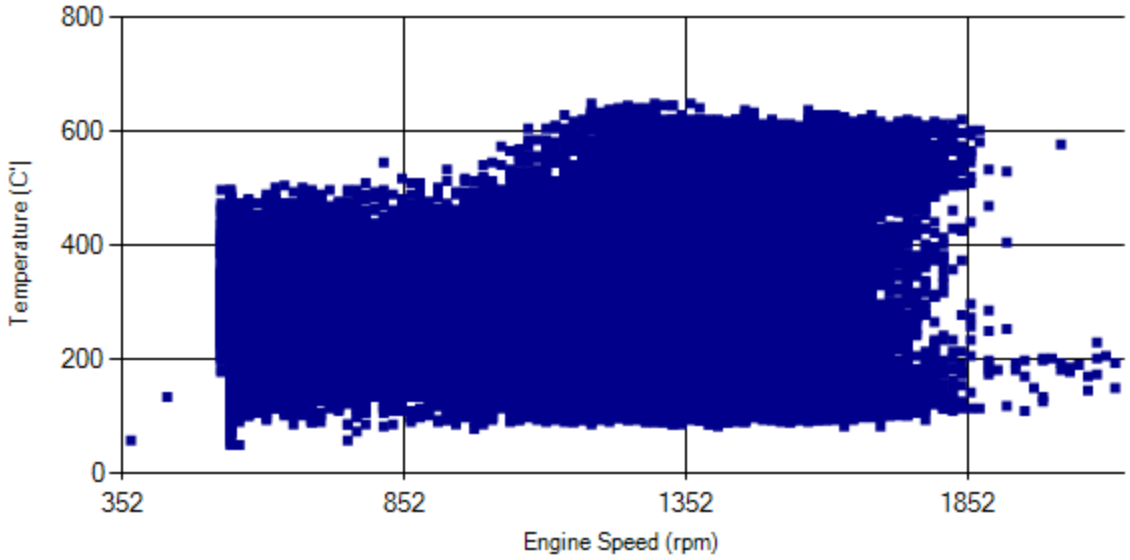


Figure 13- Temperature against engine speed

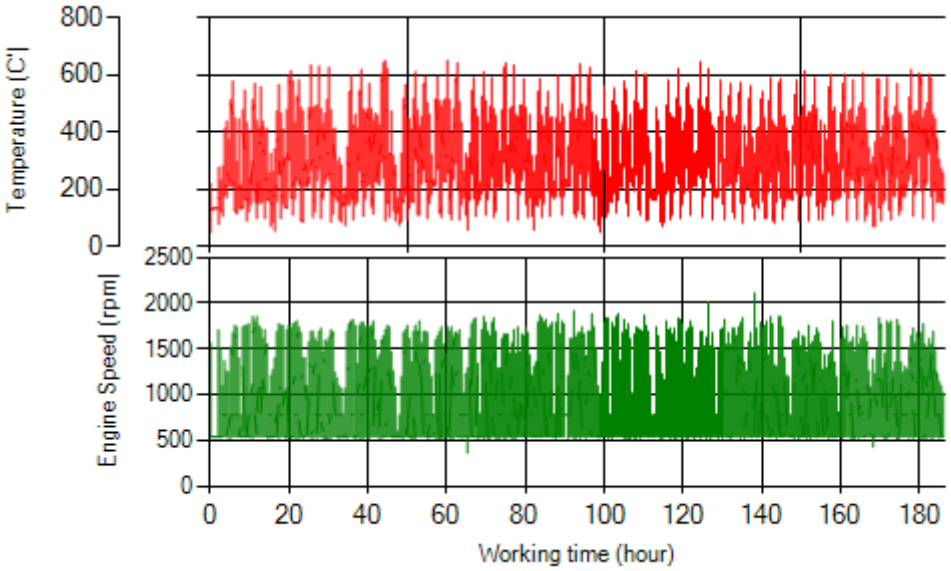


Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, none of working time, pressure was above 200 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 17.5% of total working time temperature is above 400 ℃ and 26.3% above 350℃.

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

ASA Azmoon Sanat Arvin	Document Number: DPF2016062/1 Date: 6/Jul/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/Jun/2016 – 30/Jun/2016 (fifteen days)
K value	1.90
K value	0.02

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 2016.06.25.
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)	91006 km
Bus mileage over the period	2714 km
Working days over the period	12 days
Stop days	3 days
Data logger working days	12 days
Working hours over the period	165 hours 33 minutes
Average working hours per day (including stop days)	11 hours 2 minutes
Bus average speed	16.4 km/hr
idle speed time to all working time ration	25.2 %
Total Bus fuel consumption over the period	1466 lit
Fuel consumption per hour	8.85 lit/hr
Average fuel consumption	0.54 lit/km
Total Bus additive consumption over the period	0.697 lit
Average additive consumption	257 cc/km
Additive consumption to fuel ration	476 cc/1000lit

Temperature, Pressure and Engine Speed Overview

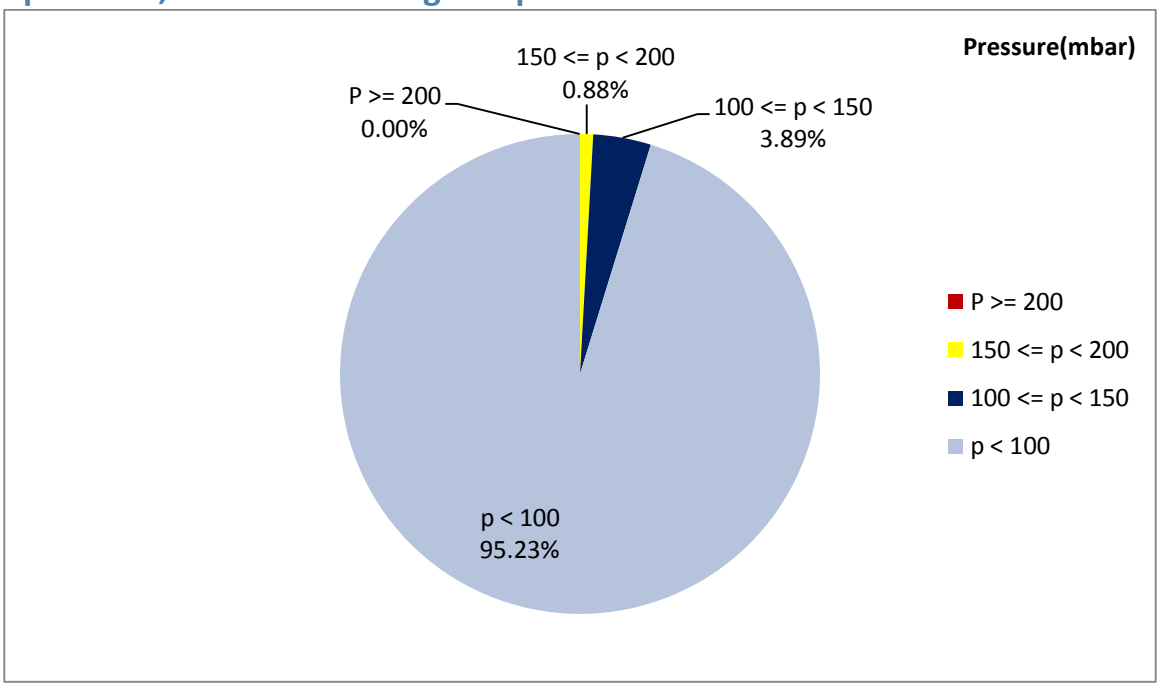


Figure 1- Pressure distribution over the working hours

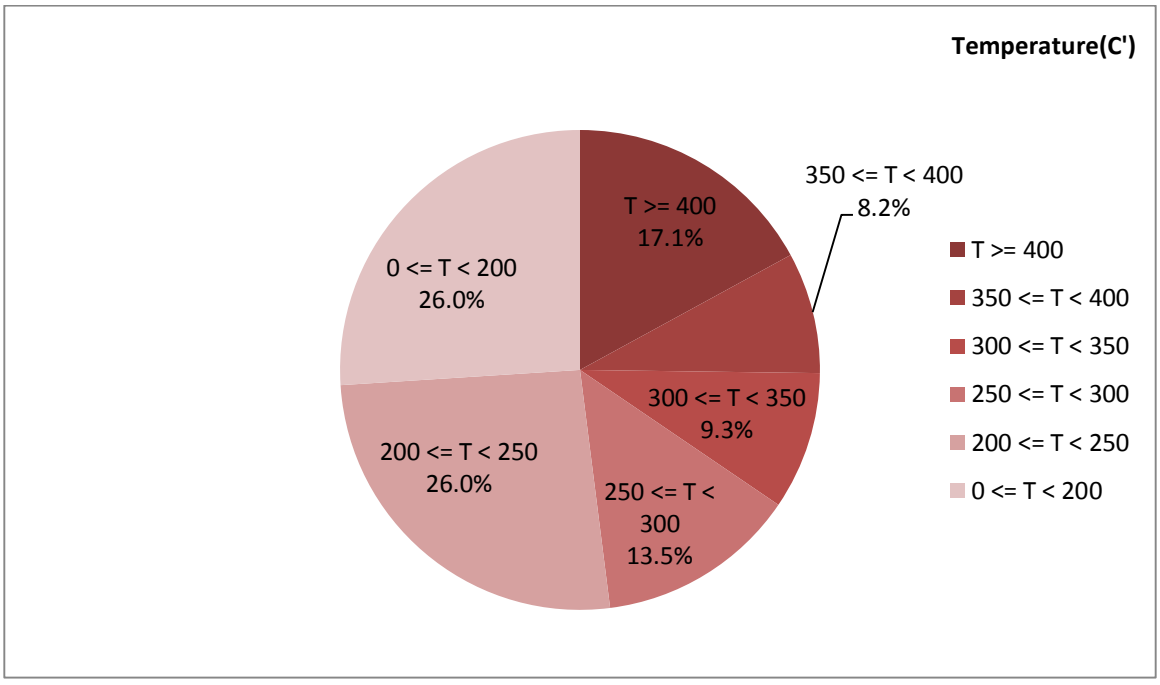


Figure 2-Temperature distribution over the working hours

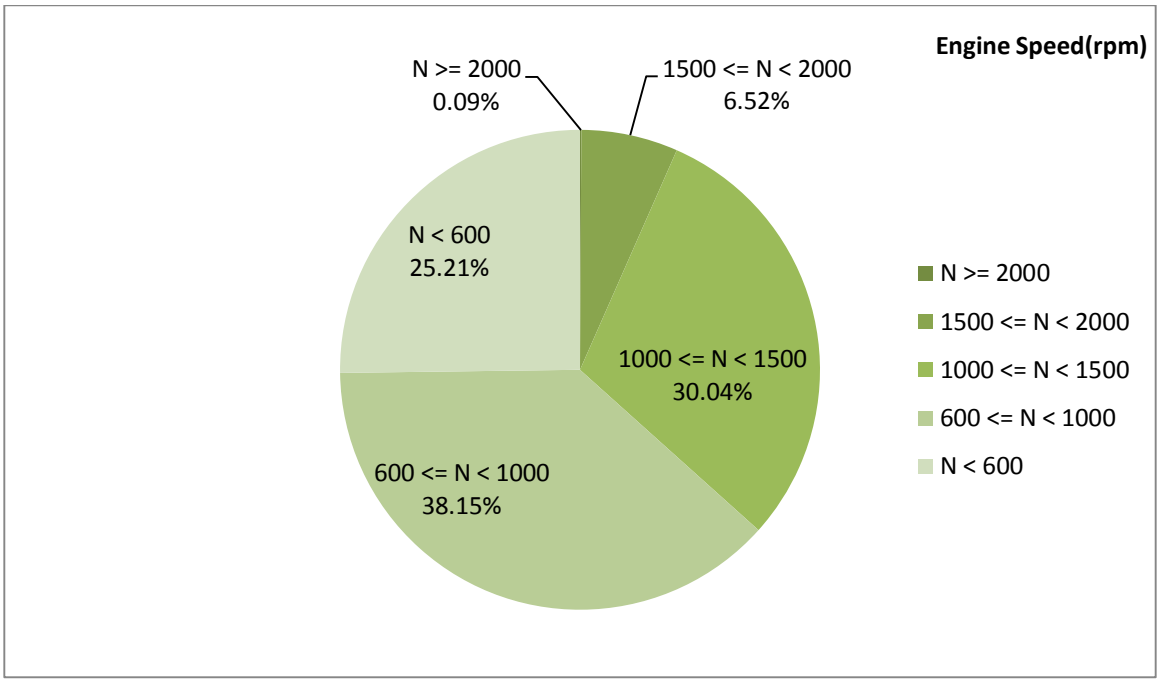


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
277.66	24.65	912

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
302	31.29	1036

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
646-50	201-0	2144-288

Detailed Pressure Analysis

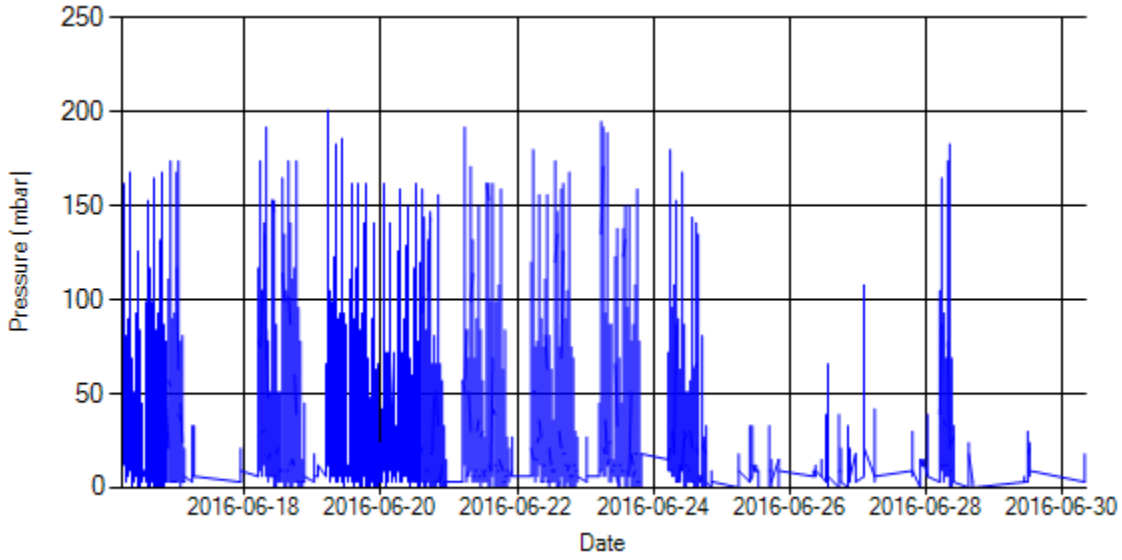


Figure 4- Pressure distribution over the period

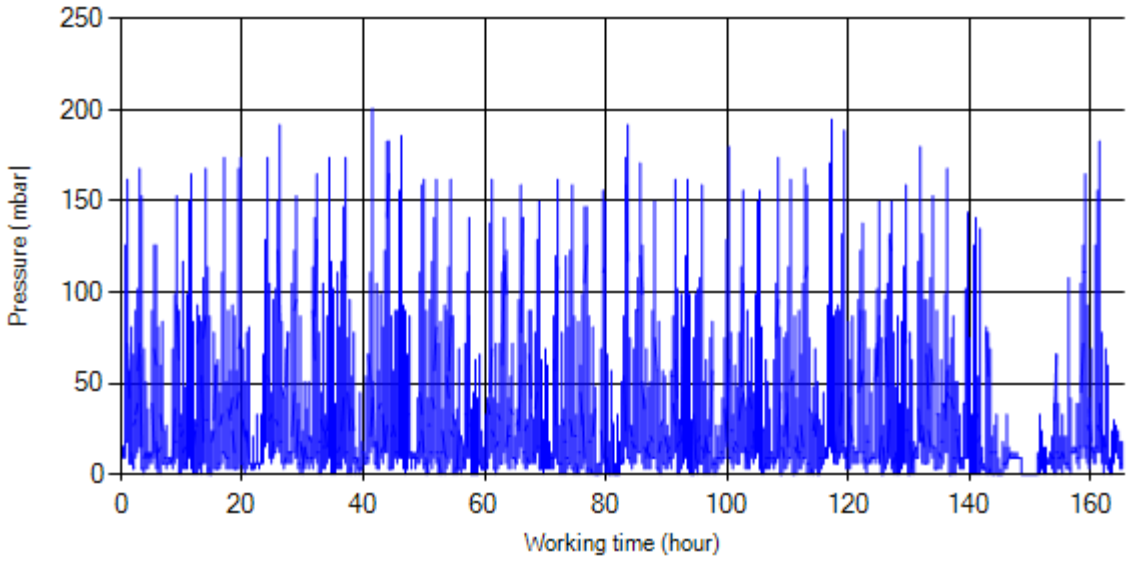


Figure 5- Pressure vs. working hours

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

Detailed Temperature Analysis

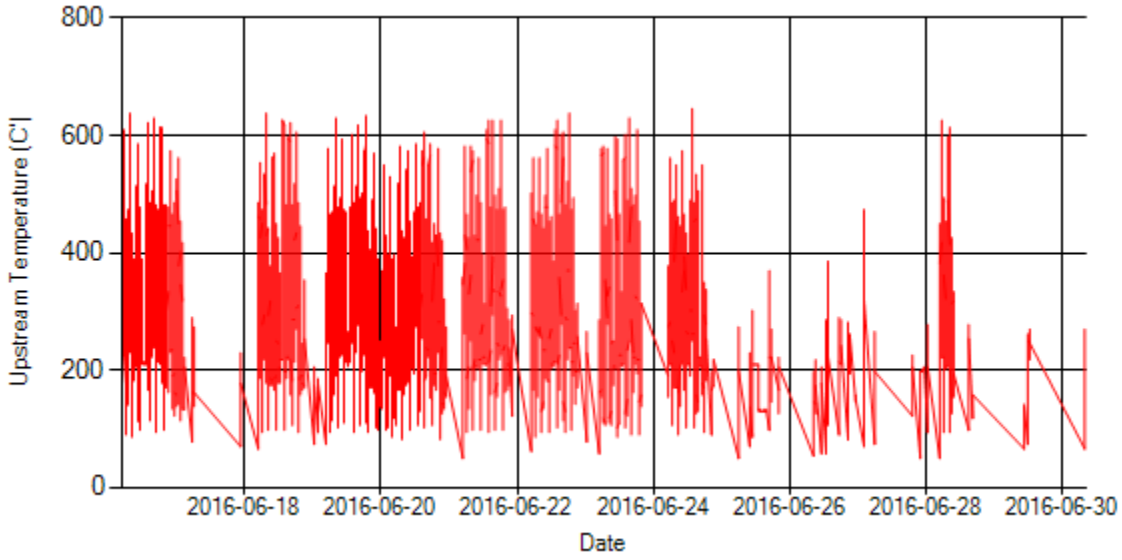


Figure 6- Temperature distribution over the period

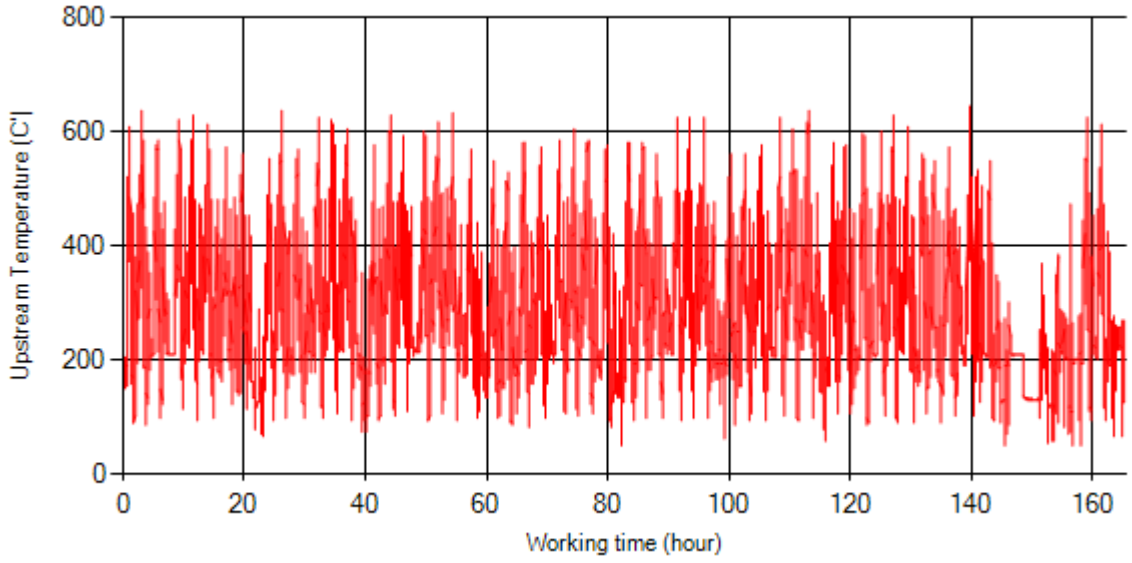


Figure 7- Temperature vs. working hours

Engine Speed Diagrams

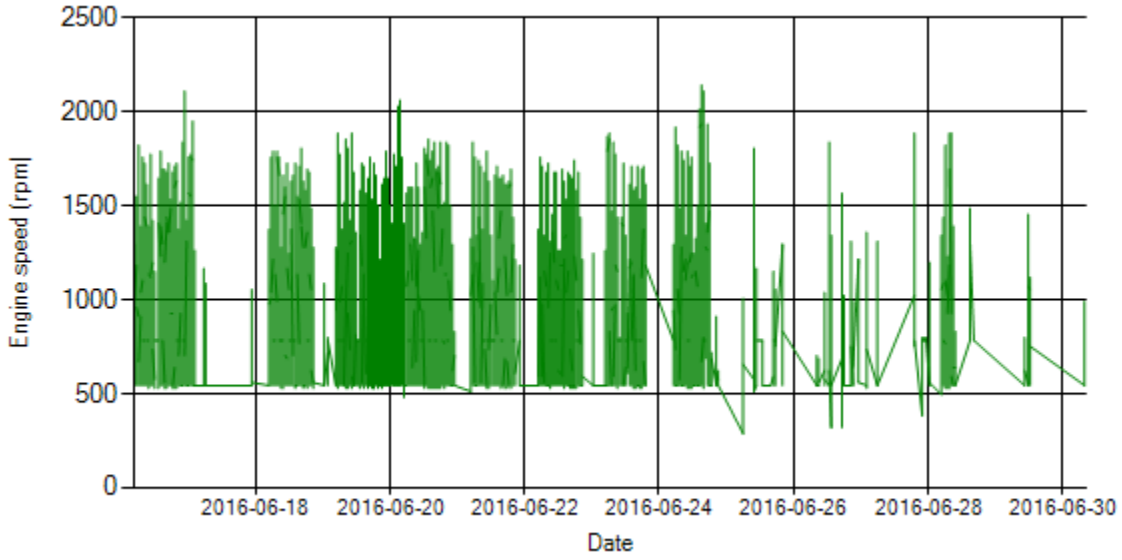


Figure 8- Engine speed distribution over the period

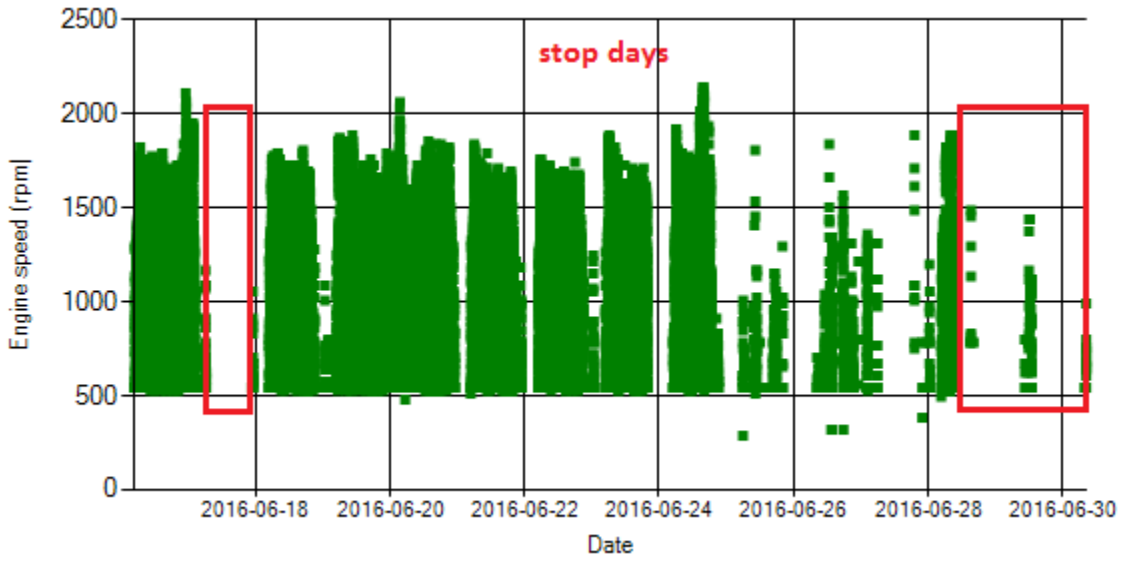


Figure 9- Engine speed diagram for calculating CPK's working days

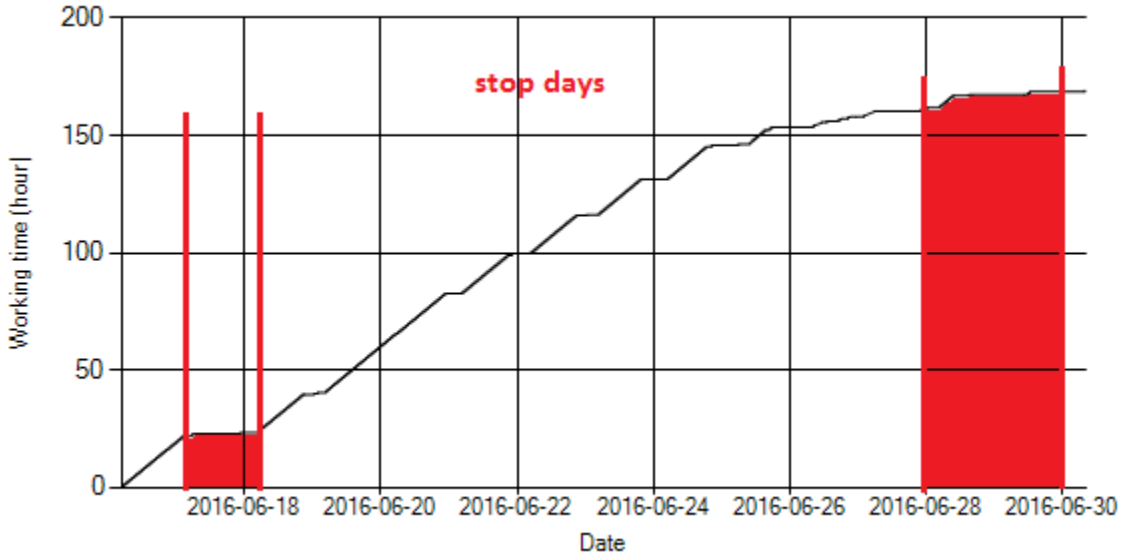


Figure 10- Time diagram for calculating CPK's working days

Notice: Data logger sampling time can be calculated from Figure 10. The lines parallel with Date axis show days without data logger data. As depicted in Figure 10 system was stationary for 3 days.

Pressure-Engine Speed diagrams

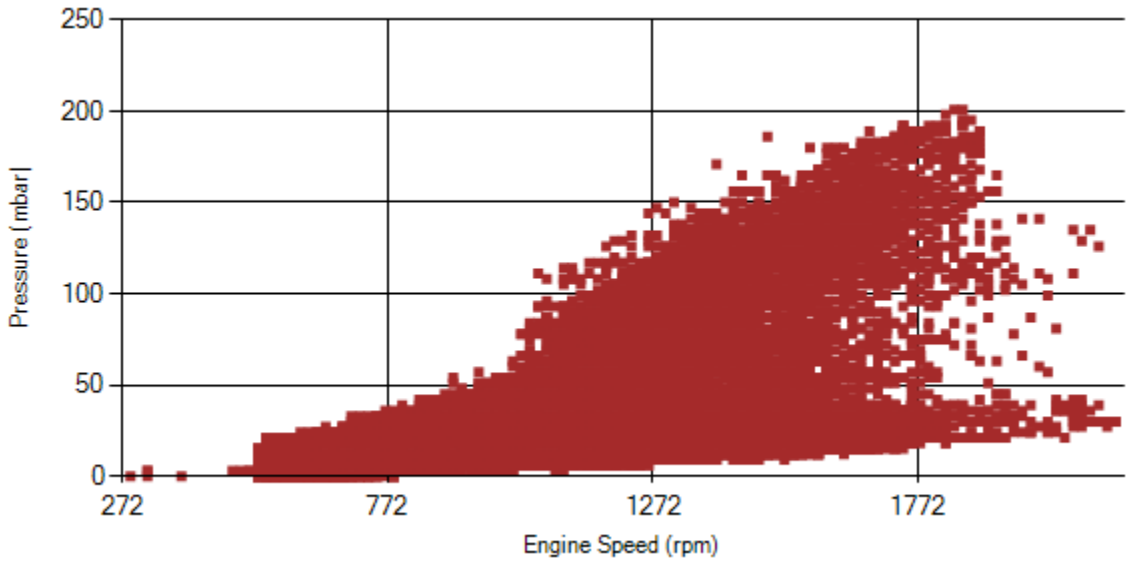


Figure 11- Pressure against engine speed

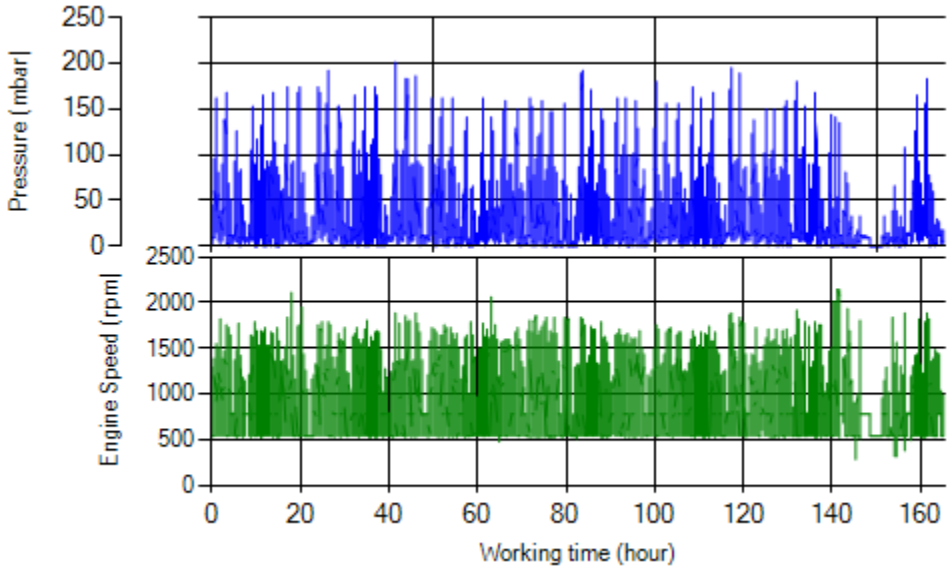


Figure 12- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

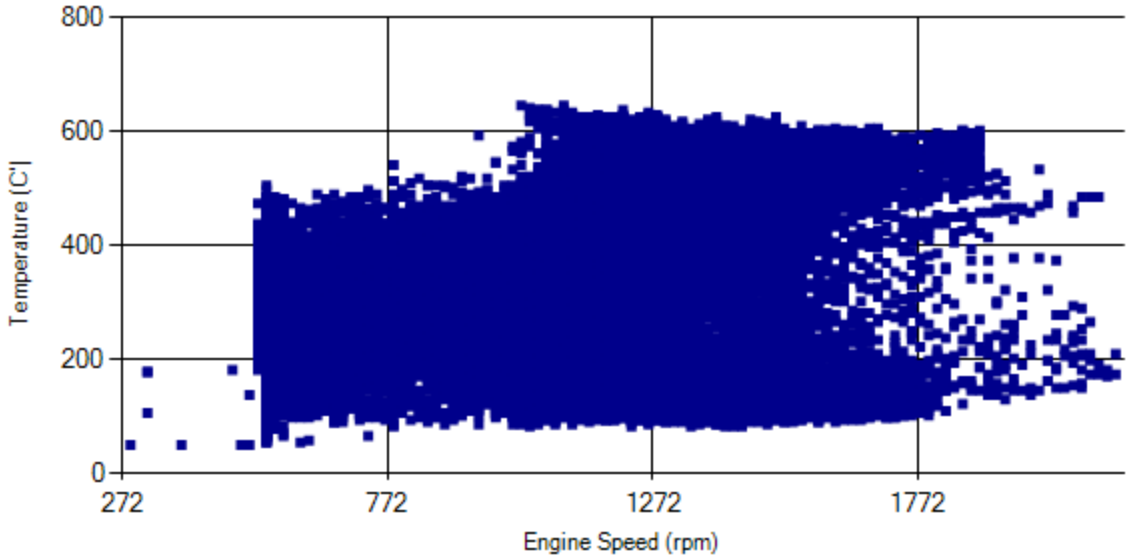


Figure 13- Temperature against engine speed

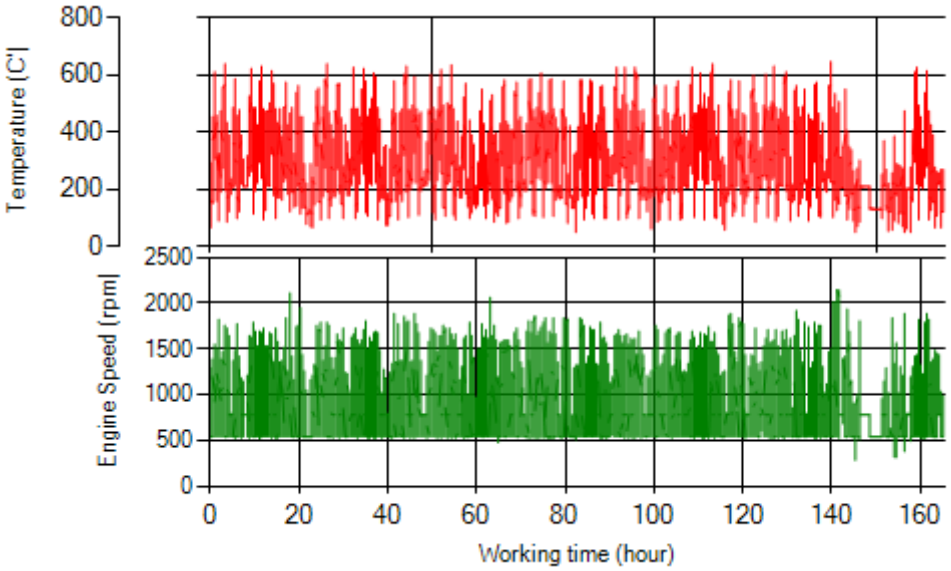


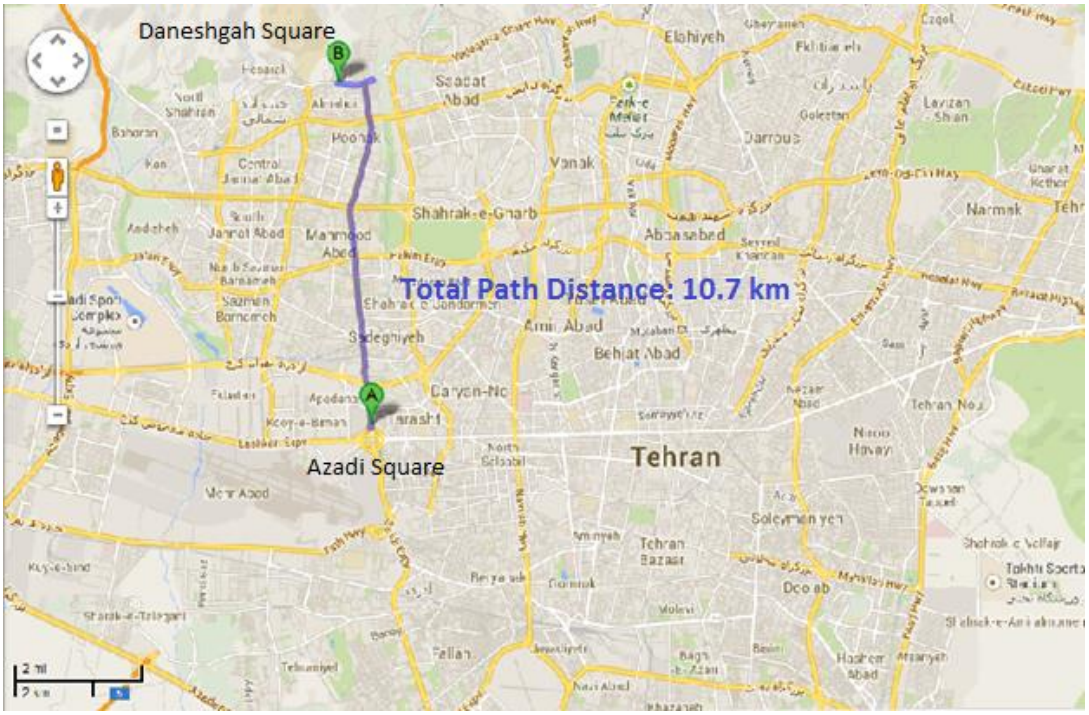
Figure 14- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 0.88% of working time, pressure was above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 17.1% of total working time temperature is above 400 ℃ and 25.3% above 350℃.

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

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/Jun/2016 – 15/Jun/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)	14221 km
Bus mileage over the period	2316 km
Working days over the period	13 days
Stop days	2 days
Data logger working days	13 days
Working hours over the period	193 hours 2 minutes
Average working hours per day (including stop days)	12 hours 52 minutes
Bus average speed	12 km/hr
idle speed time to all working time ration	65.54 %
Total Bus fuel consumption over the period	1505 lit
Fuel consumption per hour	7.79 lit/hr
Average fuel consumption	0.65 lit/km

Temperature, Pressure and Engine Speed Overview

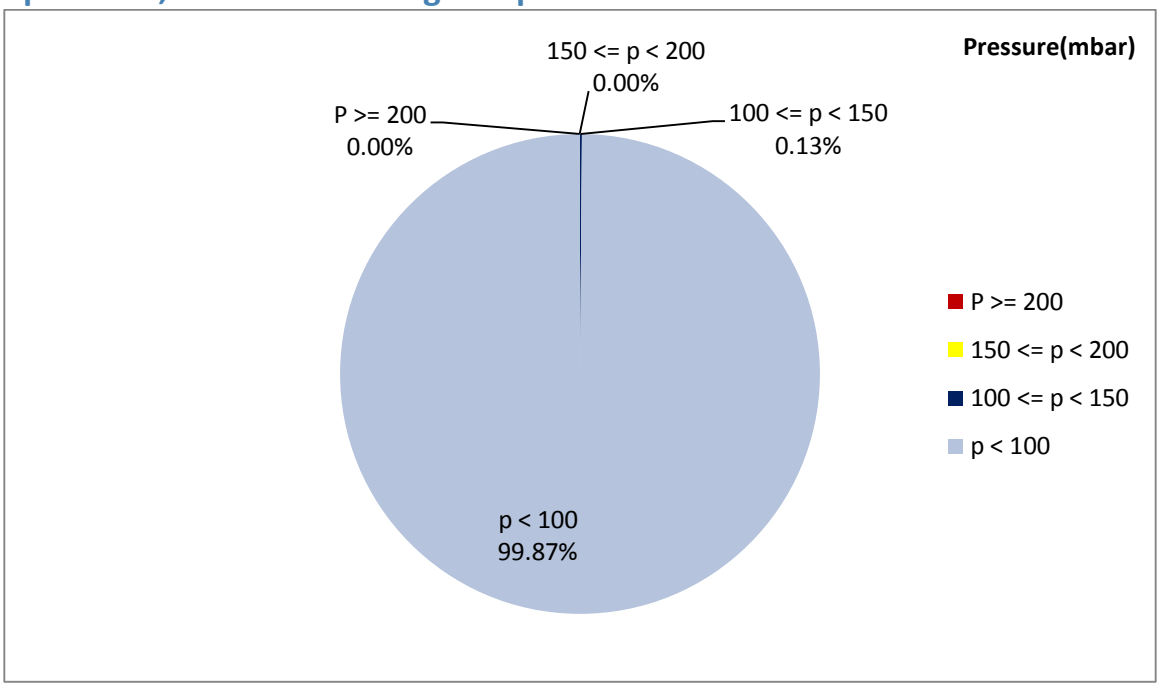


Figure 1- Pressure distribution over the working hours

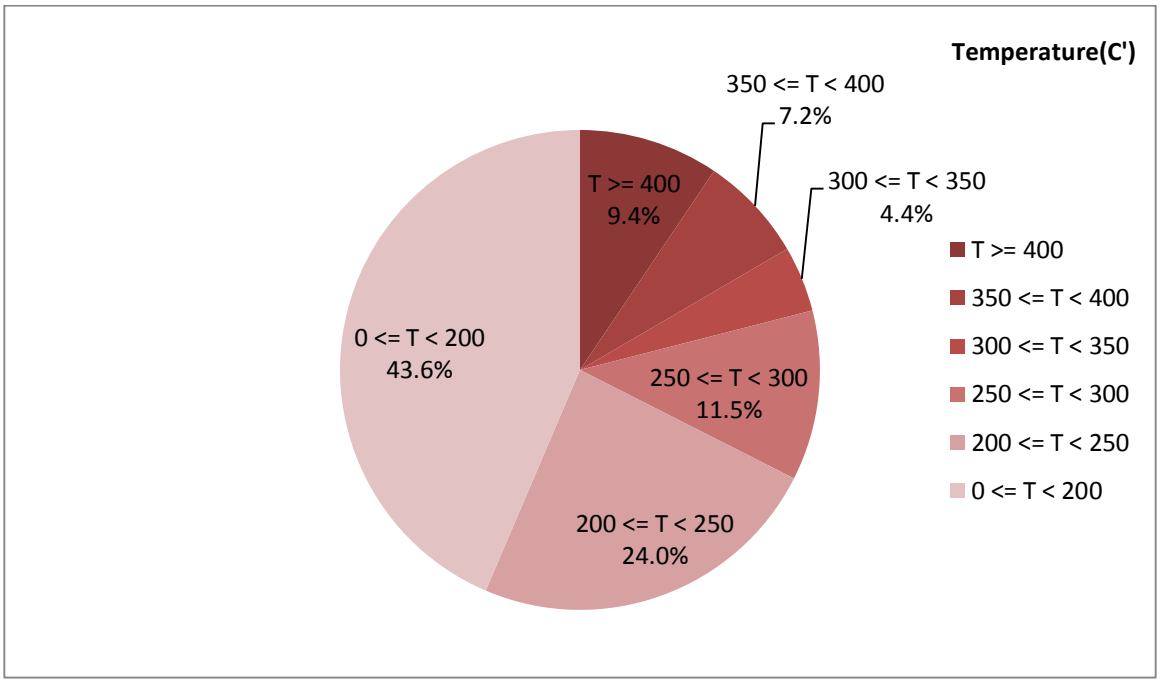


Figure 2-Temperature distribution over the working hours

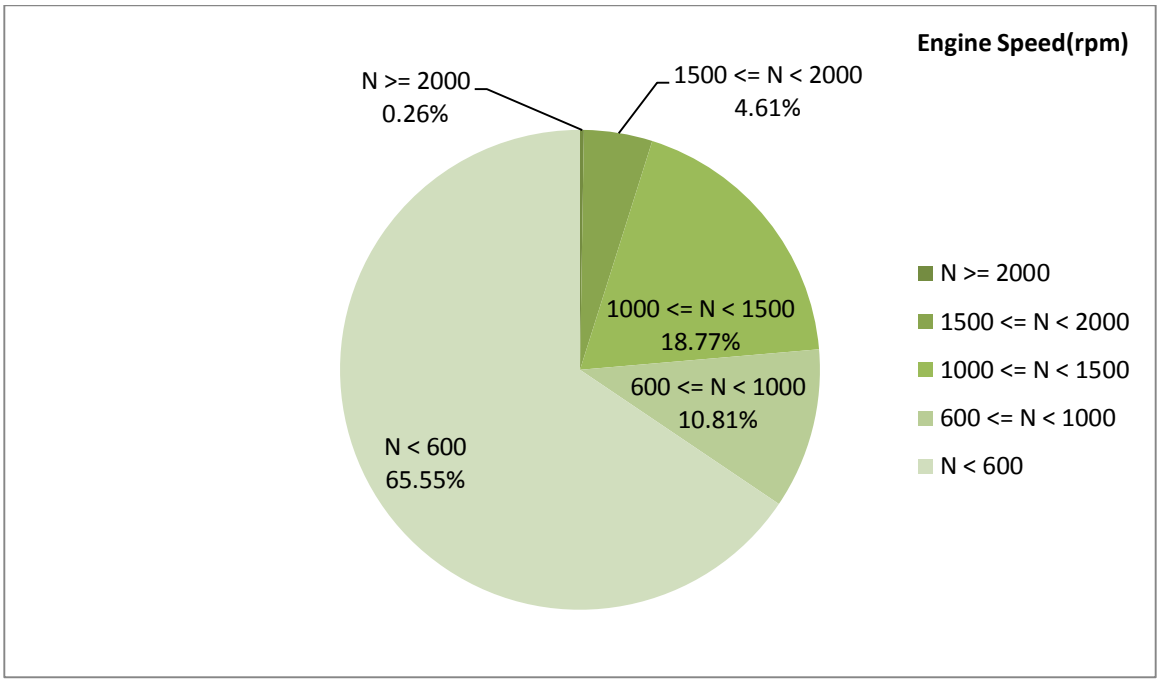


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
238.41	5.84	755

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
301.52	16.92	1153

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
522-50	111-0	2224-256

Detailed Pressure Analysis

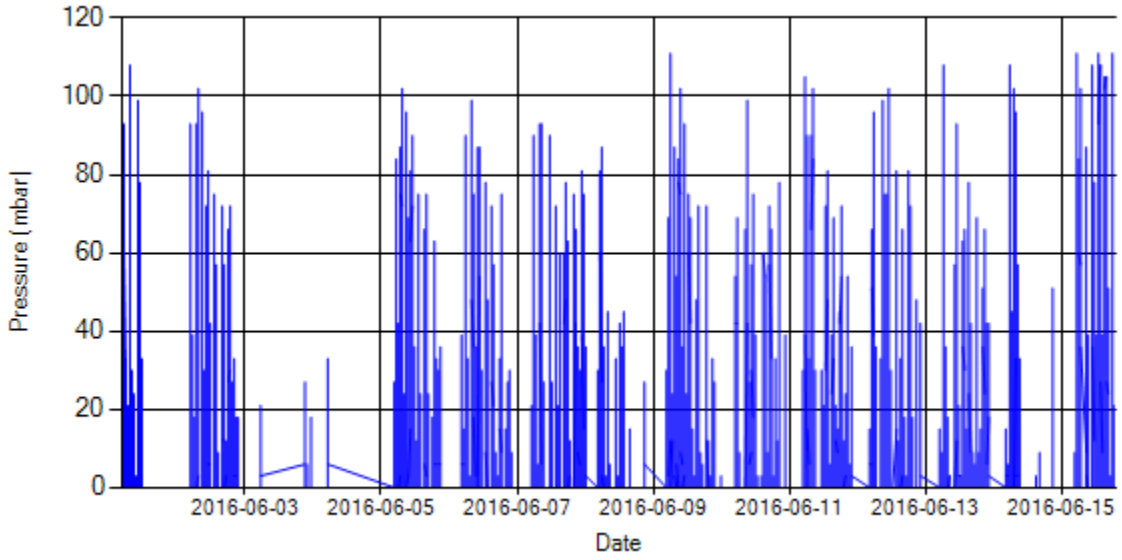


Figure 4- Pressure distribution over the period

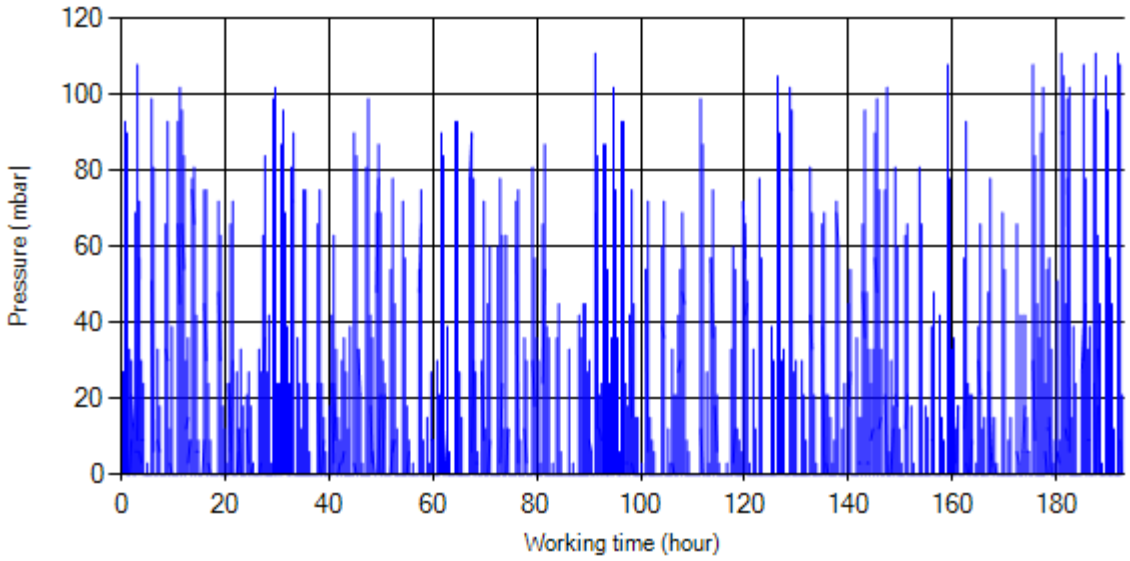


Figure 5- Pressure vs. working hours

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

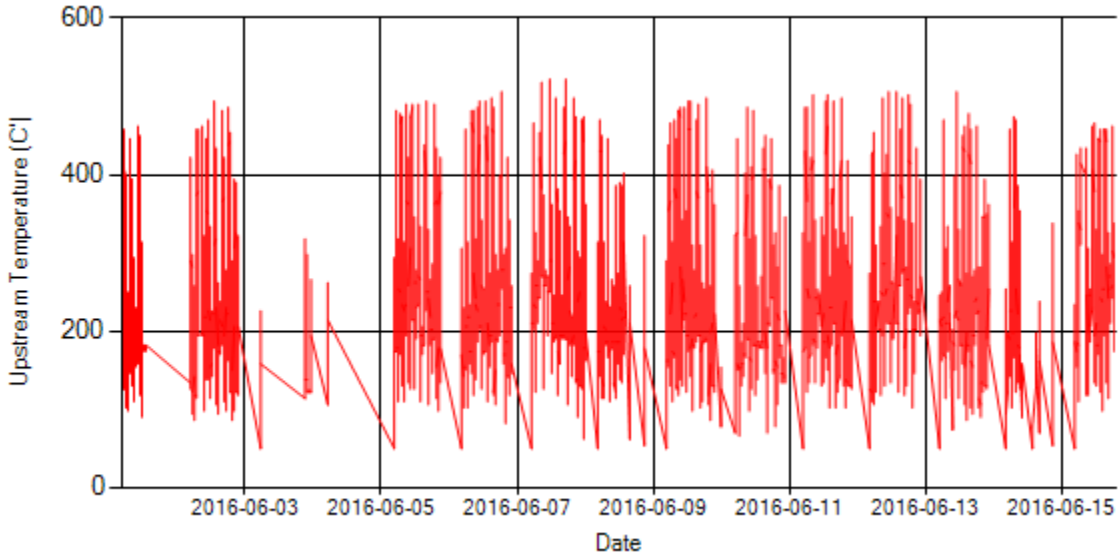


Figure 6- Temperature distribution over the period

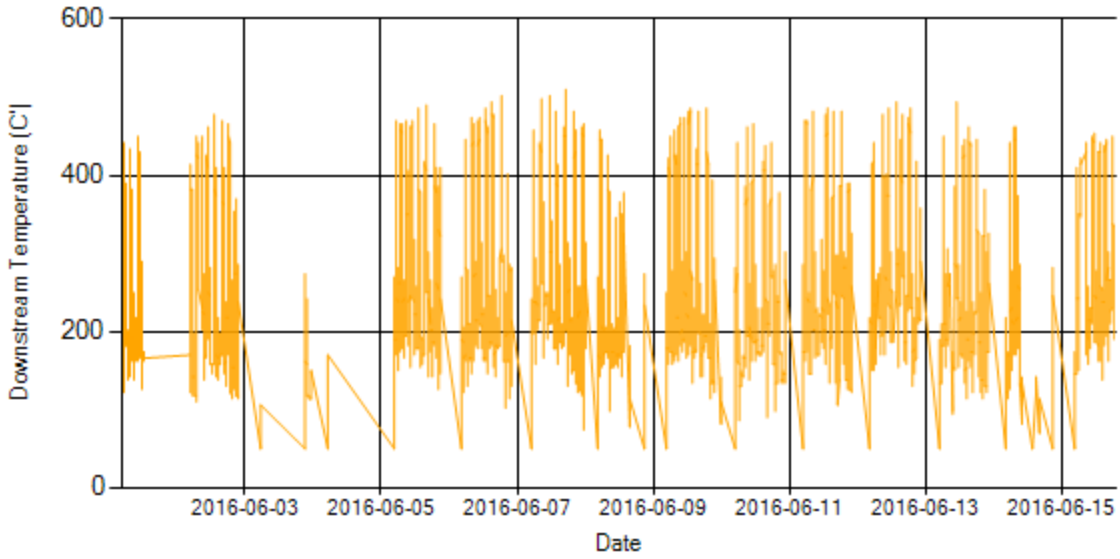


Figure 7- Temperature distribution over the period

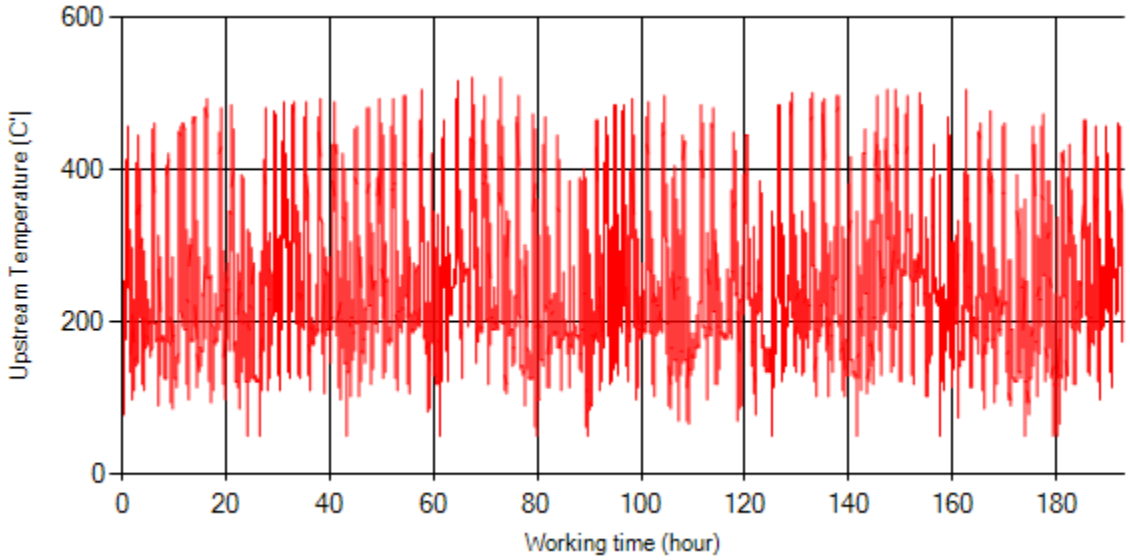


Figure 8- Temperature vs. working hours

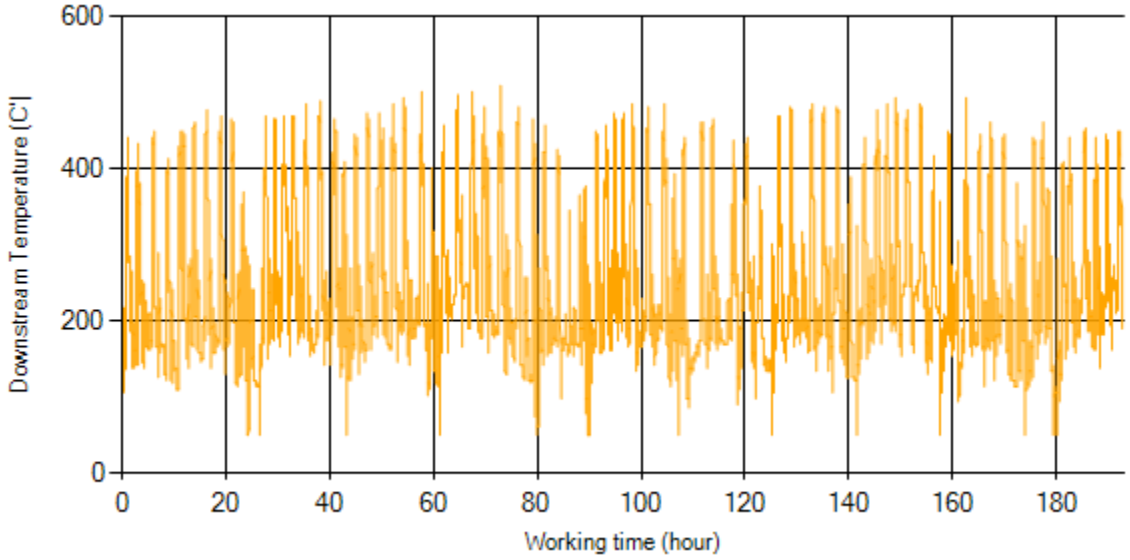


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

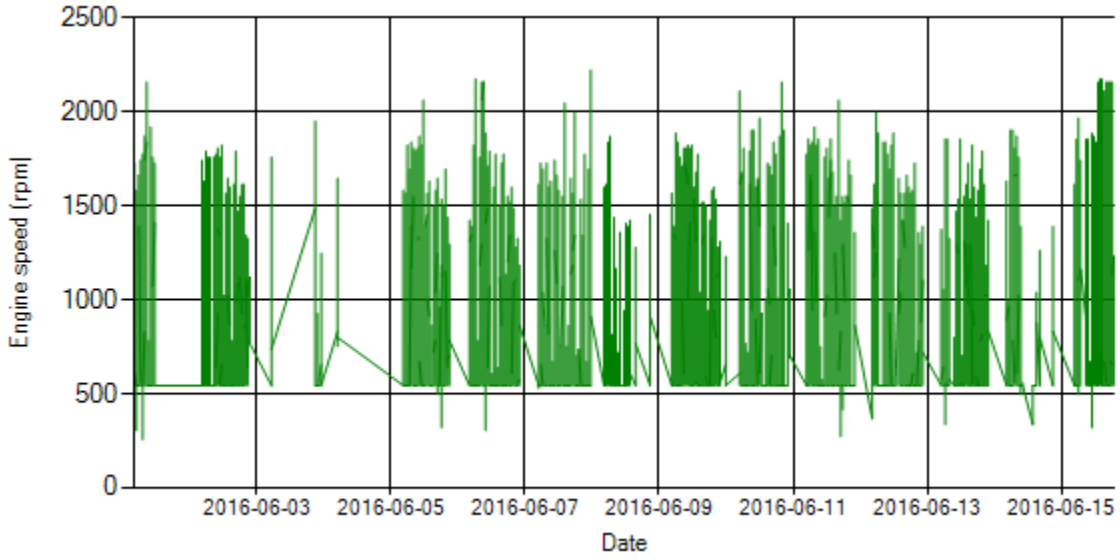


Figure 10- Engine speed distribution over the period

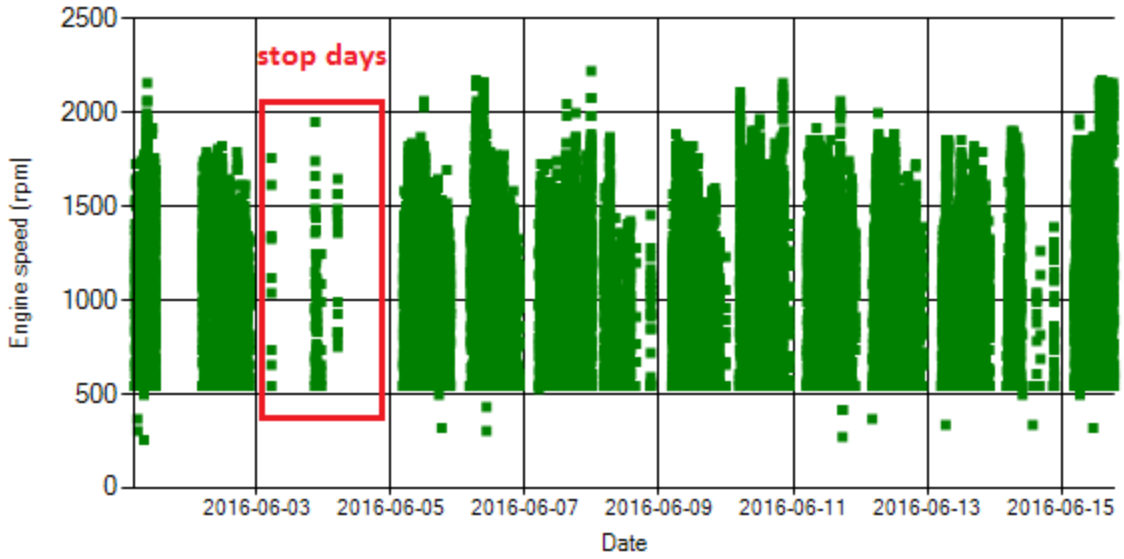


Figure 11- Engine speed diagram for calculating CPK's working days

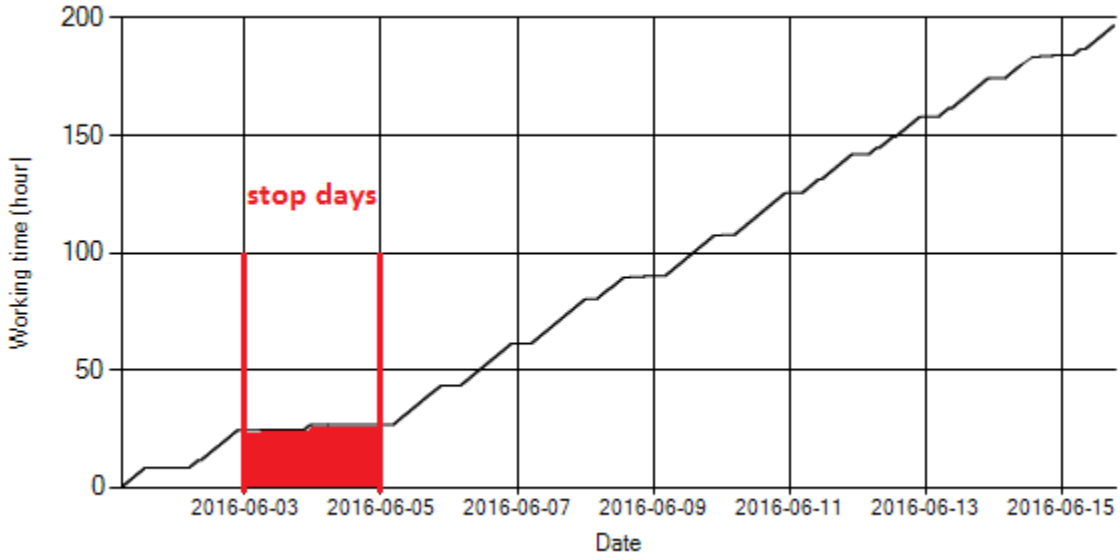


Figure 12- Time diagram for calculating CPK's working days

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

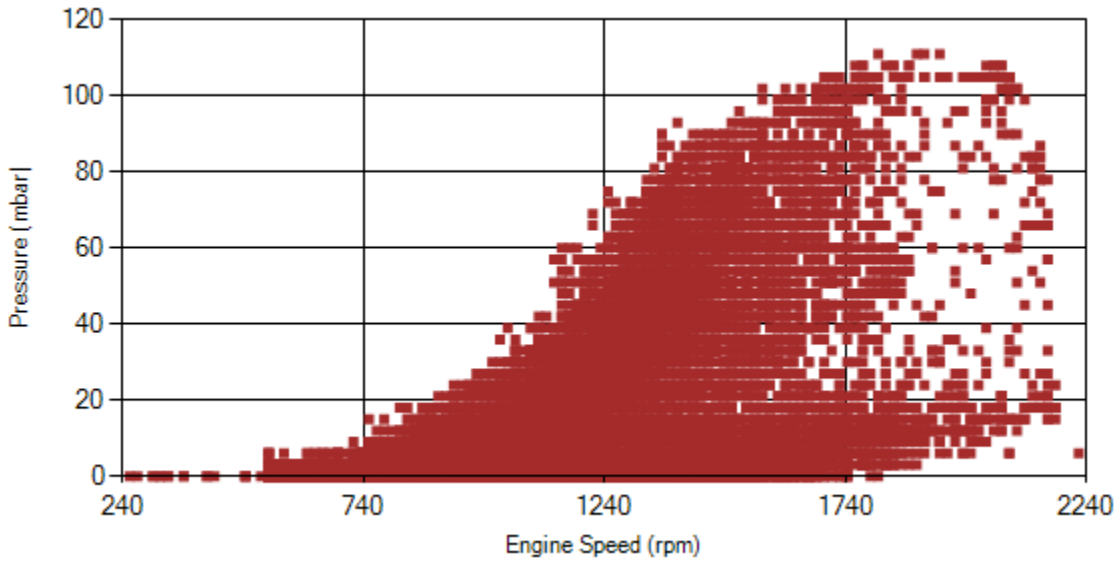


Figure 13- Pressure against engine speed

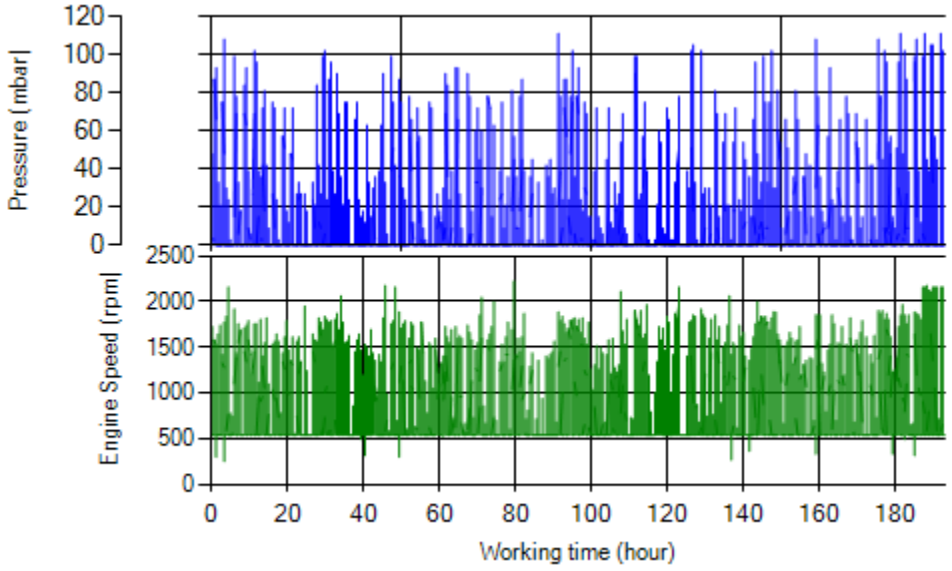


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

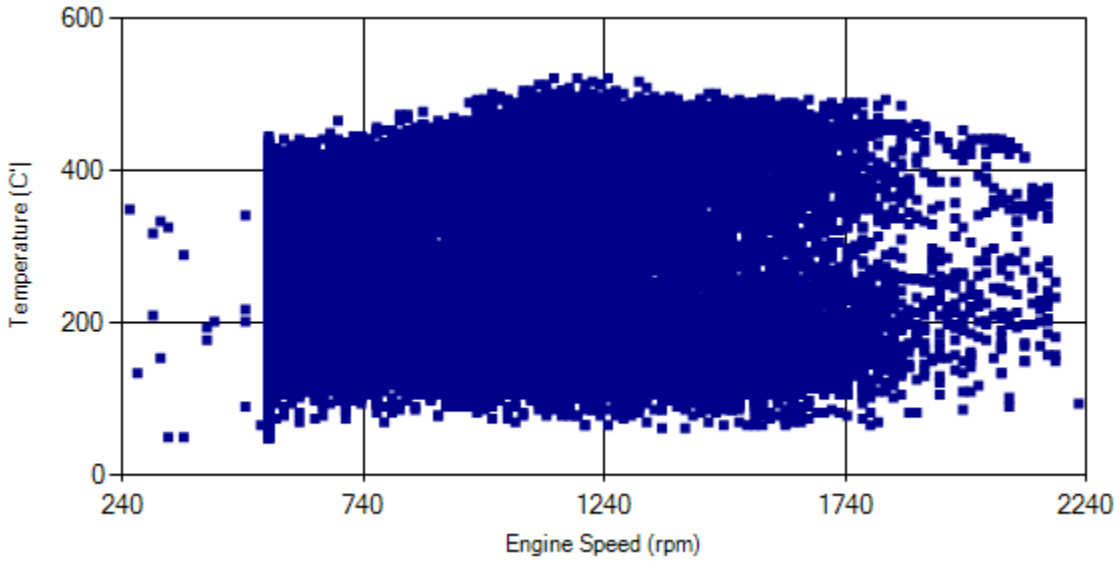


Figure 15- Temperature against engine speed

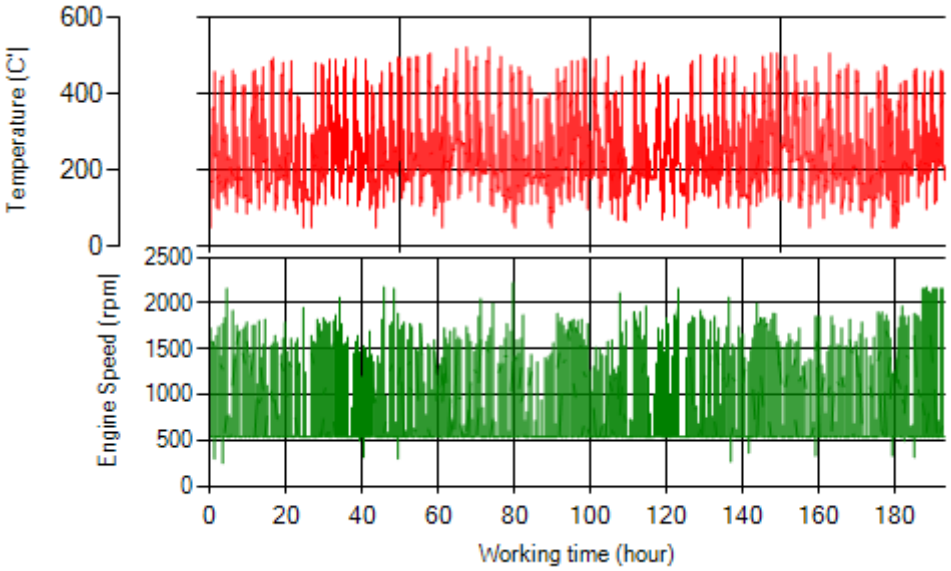


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 0.13% 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 16.6% of total working-time temperature is above 350 ℃ and 21% 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/Jun/2016 – 30/Jun/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)	16202 km
Bus mileage over the period	1981 km
Working days over the period	12 days
Stop days	3 days
Data logger working days	12 days
Working hours over the period	163 hours 47 minutes
Average working hours per day (including stop days)	10 hours 55 minutes
Bus average speed	12.1 km/hr
idle speed time to all working time ration	65.63 %
Total Bus fuel consumption over the period	1288 lit
Fuel consumption per hour	7.86 lit/hr
Average fuel consumption	0.65 lit/km

Temperature, Pressure and Engine Speed Overview

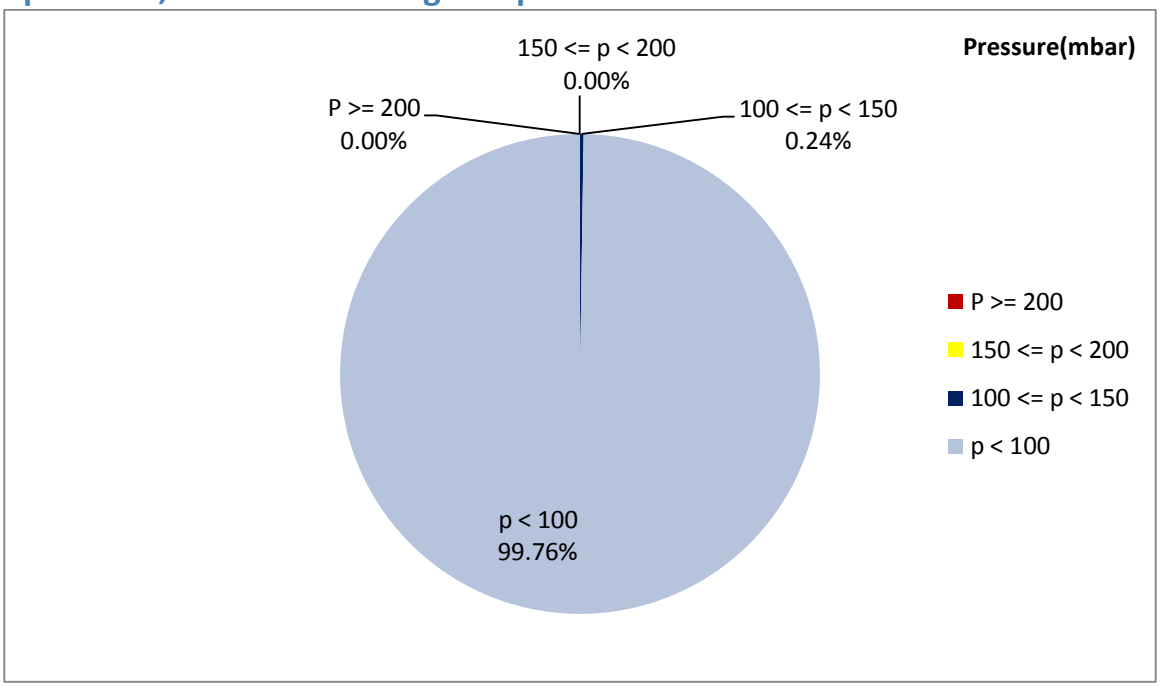


Figure 1- Pressure distribution over the working hours

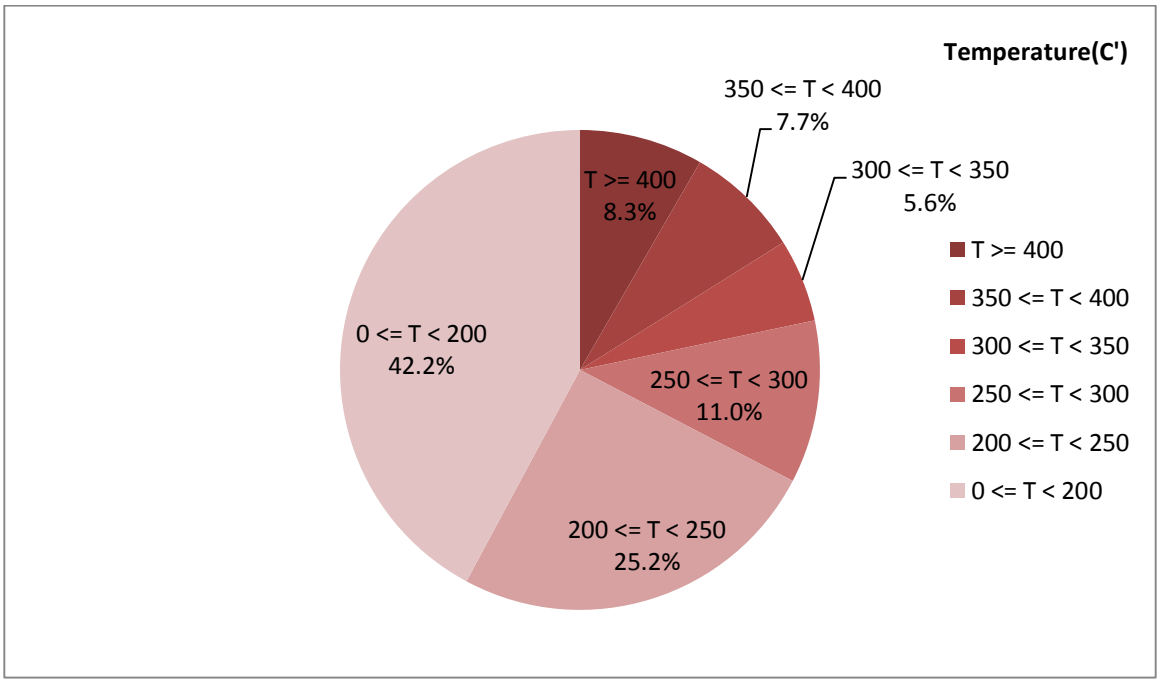


Figure 2-Temperature distribution over the working hours

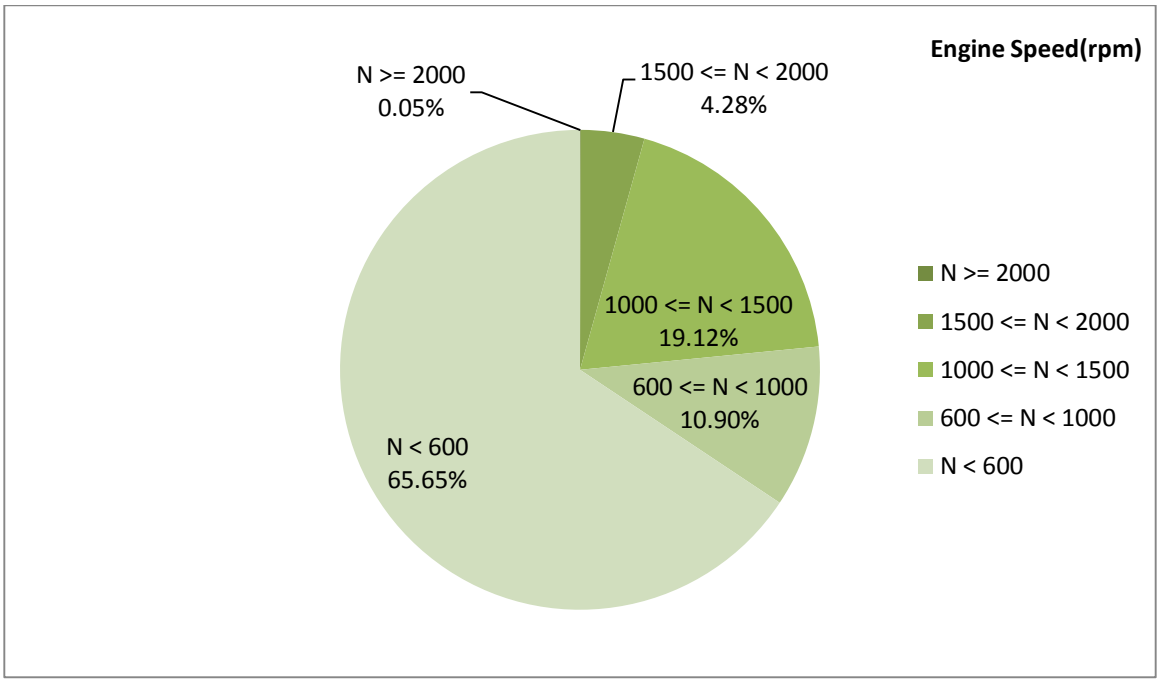


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
238.6	6.35	751

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
302.82	18.46	1145

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
510-50	117-0	2208-256

Detailed Pressure Analysis

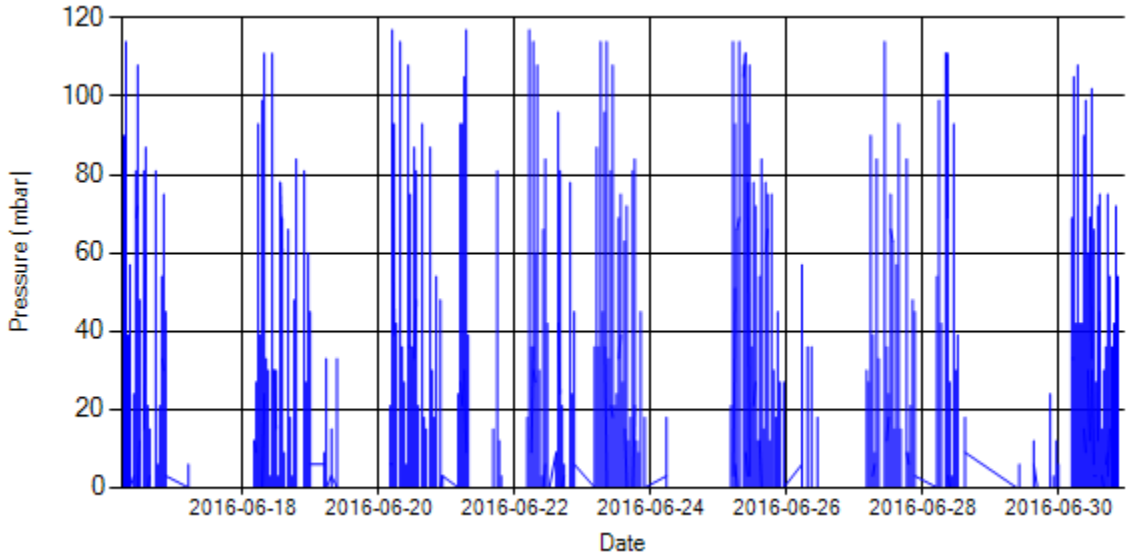


Figure 4- Pressure distribution over the period

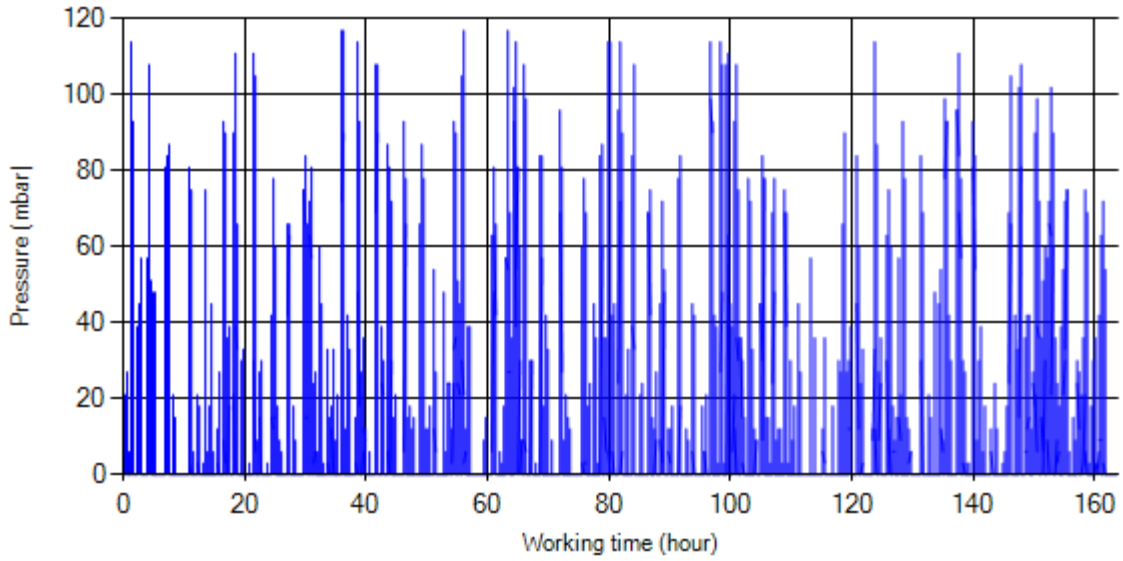


Figure 5- Pressure vs. working hours

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

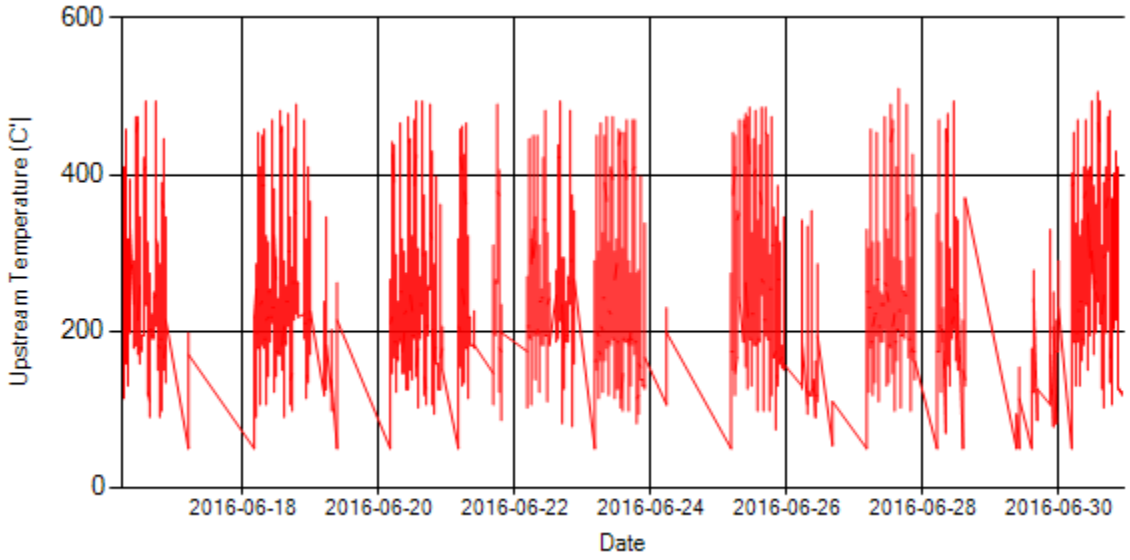


Figure 6- Temperature distribution over the period

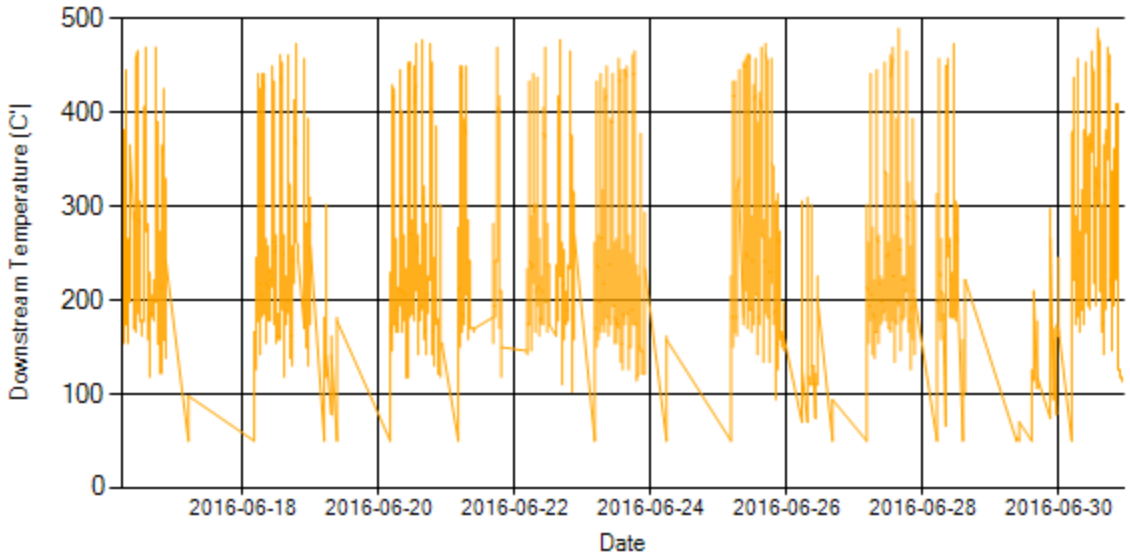


Figure 7- Temperature distribution over the period

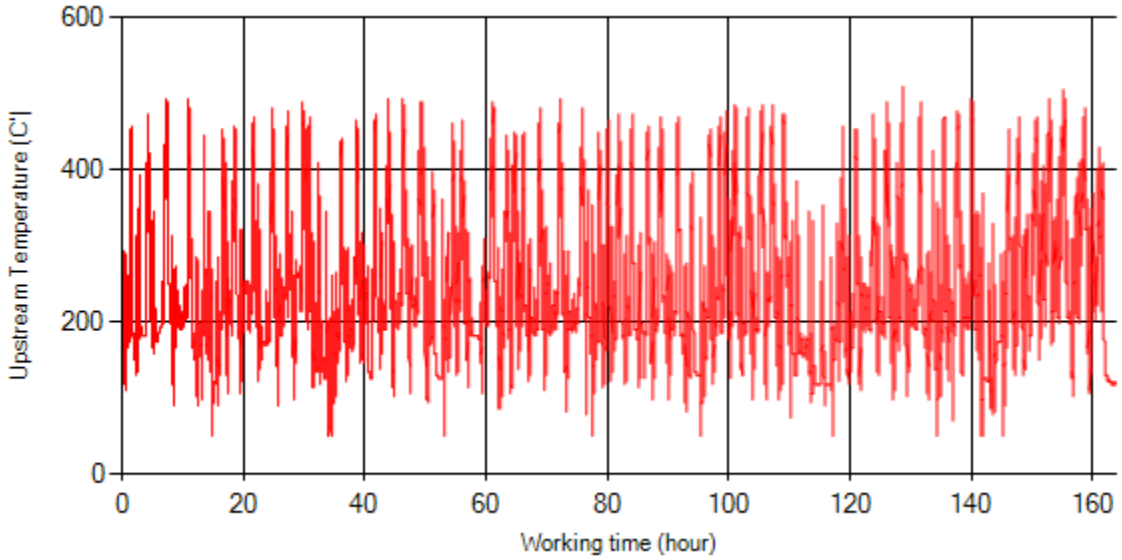


Figure 8- Temperature vs. working hours

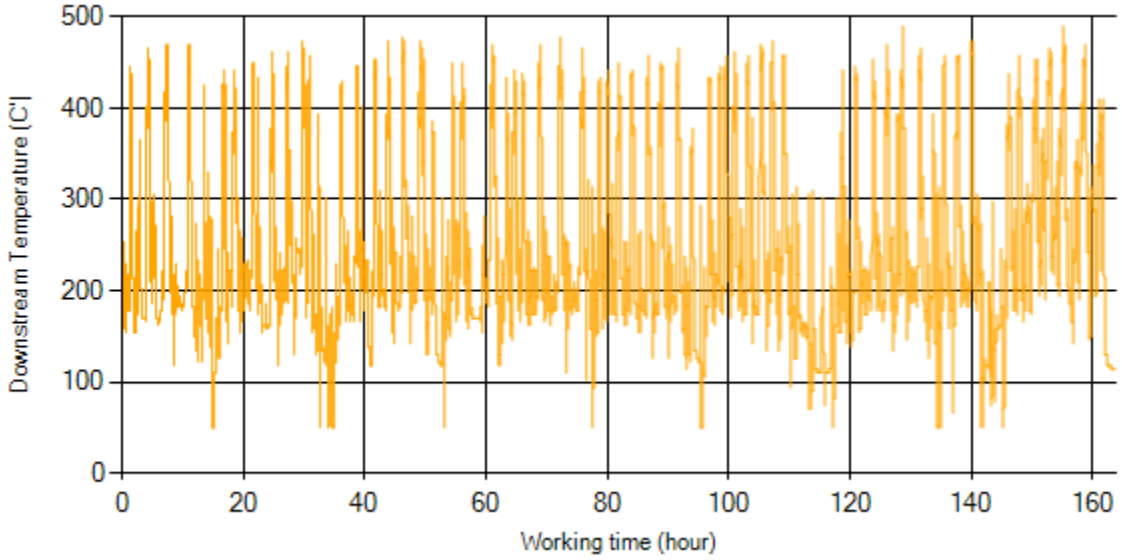


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

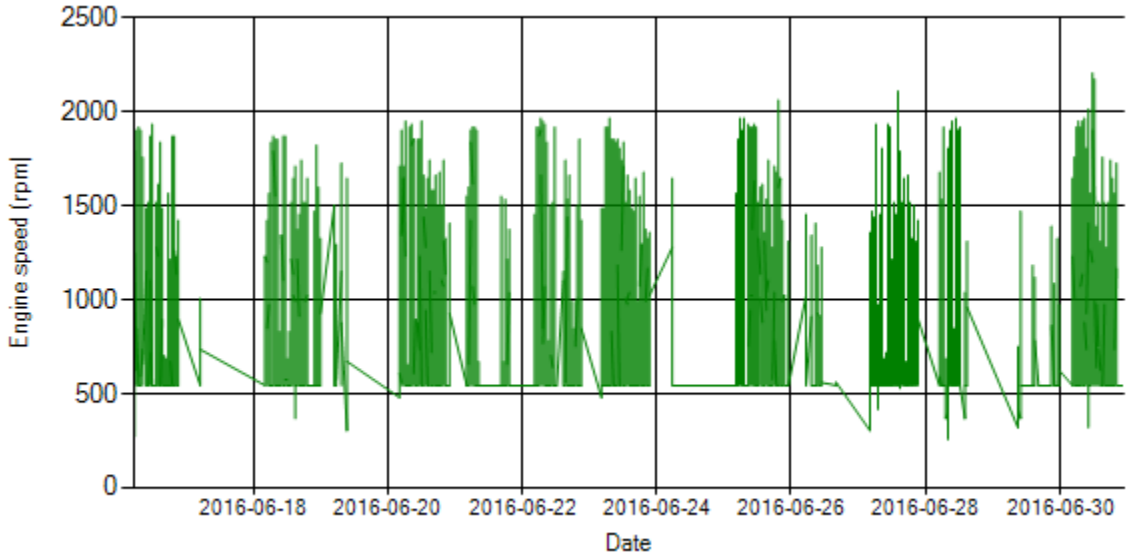


Figure 10- Engine speed distribution over the period

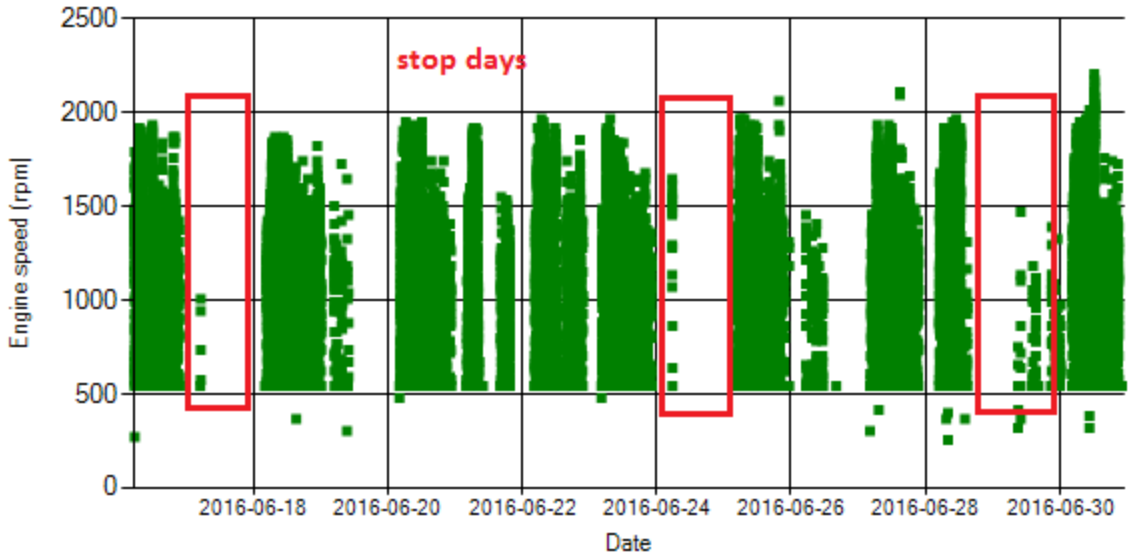


Figure 11- Engine speed diagram for calculating CPK's working days

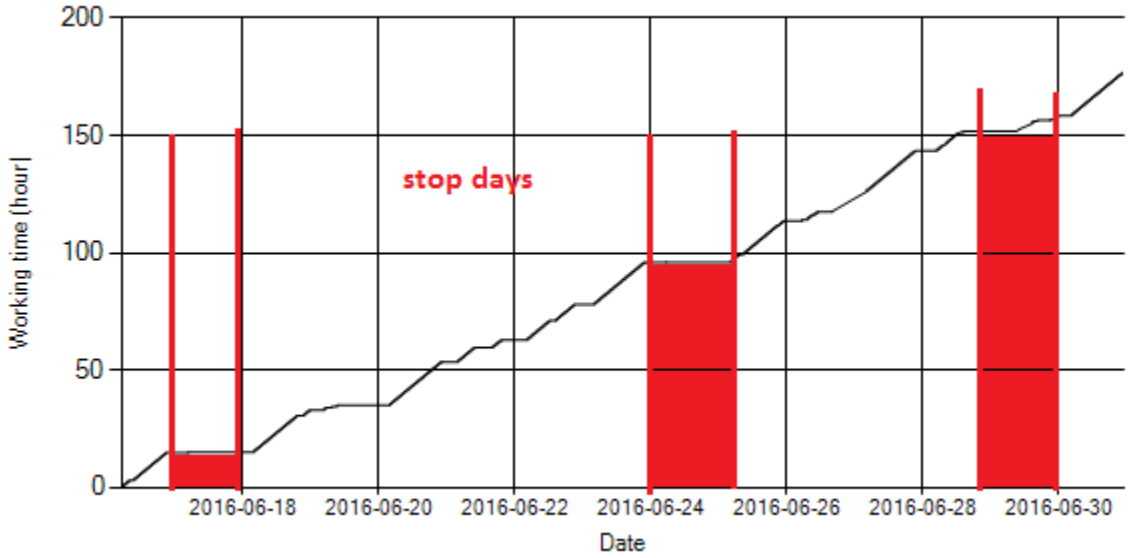


Figure 12- Time diagram for calculating CPK's working days

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

Pressure-Engine Speed diagrams

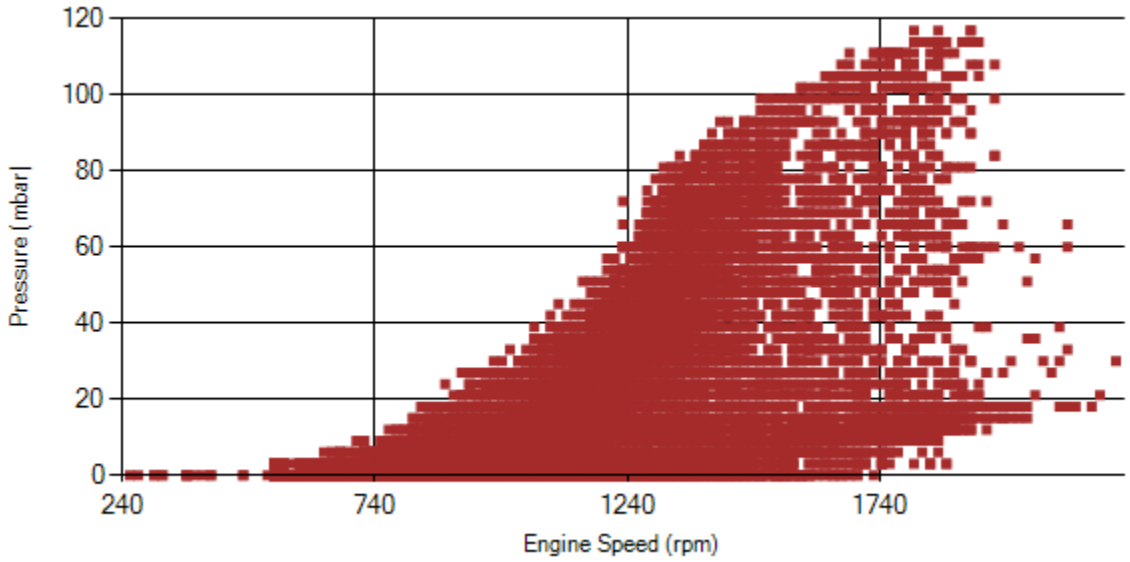


Figure 13- Pressure against engine speed

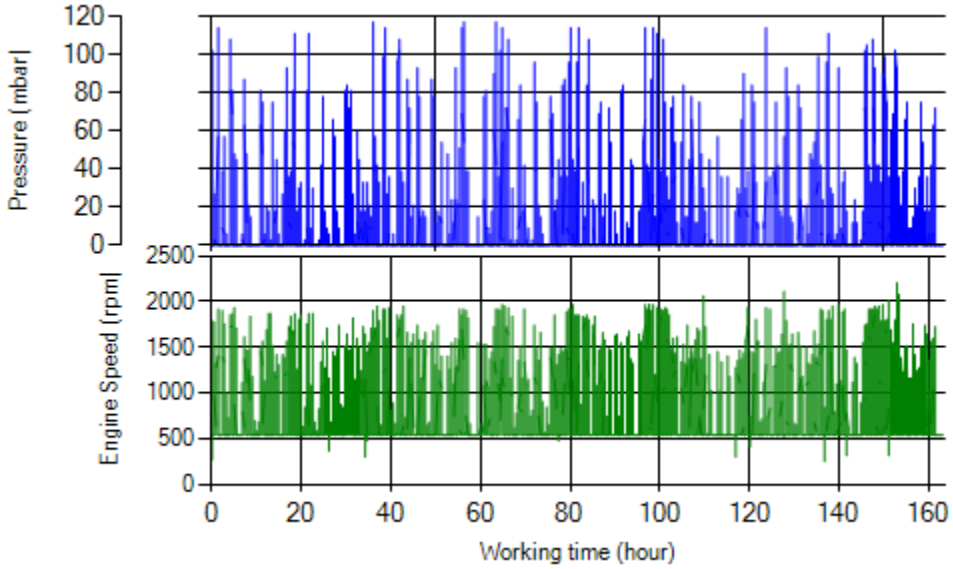


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

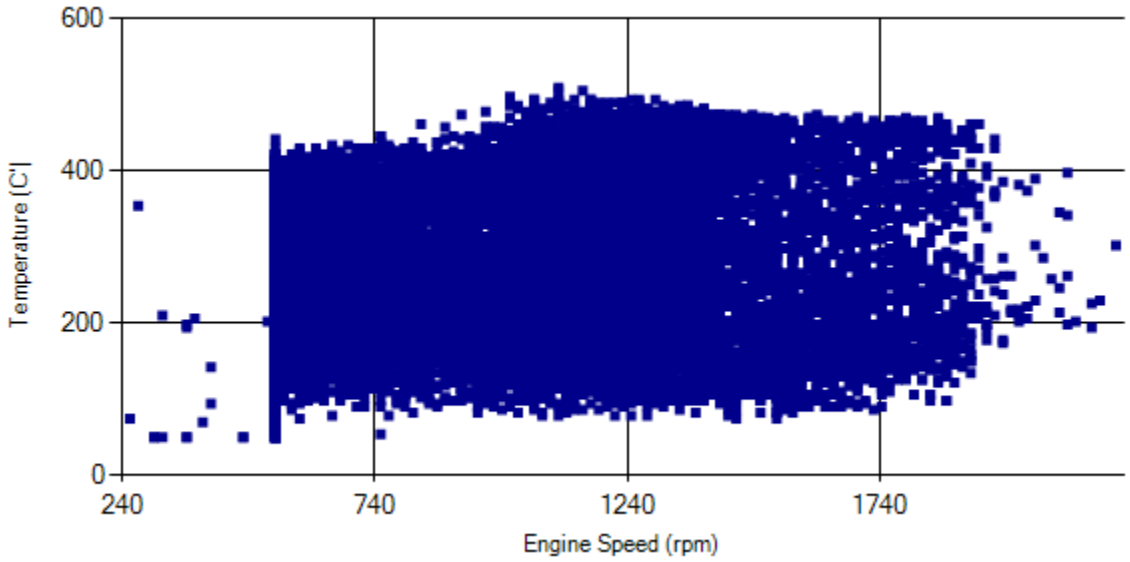


Figure 15- Temperature against engine speed

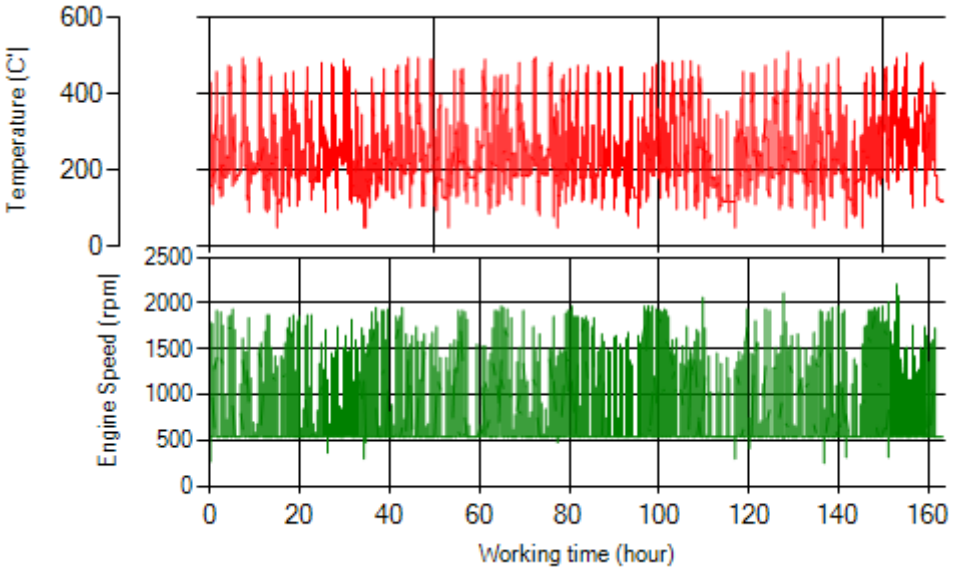


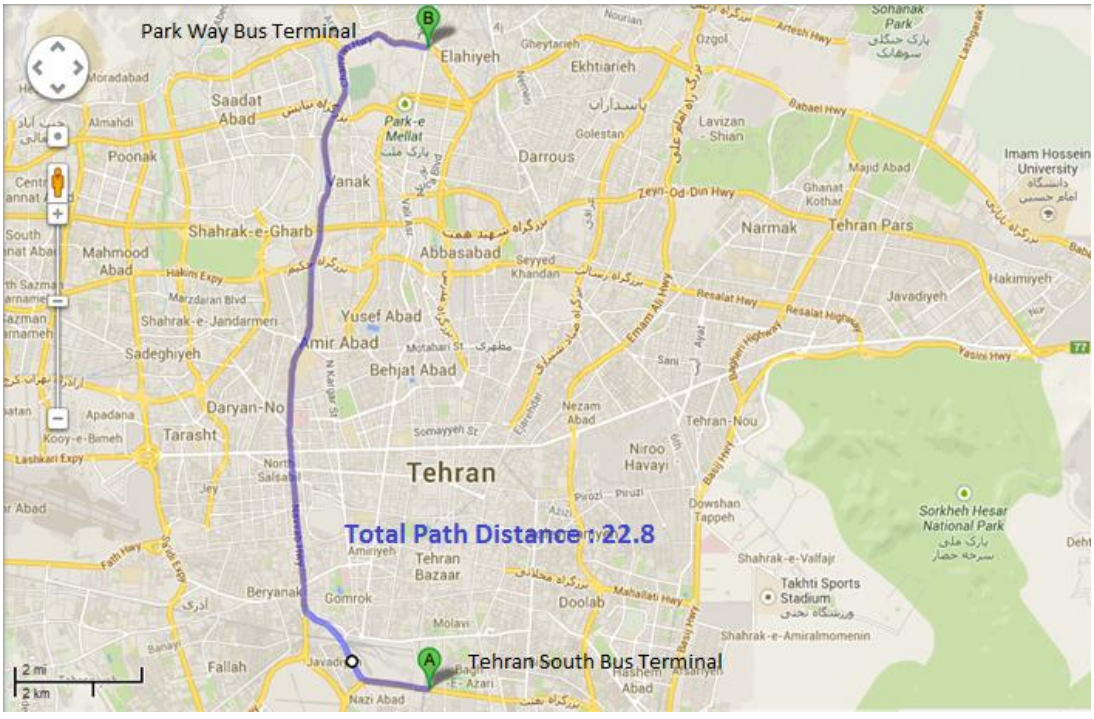
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in figure 1, 0.4% 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 16% of total working-time temperature is above 350 ℃ and 32.6% 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)



ASA Azmoon Sanat Arvin	Document Number: DPF2016061/1 Date: 04/Jul/2016

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/Jun/2016- 15/Jun/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 2016-02-03 for the first time.
Dosing status	Dosing value has been kept constant from installation date until now.

Notice: Due to data logger problem, no data was available during this period.

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/Jun/2016- 30/Jun/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 2016-02-03 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)	- km
Bus mileage over the period	1203 km
Working days over the period	7 days
Stop days	8 days
Data logger working days	7 days
Working hours over the period	83 hours 1 minutes
Average working hours per day (including stop days)	6 hours 55 minutes
Bus average speed	14.5 km/hr
idle speed time to all working time ration	53.94 %
Total Bus fuel consumption over the period	701 lit
Fuel consumption per hour	0 lit/hr
Average fuel consumption	0.57 lit/km
Total Bus additive consumption over the period	0.335 lit
Average additive consumption	278.5 cc/km
Additive consumption to fuel ration	478 cc/1000lit

Temperature, Pressure and Engine Speed Overview

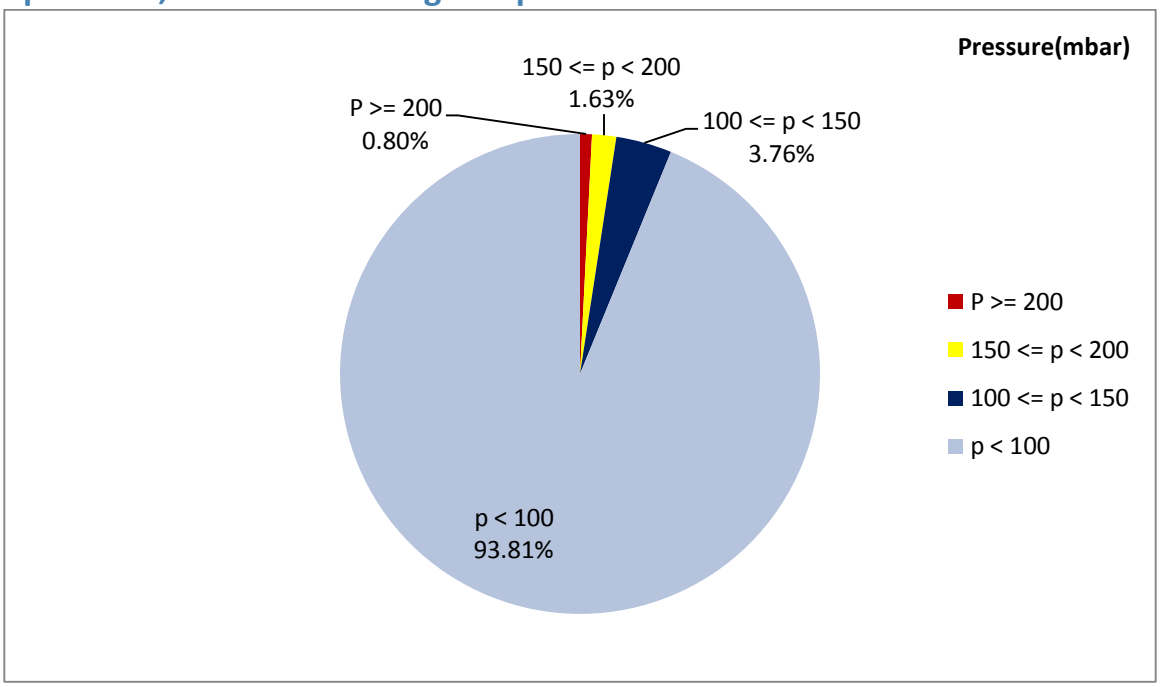


Figure 1- Pressure distribution over the working hours

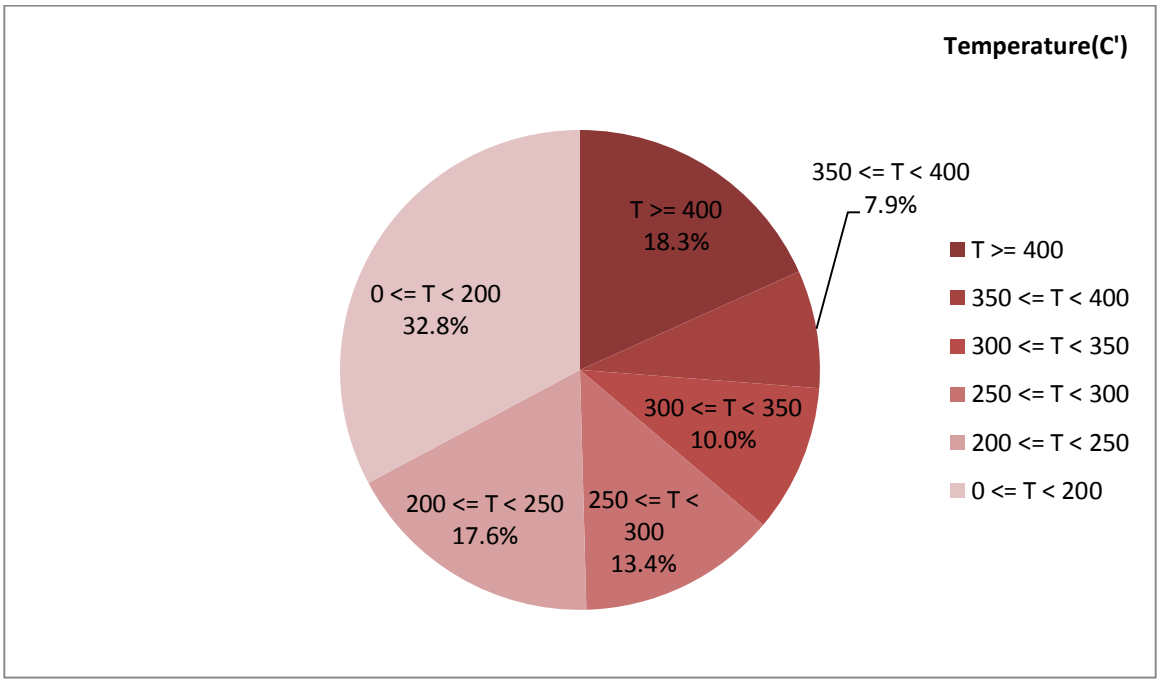


Figure 2-Temperature distribution over the working hours

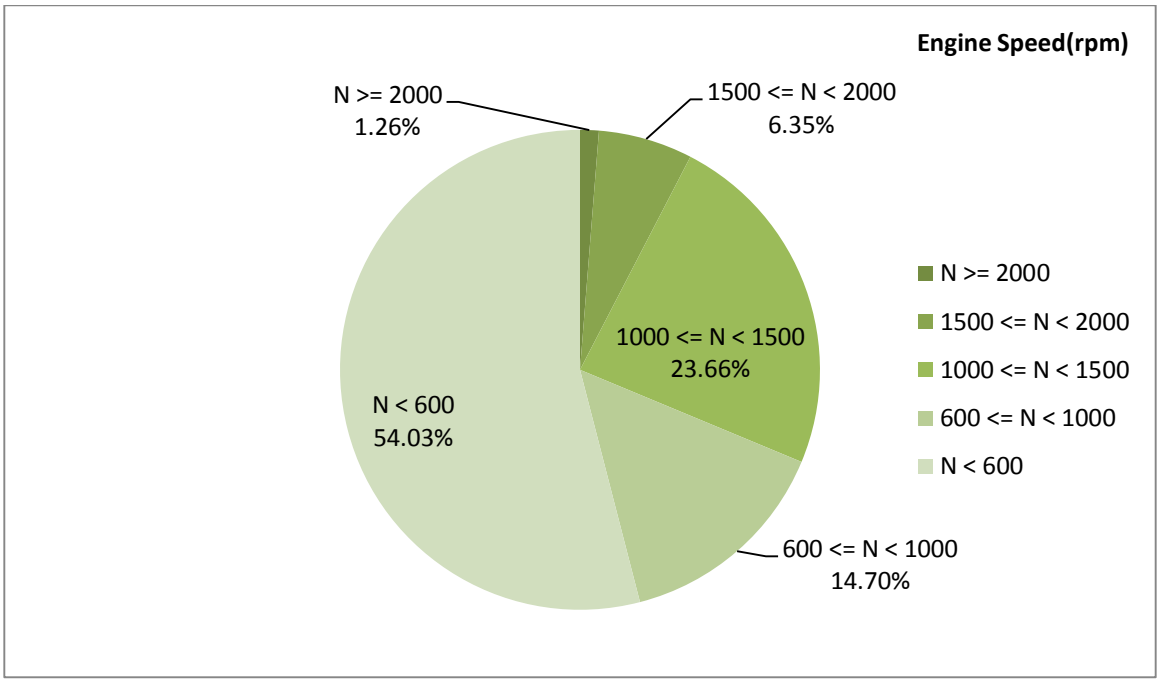


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
282.41	24.68	826

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
360.56	48.24	1171

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
726-50	357-0	2272-256

Detailed Pressure Analysis

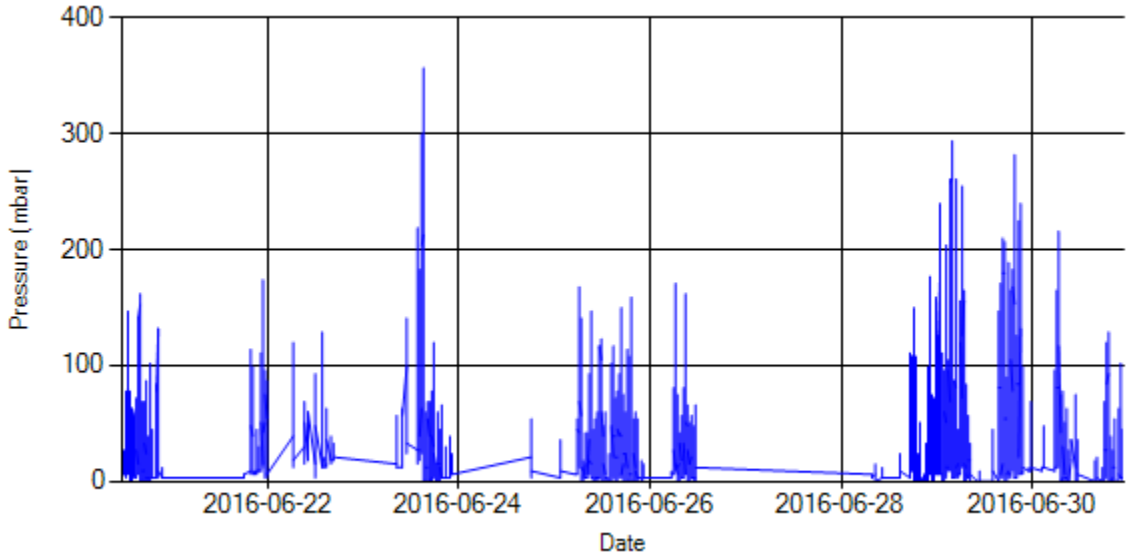


Figure 4- Pressure distribution over the period

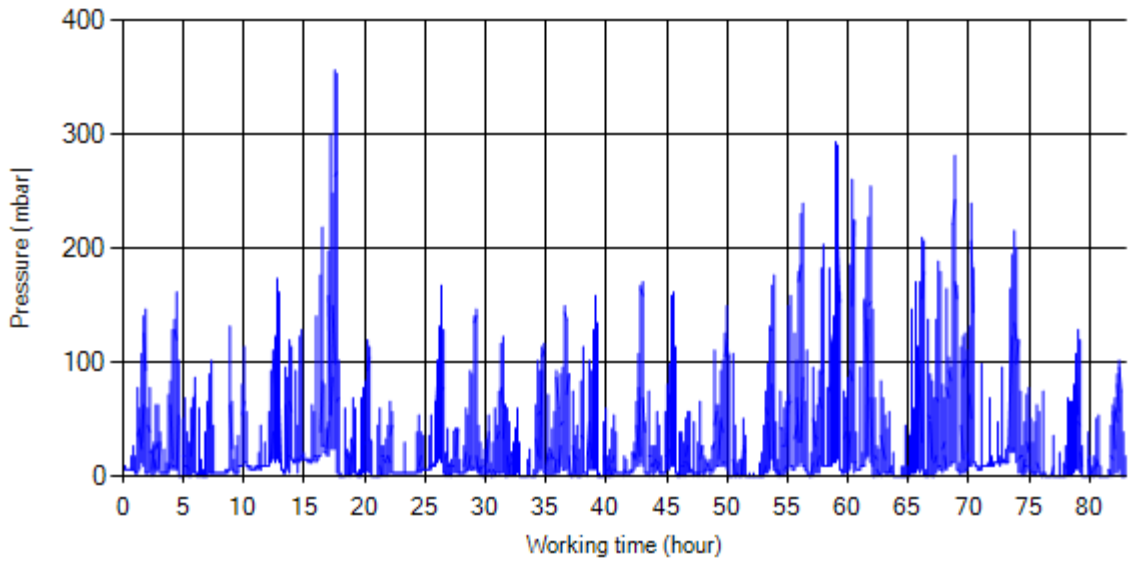


Figure 5- Pressure vs. working hours

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

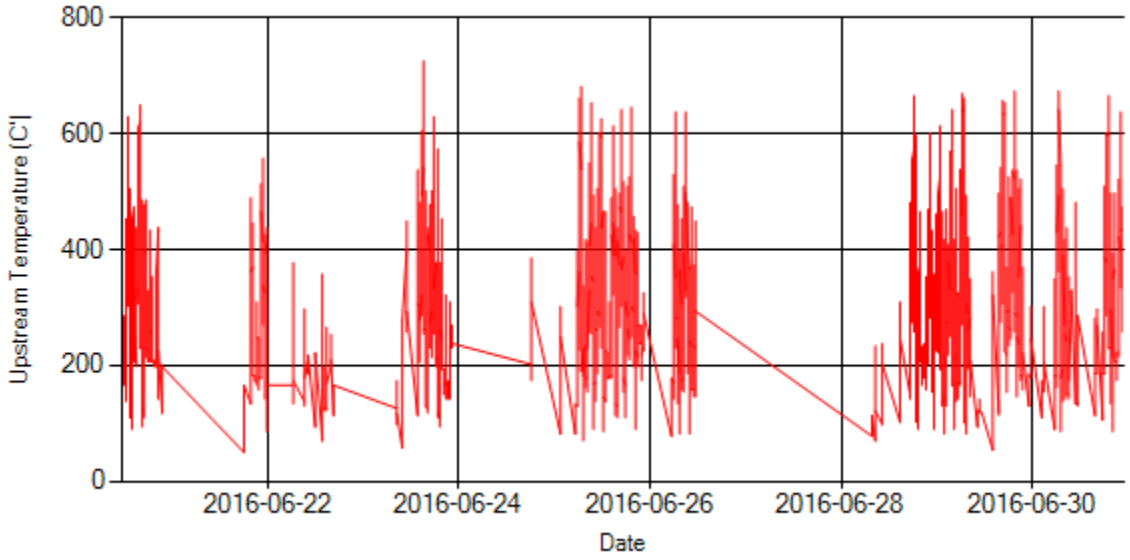


Figure 6- Temperature distribution over the period

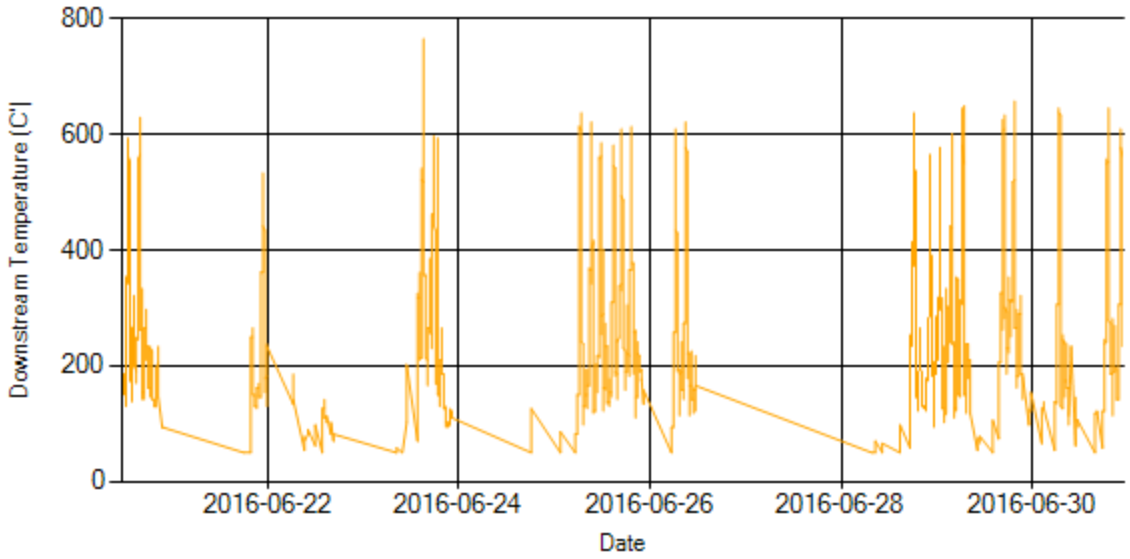


Figure 7- Temperature distribution over the period

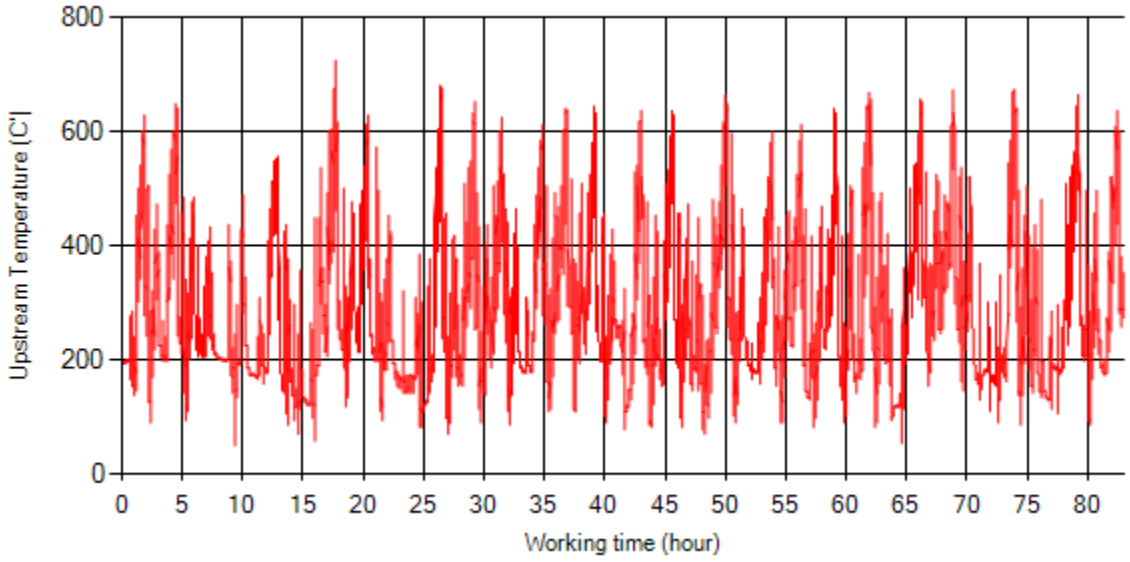


Figure 8- Temperature vs. working hours

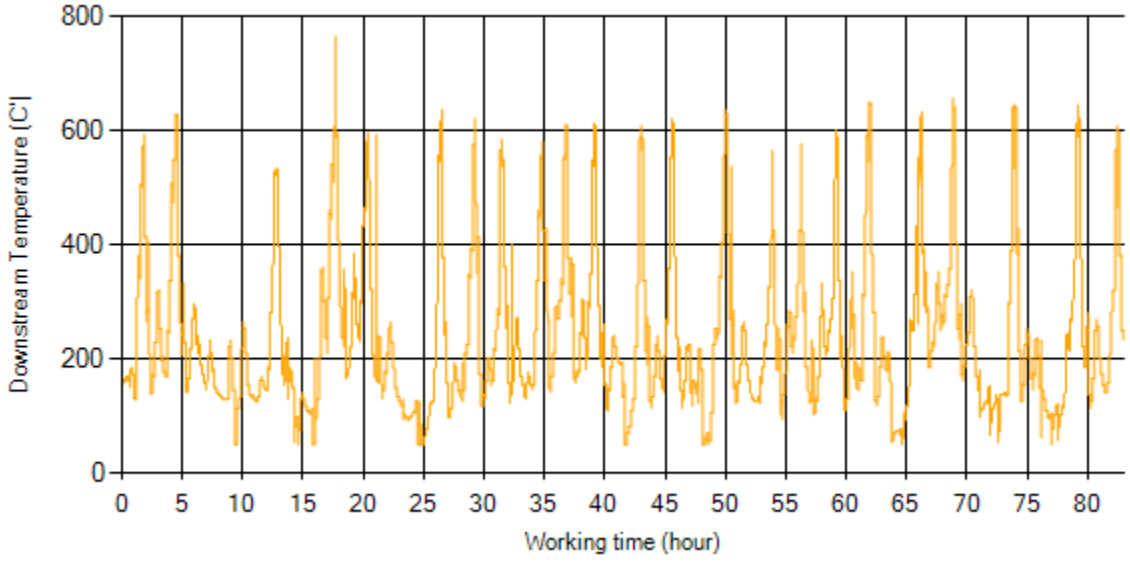


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

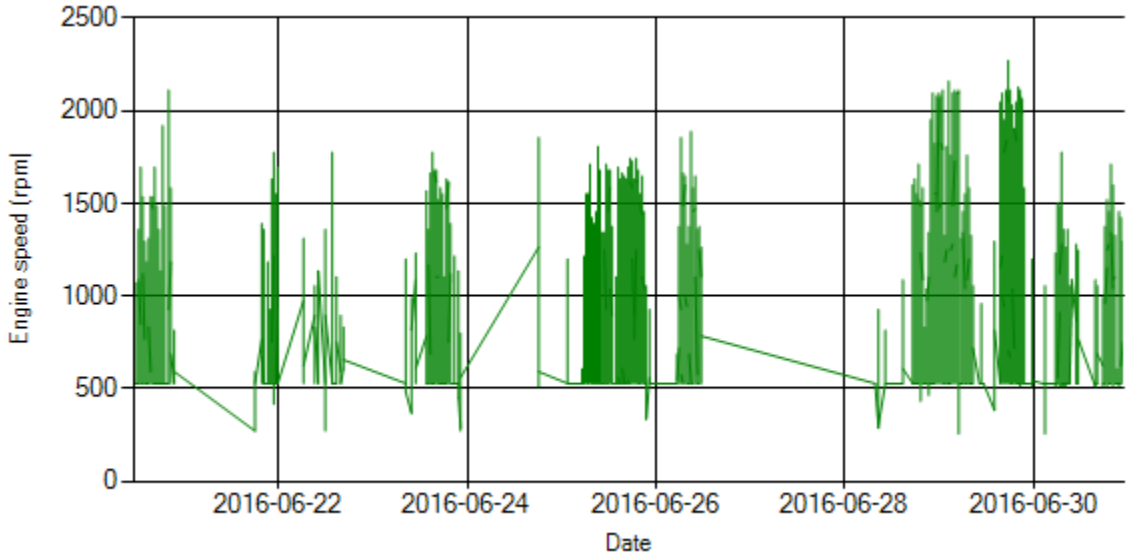


Figure 10- Engine speed distribution over the period

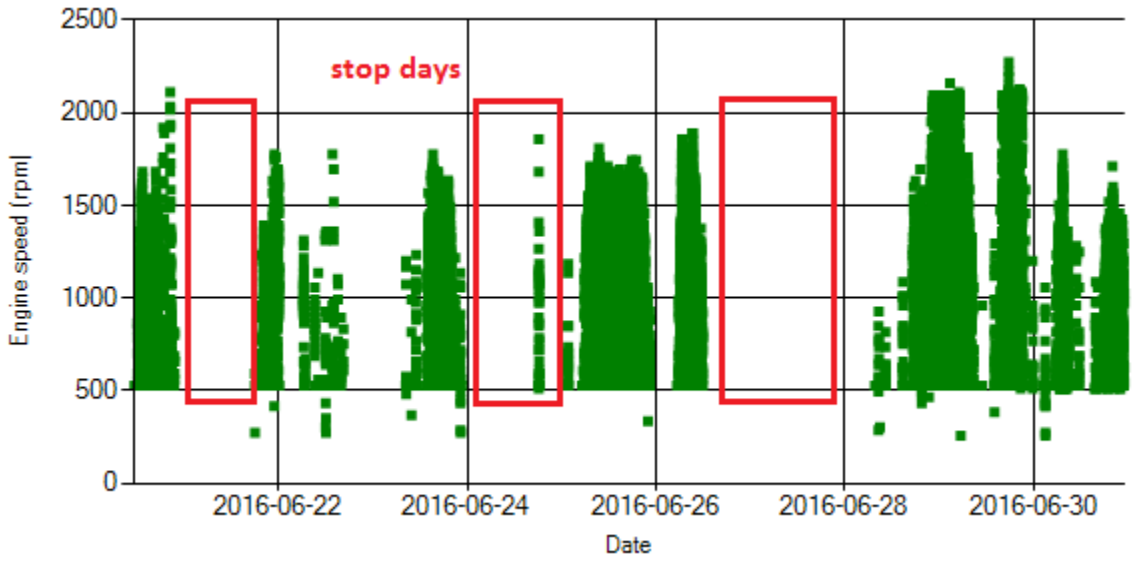


Figure 11- Engine speed diagram for calculating CPK's working days

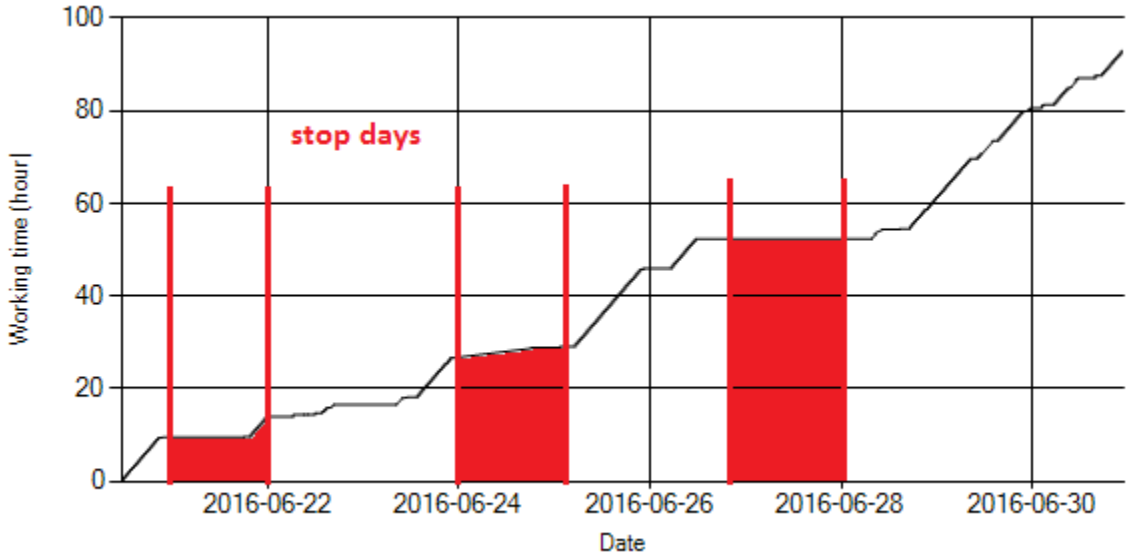


Figure 12- Time diagram for calculating CPK's working days

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 stationary for 8 days.

Pressure-Engine Speed diagrams

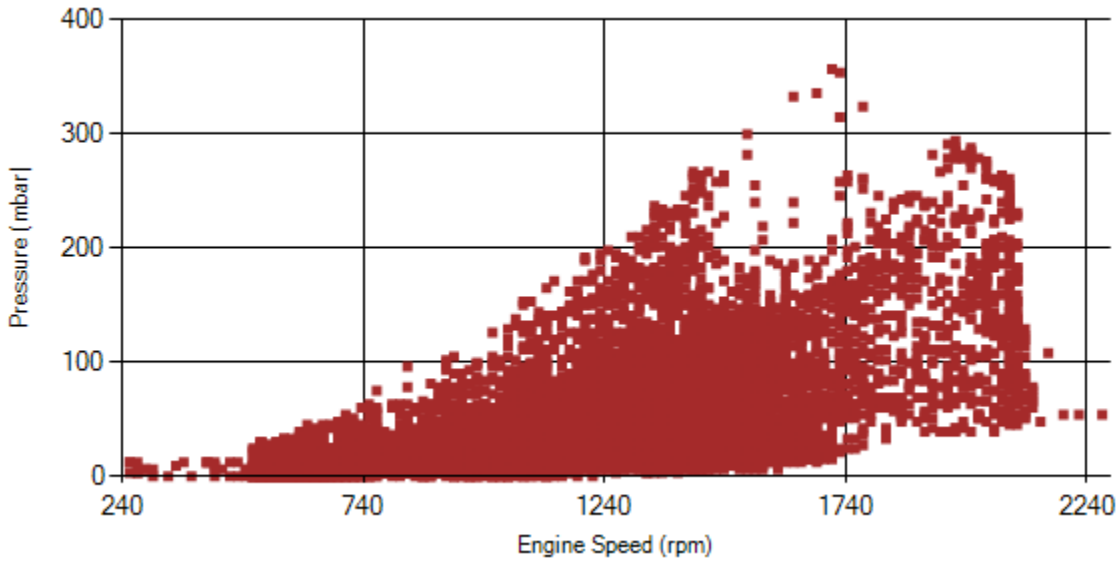


Figure 13- Pressure against engine speed

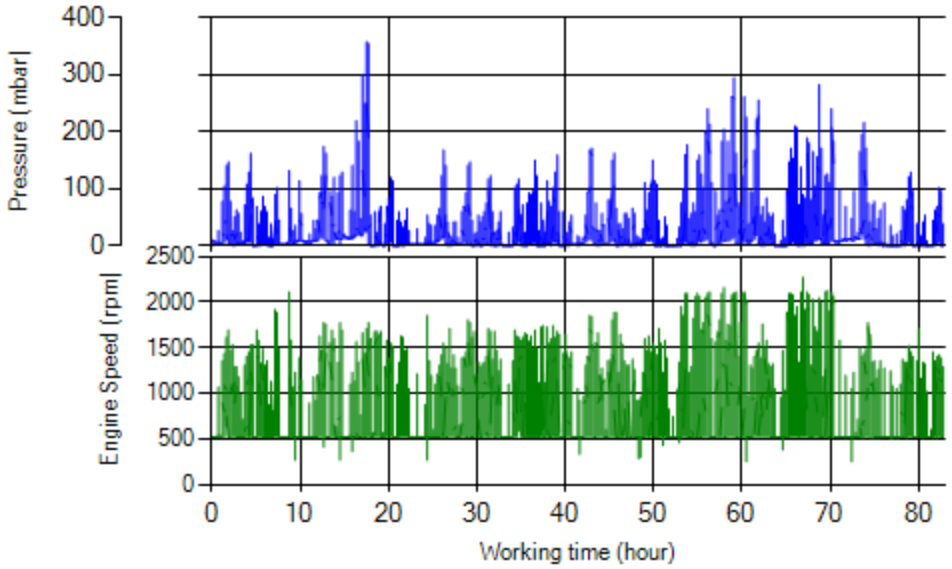


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

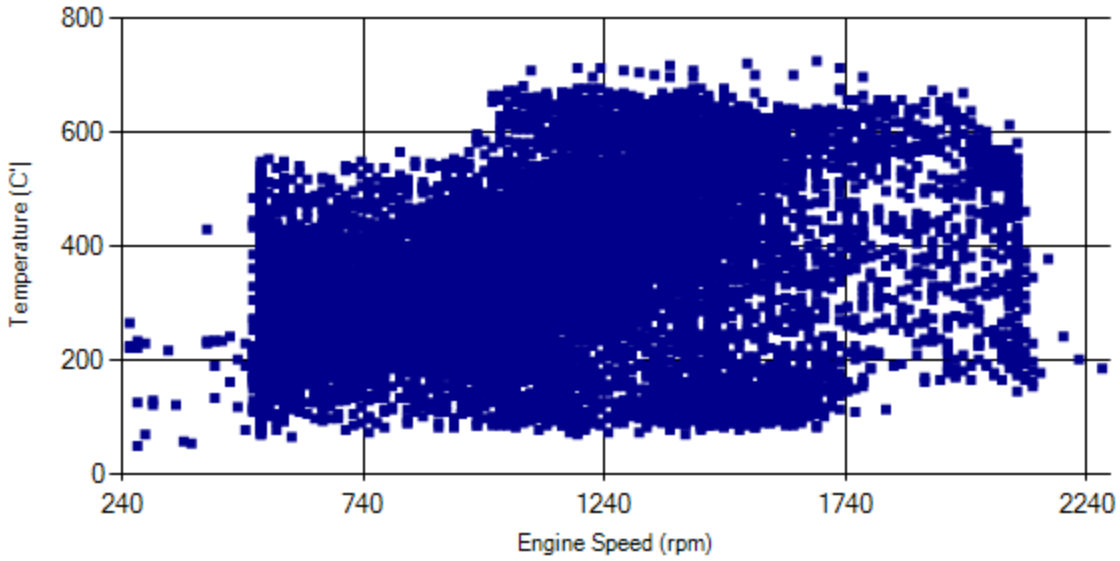


Figure 15- Temperature against engine speed

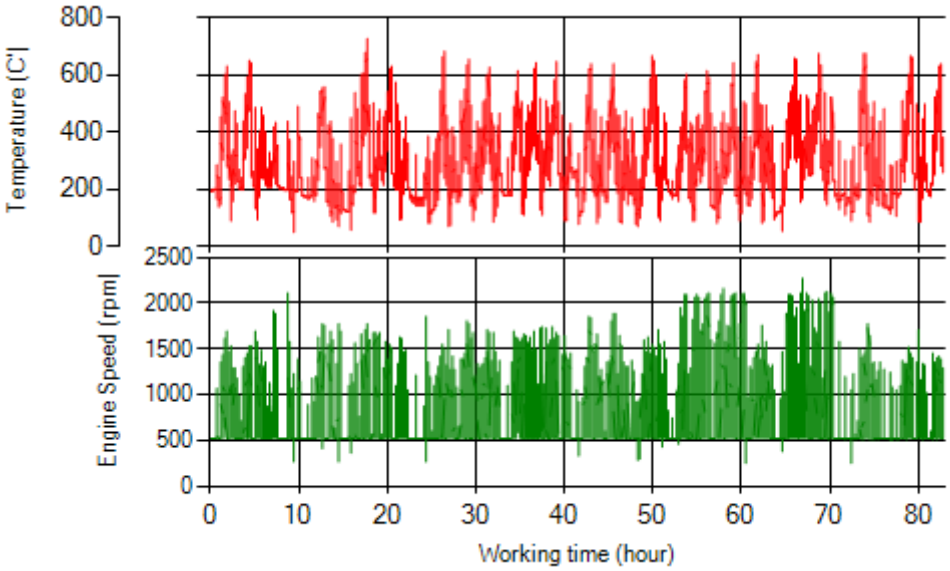


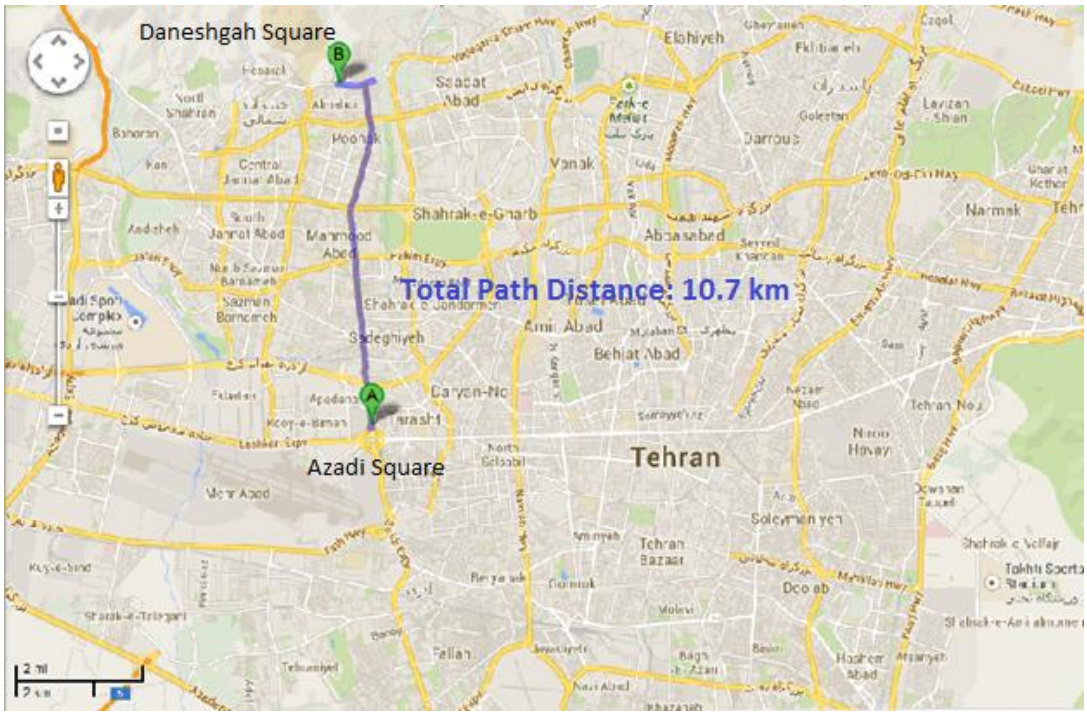
Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 0.8% of working time, pressure was above 200 mbar and 2.43% above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 18.3% of total working time temperature is above 400 ℃ and 26.2% 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)



ASA Azmoon Sanat Arvin	Document Number: DPF2016061/1 Date: 4/Jul/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/Jun/2016 – 15/Jun/2016 (fifteen days)
K value - DPF upstream	1.90 [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.
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)	69575 km
Bus mileage over the period	2814 km
Working days over the period	14 days
Stop days	1 day
Data logger working days	14 days
Working hours over the period	176 hours 58 minutes
Average working hours per day (including stop days)	11 hours 48 minutes
Bus average speed	15.9 km/hr
idle speed time to all working time ration	33.73 %
Total Bus fuel consumption over the period	1745 lit
Fuel consumption per hour	9.85 lit/hr
Average fuel consumption	0.62 lit/km
Total Bus additive consumption over the period	0.835 lit
Average additive consumption	297 cc/km
Additive consumption to fuel ration	479 cc/1000lit

Temperature, Pressure and Engine Speed Overview

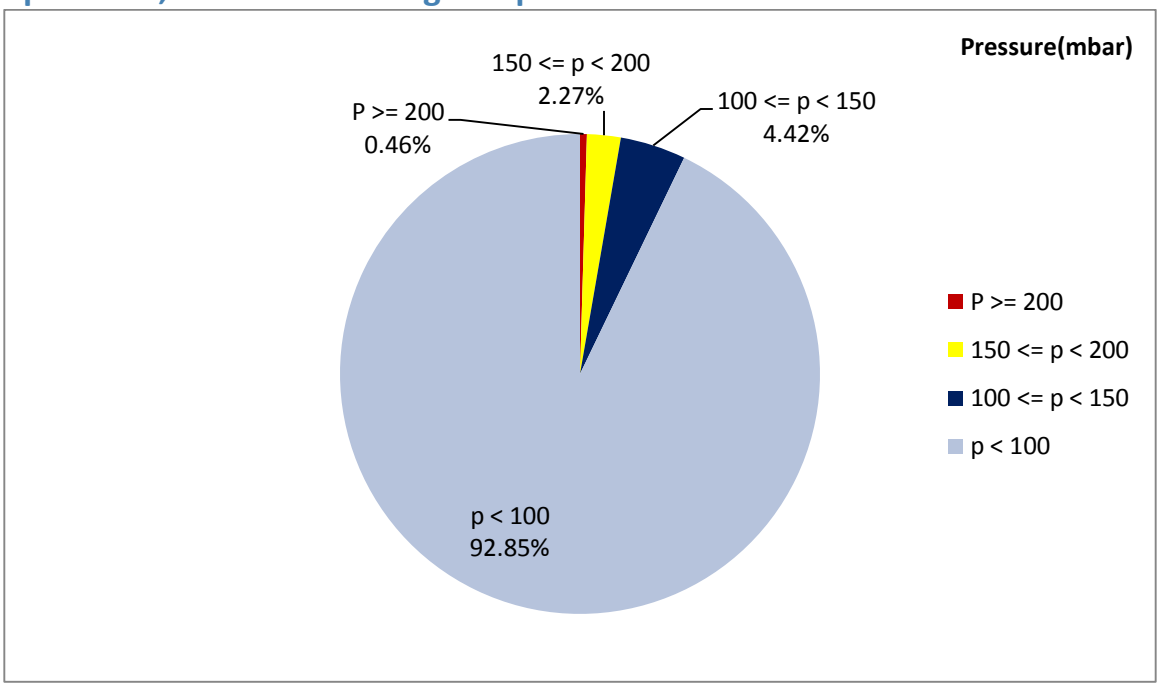


Figure 1- Pressure distribution over the working hours

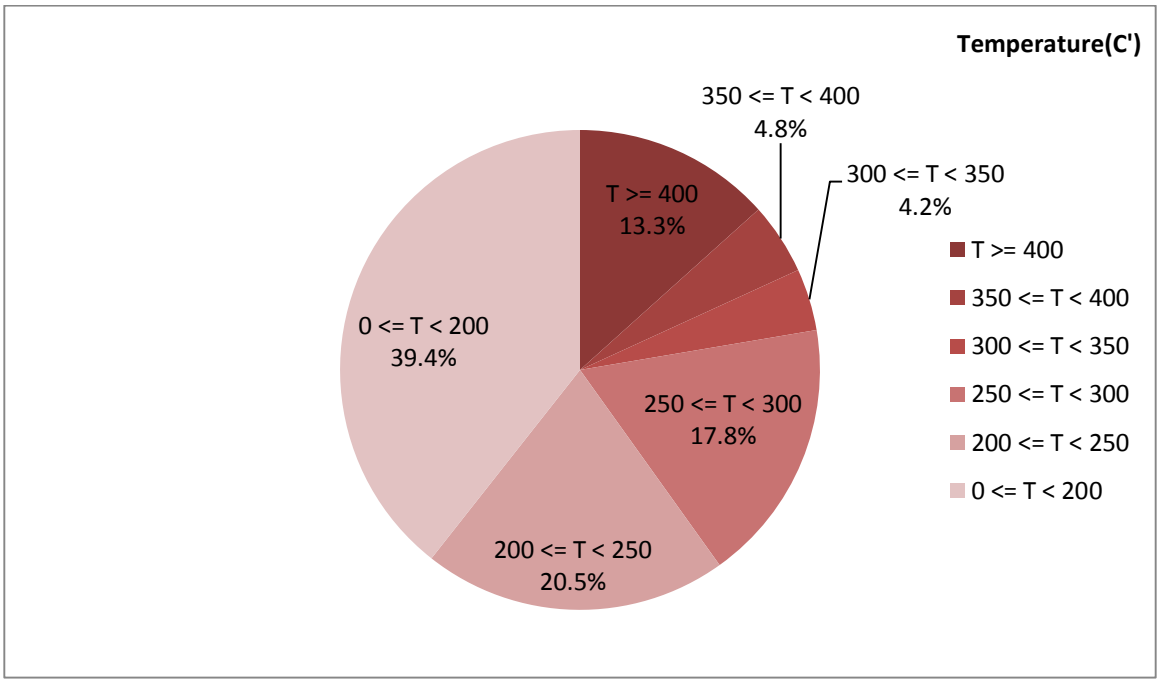


Figure 2-Temperature distribution over the working hours

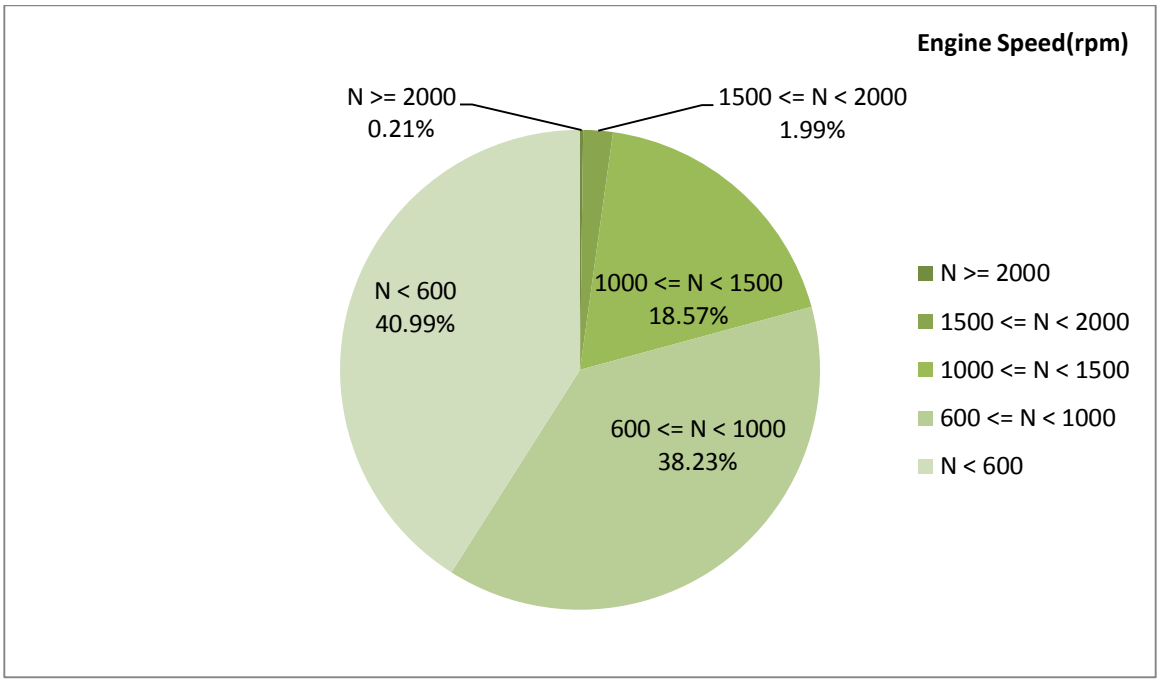


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
248.31	31.9	734

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
258.09	40.33	827

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
586-50	279-0	2304-256

Detailed Pressure Analysis

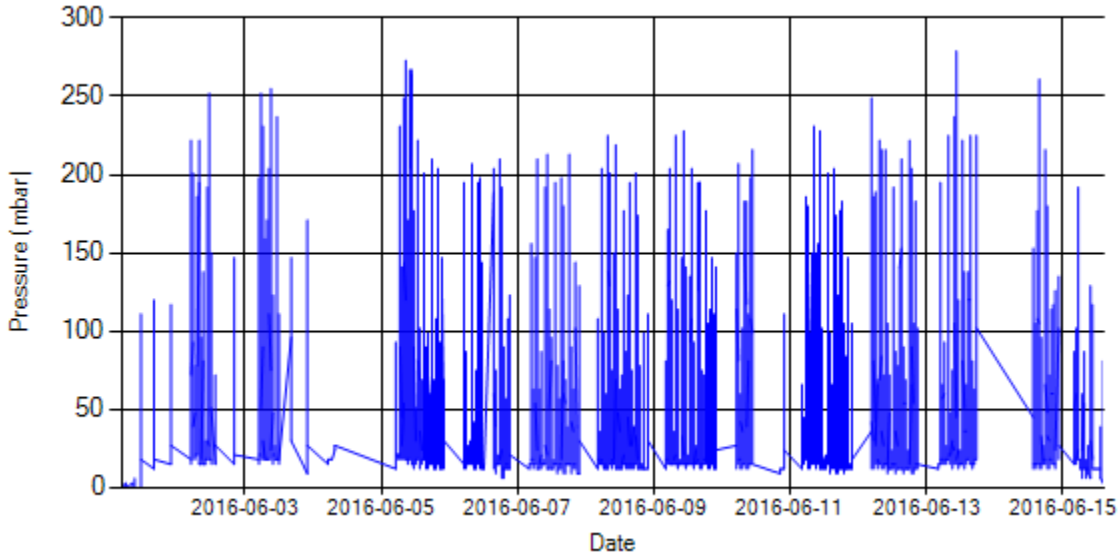


Figure 4- Pressure distribution over the period

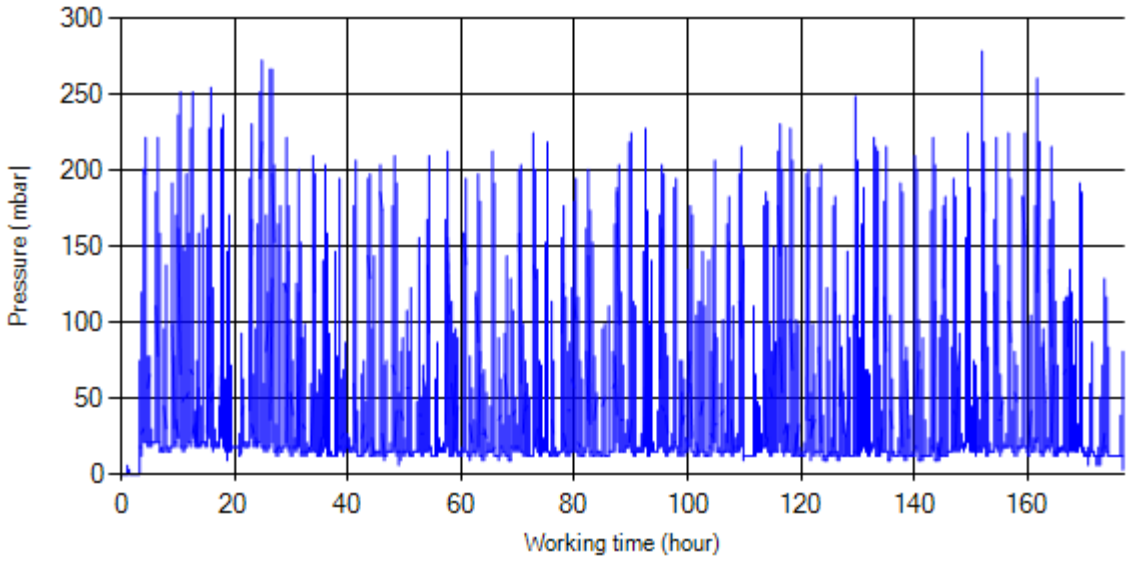


Figure 5- Pressure vs. working hours

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

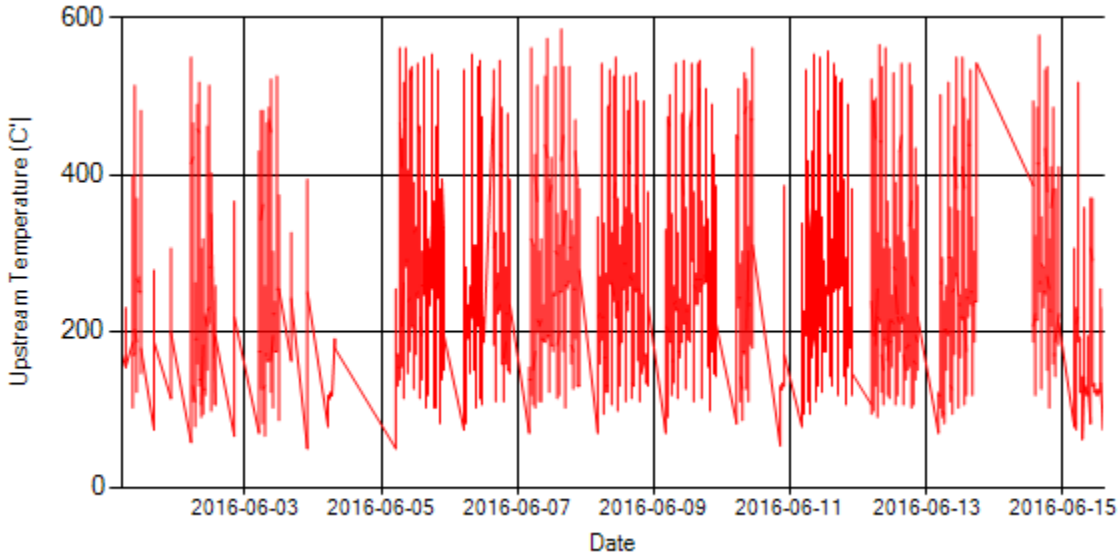


Figure 6- Temperature distribution over the period

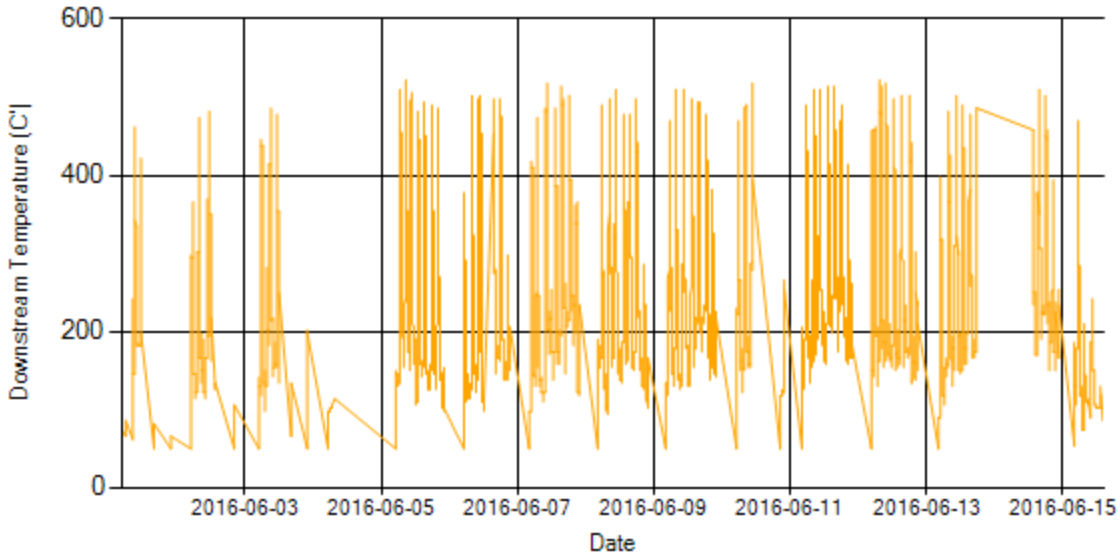


Figure 7- Temperature distribution over the period

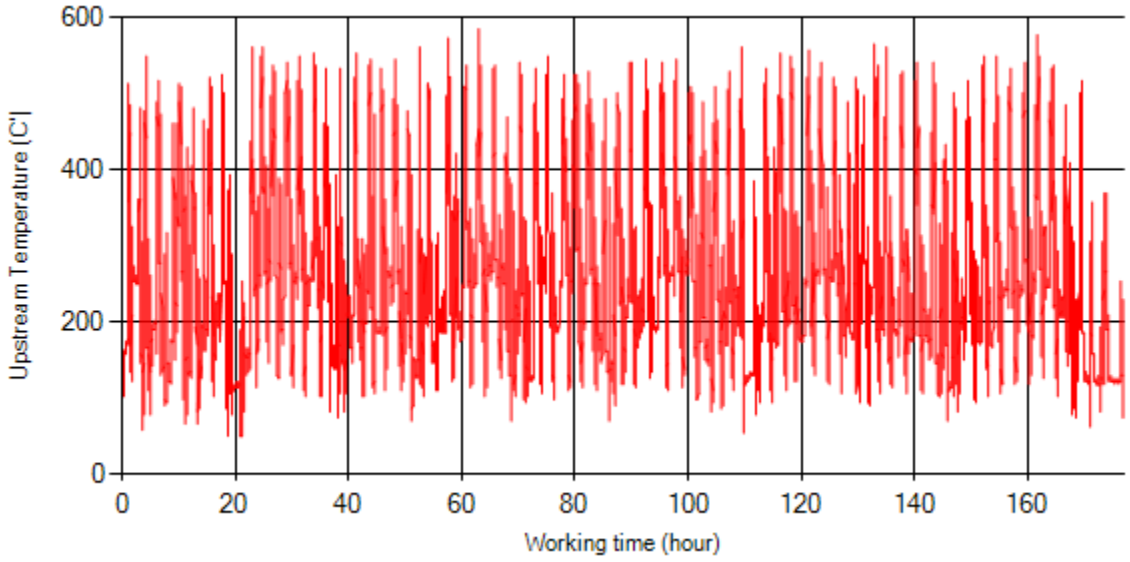


Figure 8- Temperature vs. working hours

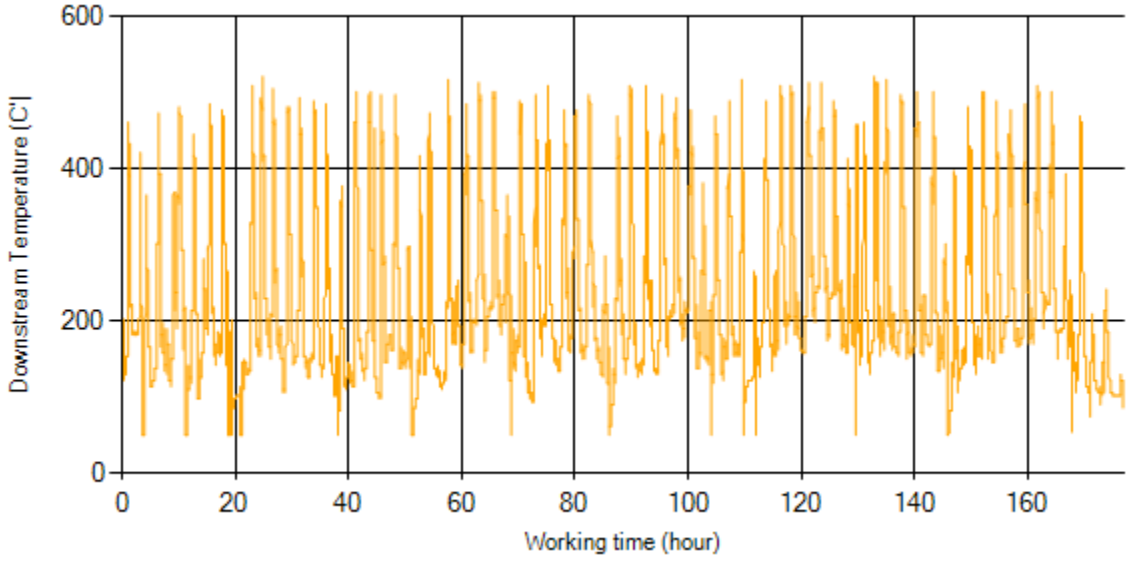


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

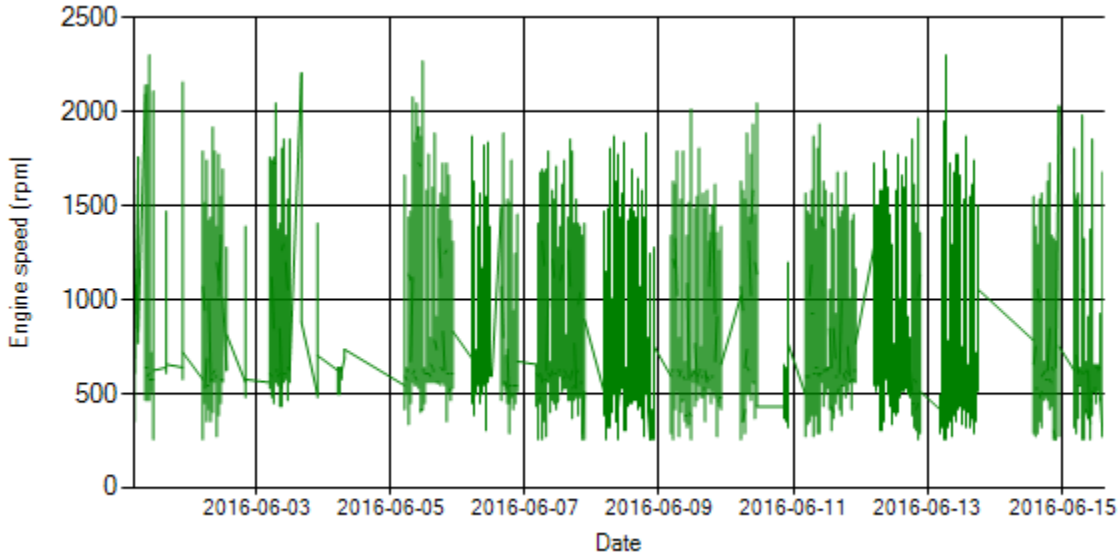


Figure 10- Engine speed distribution over the period

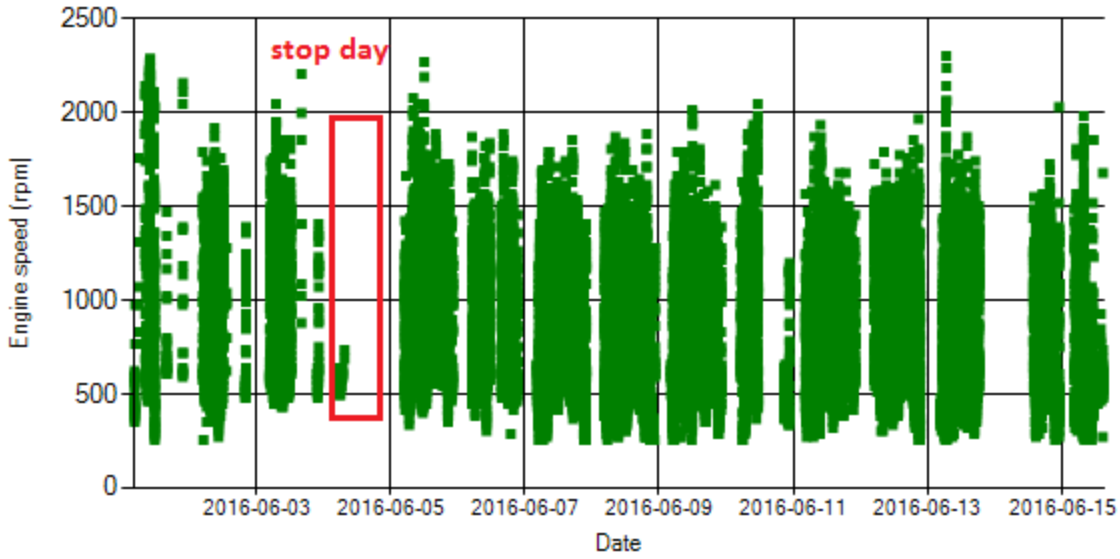


Figure 11- Engine speed diagram for calculating CPK's working days

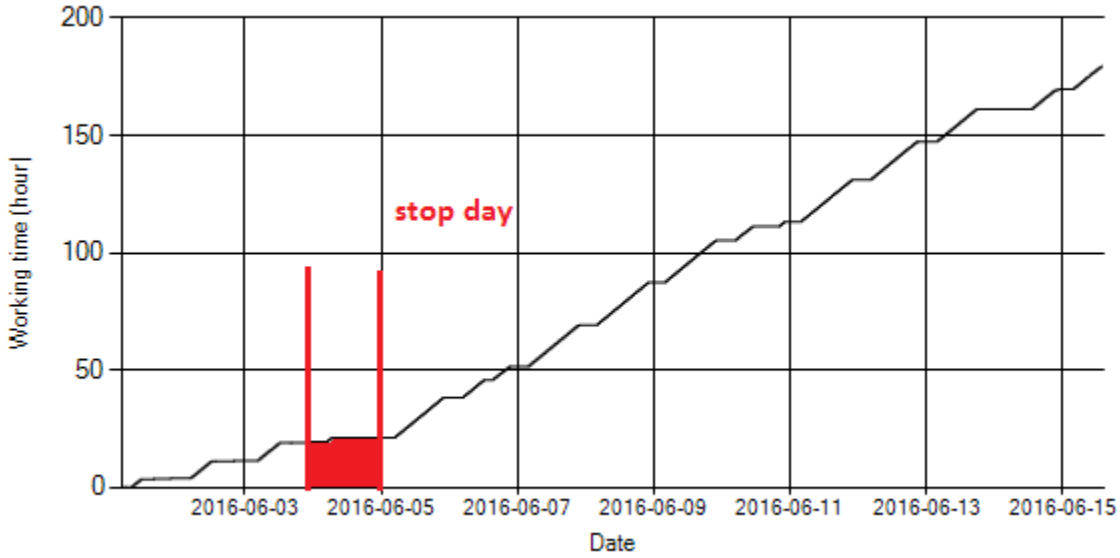


Figure 12- Time diagram for calculating CPK's working days

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 the bus was stationary for 1 day.

Pressure-Engine Speed diagrams

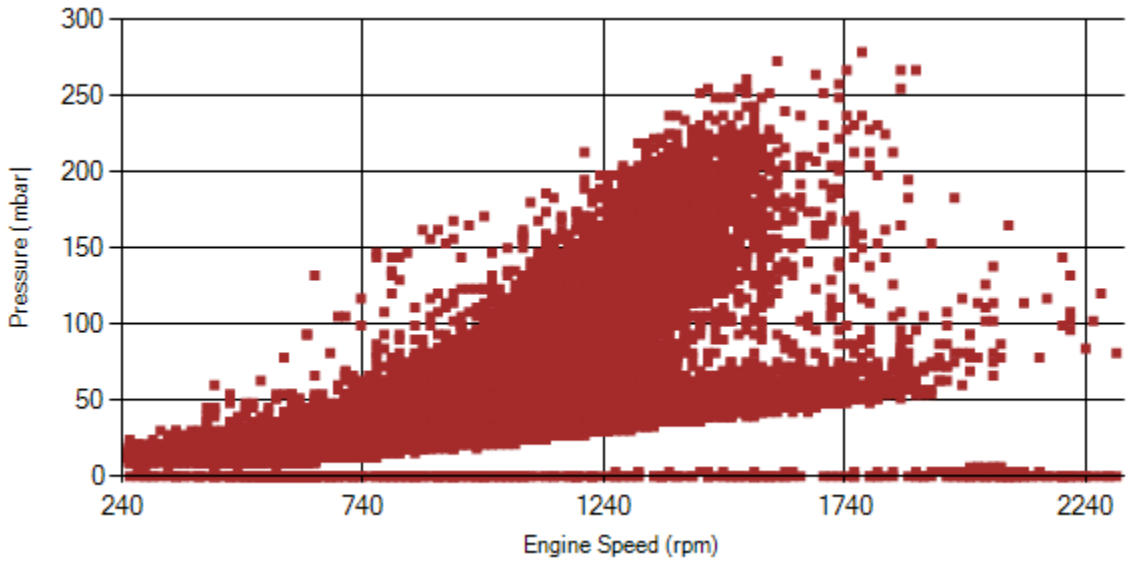


Figure 13- Pressure against engine speed

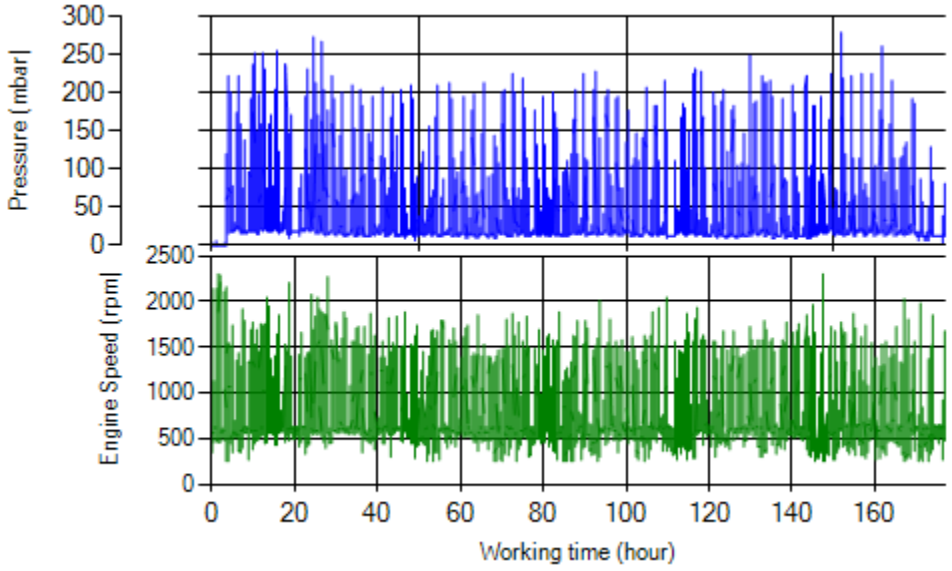


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

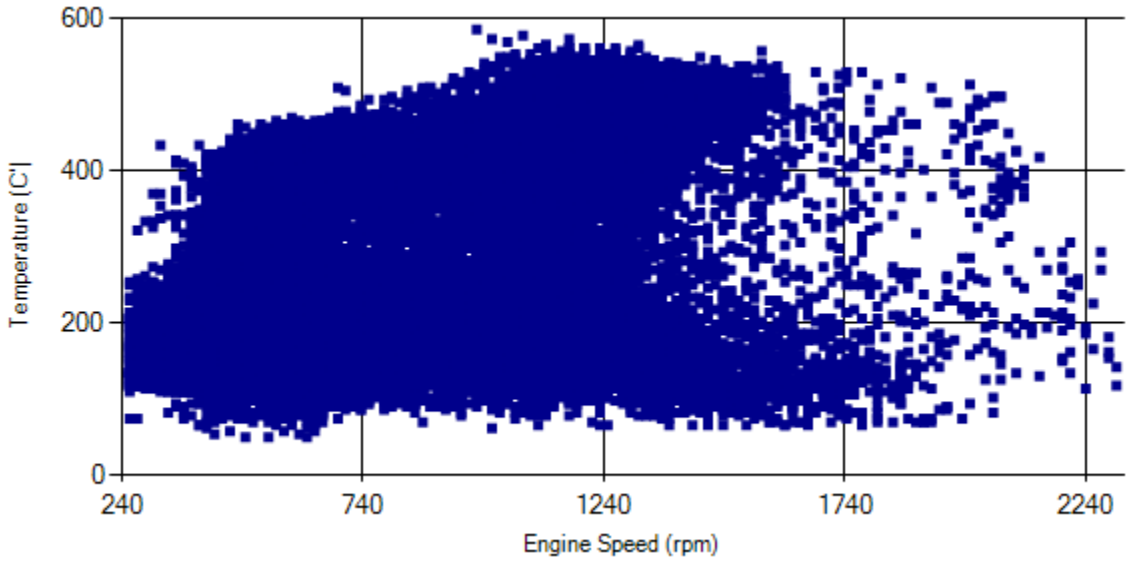


Figure 15- Temperature against engine speed

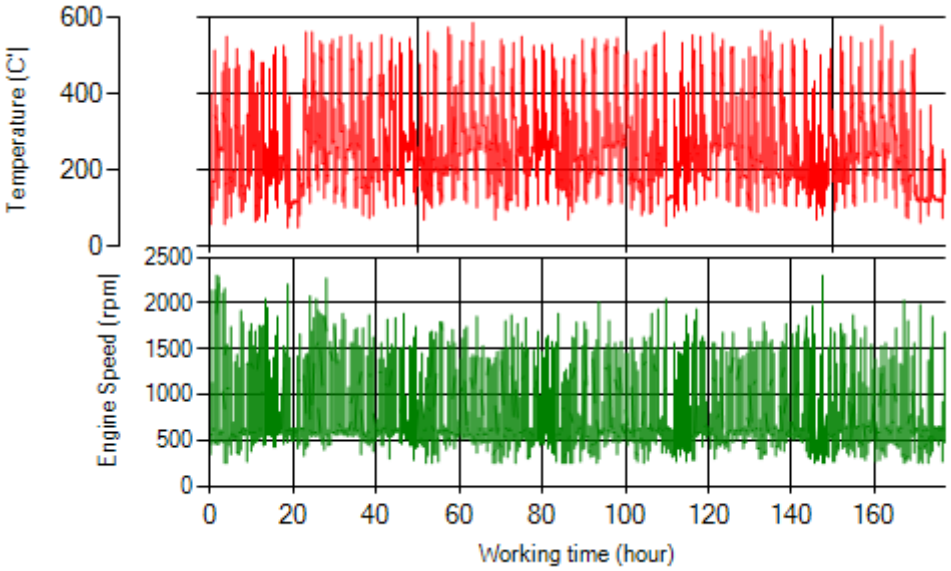


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 0.46% of working time, pressure was above 200 mbar and 2.73% was above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 13.3% of total working time temperature is above 400 ℃ and 18.1% above 350℃.

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

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/Jun/2016 – 30/Jun/2016 (fifteen days)
K value - DPF upstream	1.90 [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.
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)	70851 km
Bus mileage over the period	1276 km
Working days over the period	10 days
Stop days	5 days
Data logger working days	10 days
Working hours over the period	79 hours 37 minutes
Average working hours per day (including stop days)	5 hours 18 minutes
Bus average speed	16 km/hr
idle speed time to all working time ration	27.97 %
Total Bus fuel consumption over the period	778 lit
Fuel consumption per hour	9.75 lit/hr
Average fuel consumption	0.61 lit/km
Total Bus additive consumption over the period	0.371 lit
Average additive consumption	290.8 cc/km
Additive consumption to fuel ration	477 cc/1000lit

Temperature, Pressure and Engine Speed Overview

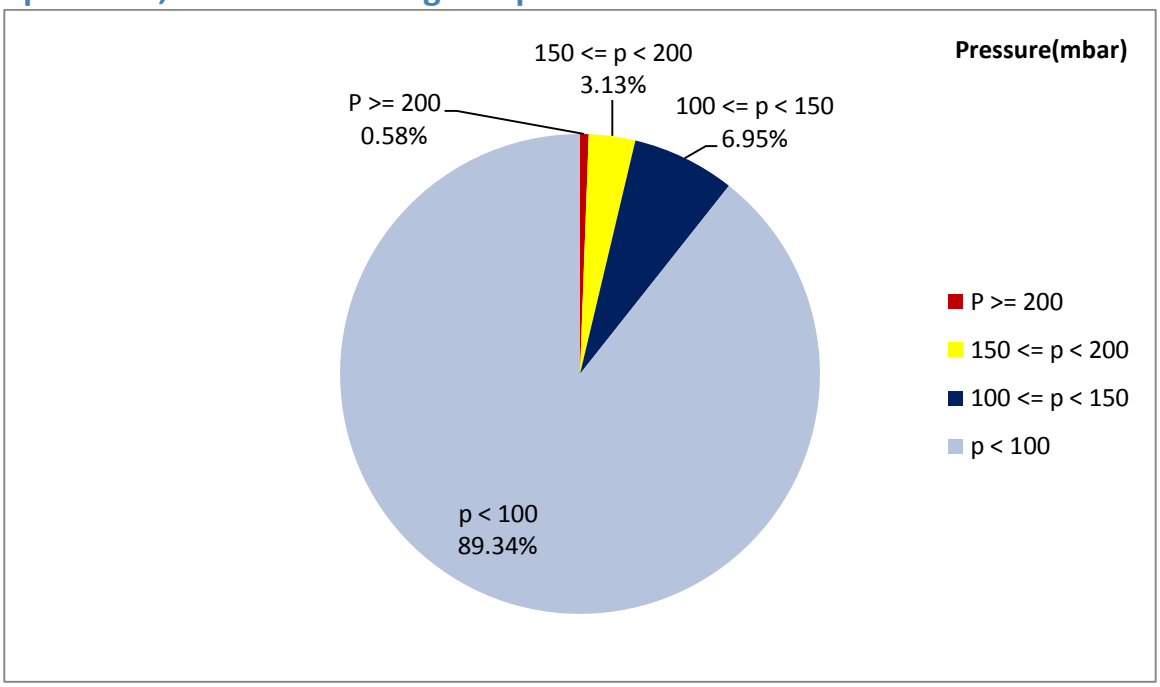


Figure 1- Pressure distribution over the working hours

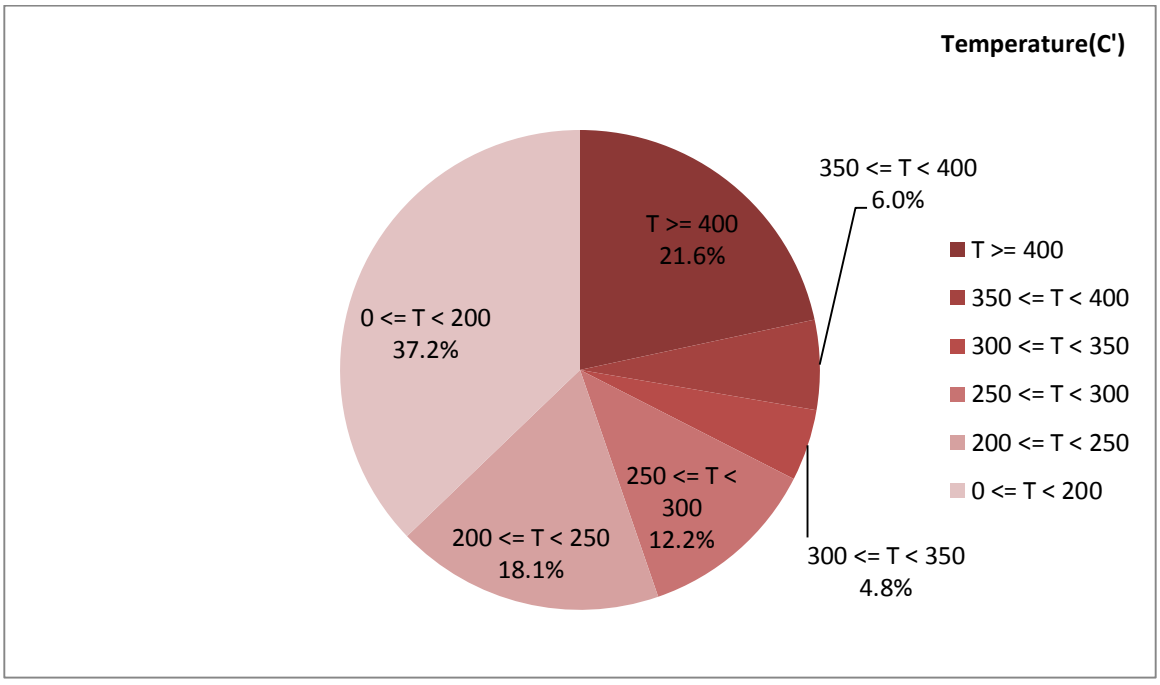


Figure 2-Temperature distribution over the working hours

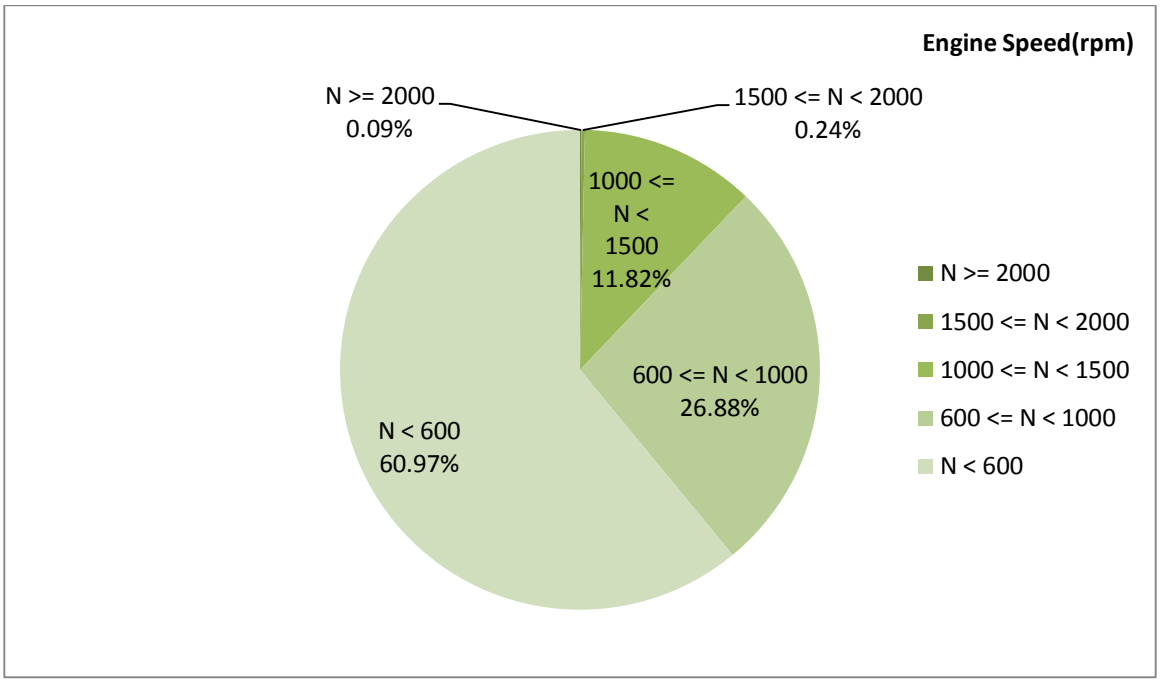


Figure 3- Engine speed distribution over the working hours

Table 4- Mean values

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
264.94	37.9	600

Table 5- Mean values without idling

Mean temperature (C)	Mean pressure(mbar)	Mean engine speed(rpm)
282.82	43.8	619

Table 6- Max-min values

Max-min temperature(C)	Max-min pressure(mbar)	Max-min engine speed(rpm)
594-50	276-3	2208-256

Detailed Pressure Analysis

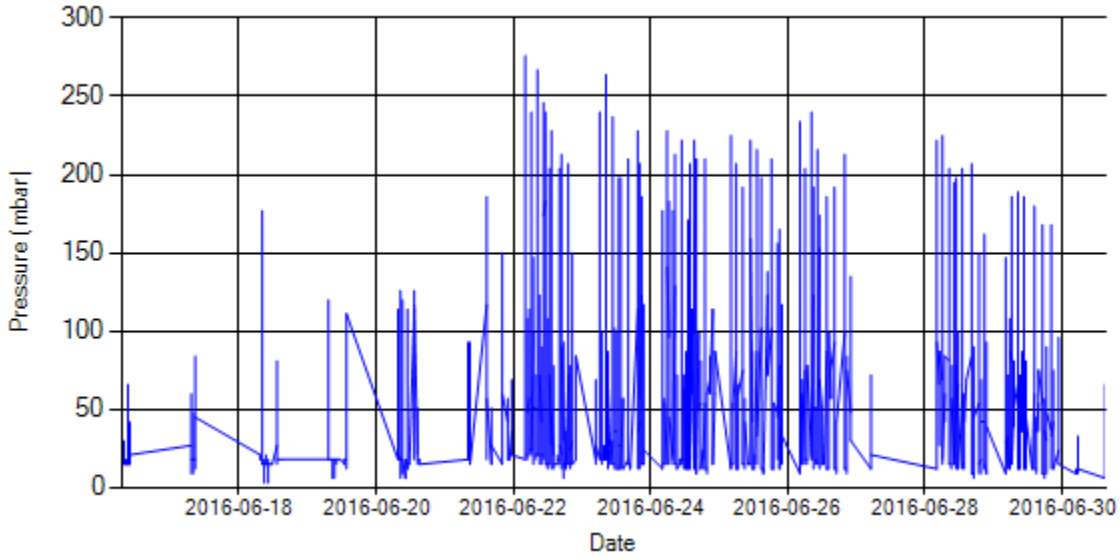


Figure 4- Pressure distribution over the period

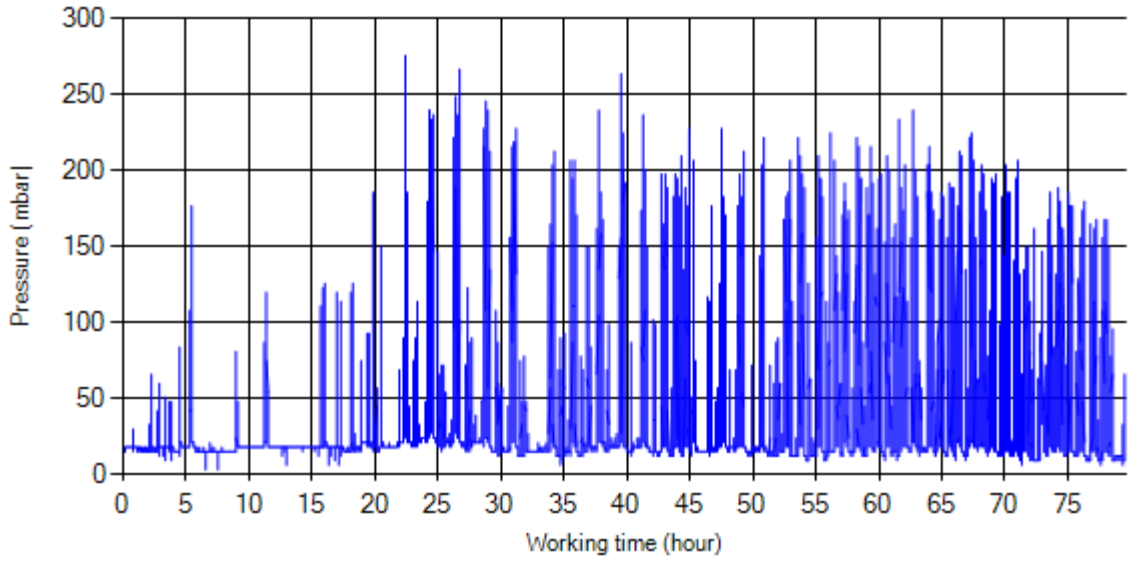


Figure 5- Pressure vs. working hours

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

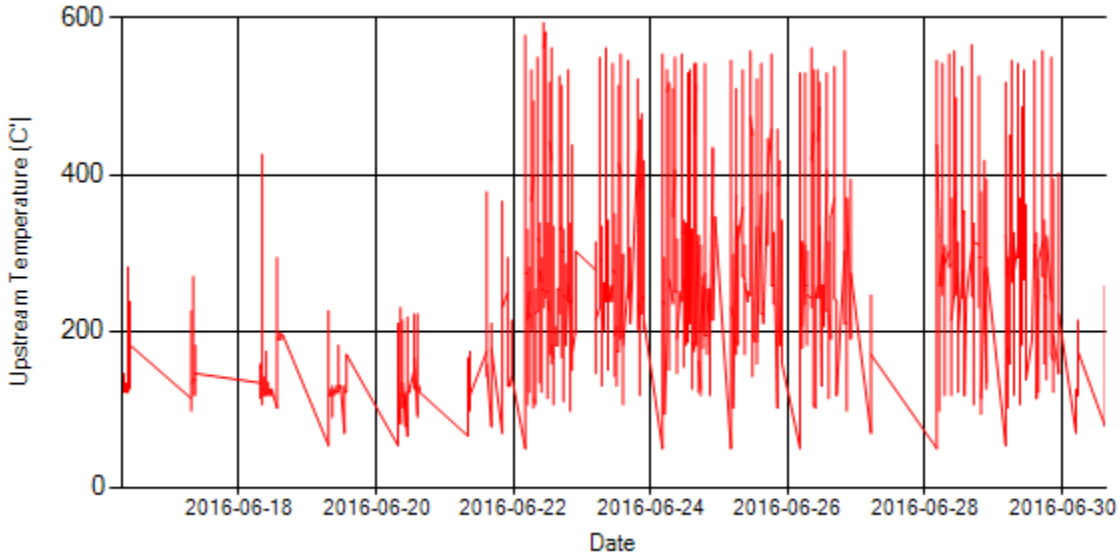


Figure 6- Temperature distribution over the period

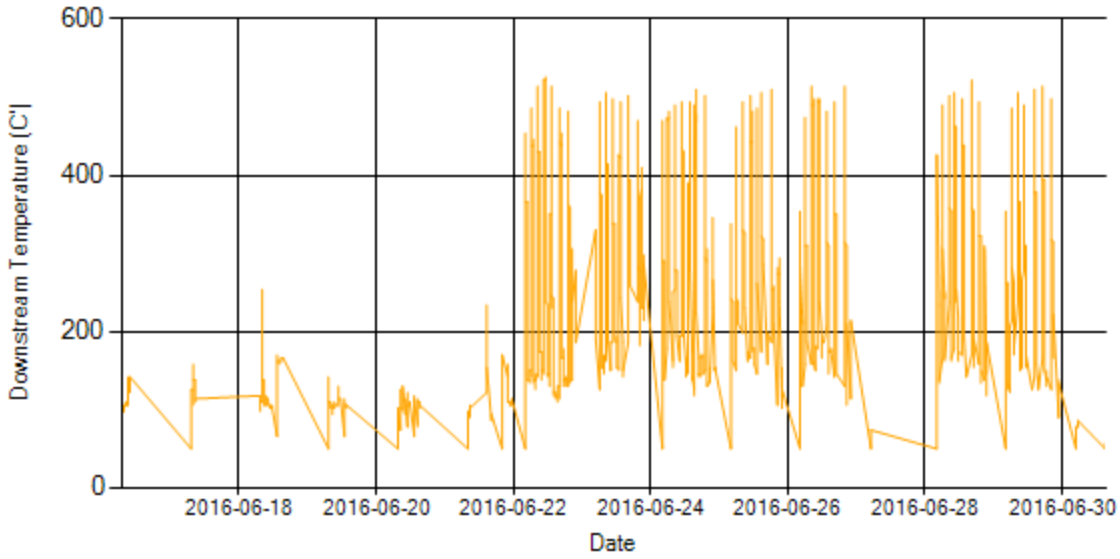


Figure 7- Temperature distribution over the period

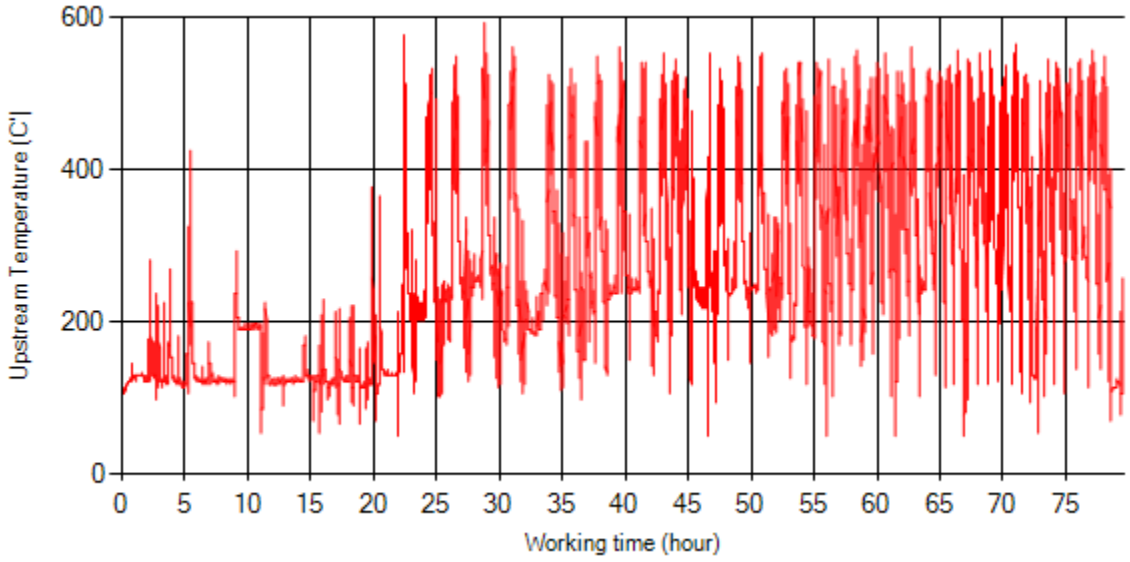


Figure 8- Temperature vs. working hours

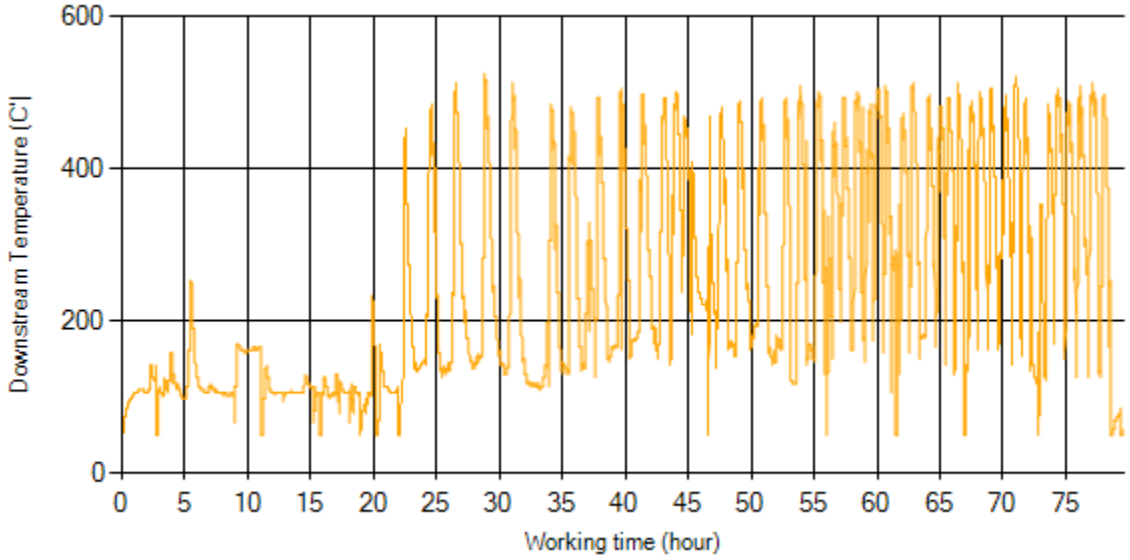


Figure 9- Temperature vs. working hours

Engine Speed Diagrams

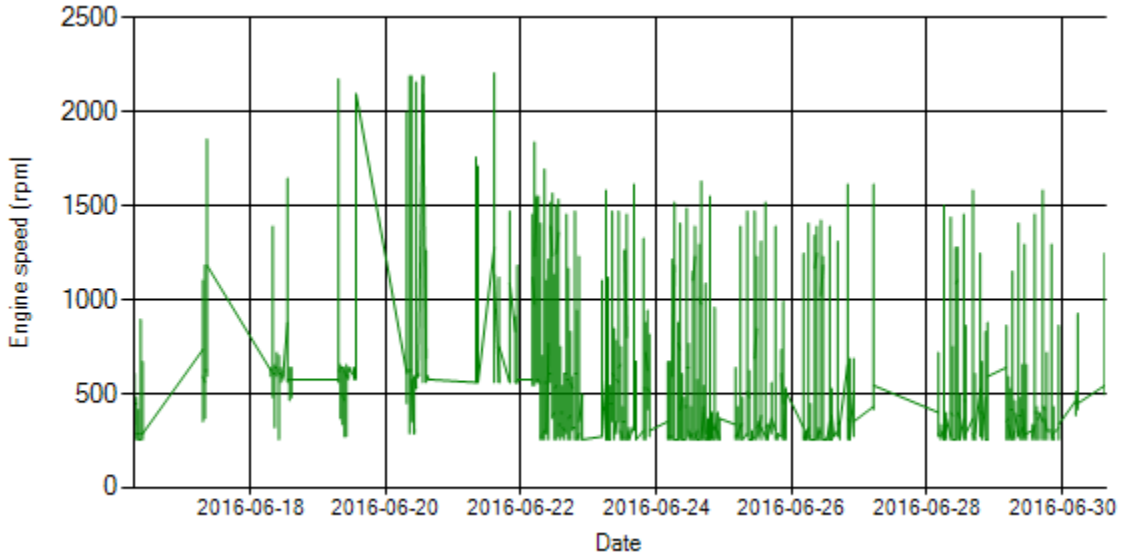


Figure 10- Engine speed distribution over the period

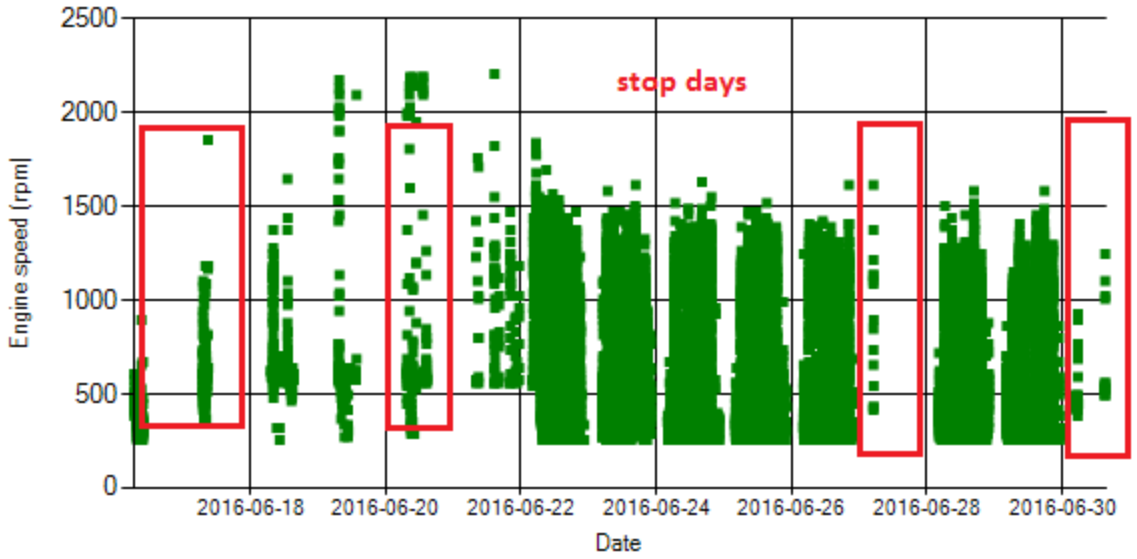


Figure 11- Engine speed diagram for calculating CPK's working days

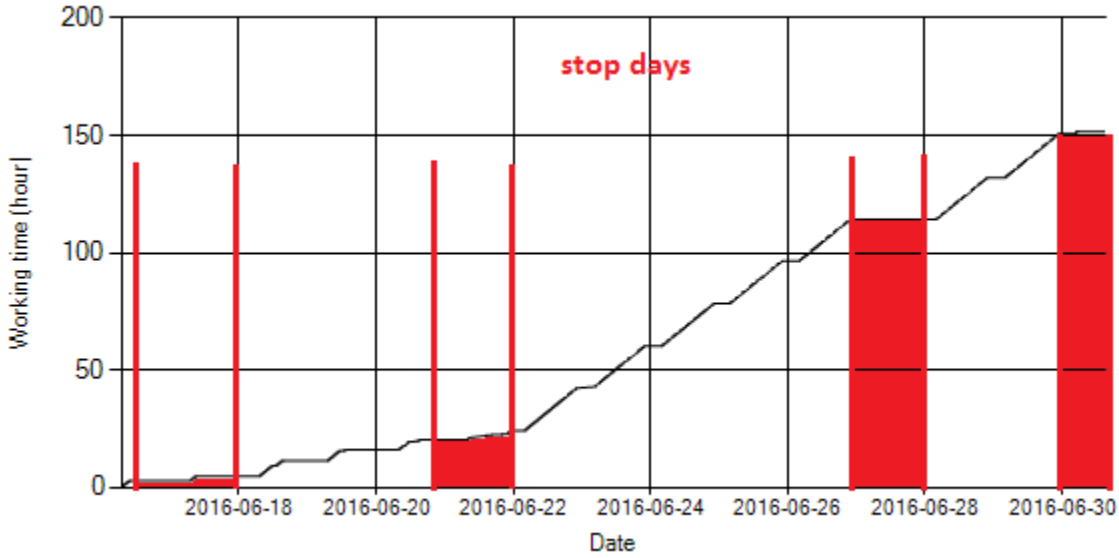


Figure 12- Time diagram for calculating CPK's working days

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 5 days.

Pressure-Engine Speed diagrams

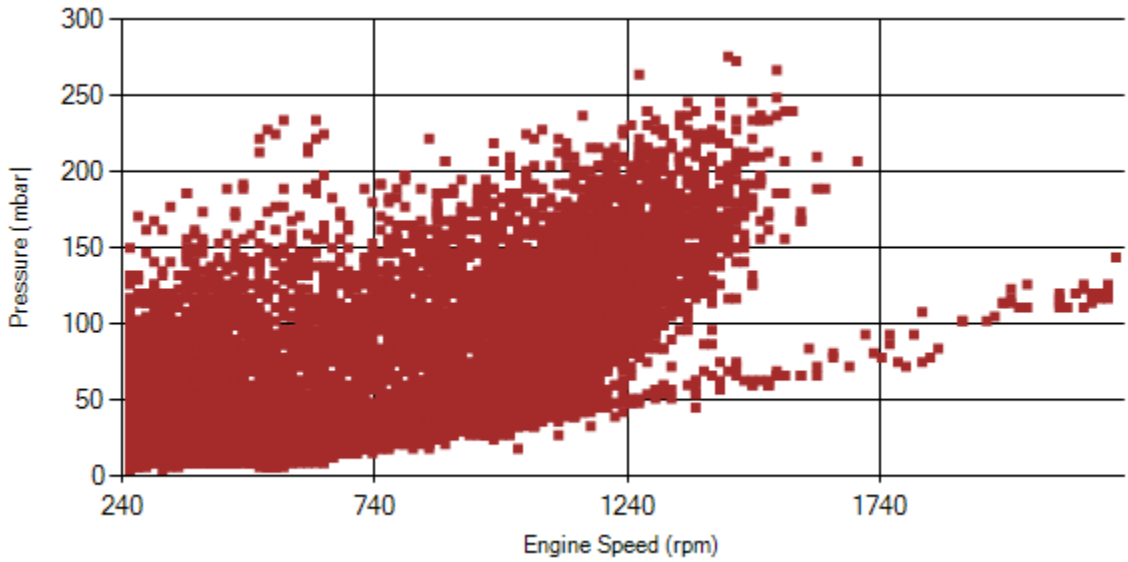


Figure 13- Pressure against engine speed

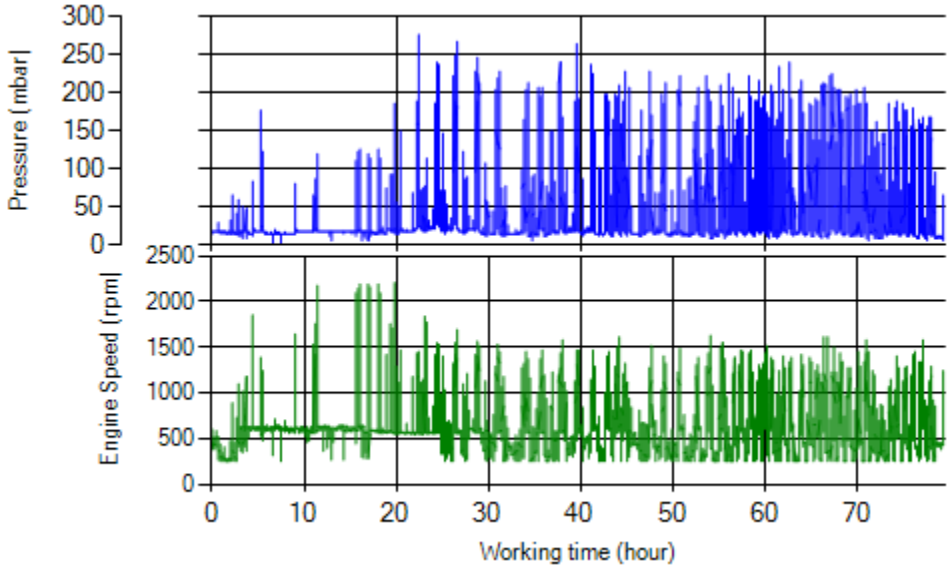


Figure 14- P, N distribution vs. working hours

Temperature-Engine Speed diagrams

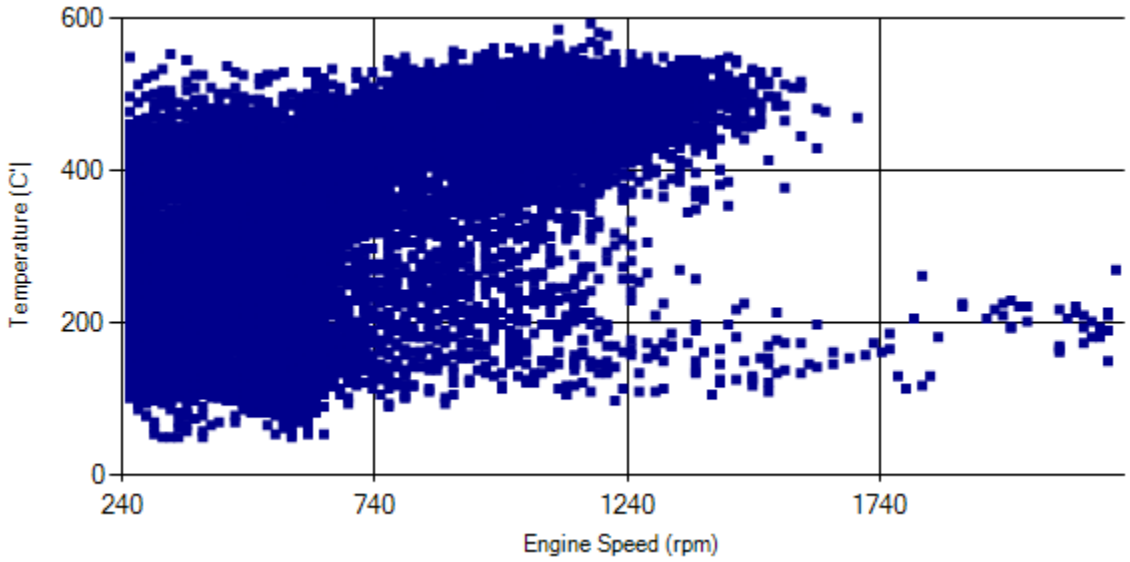


Figure 15- Temperature against engine speed

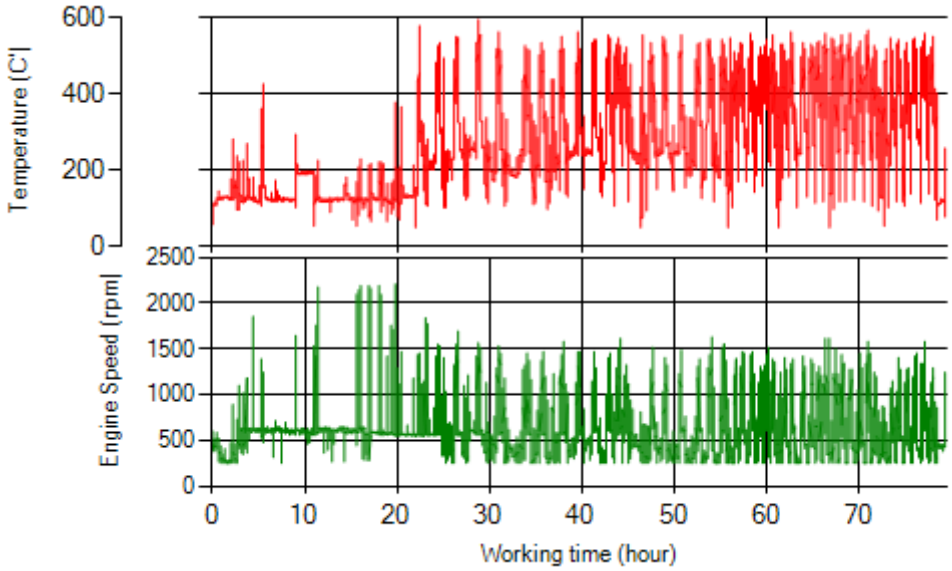


Figure 16- T, N distribution vs. working hours

Filter Operation Analysis

- As depicted in Figure 1, 0.58% of working time, pressure was above 200 mbar and 3.71% was above 150 mbar.
- Figure 2 displays flow temperature before the DPF. It can be obviously observed that 21.6% of total working time temperature is above 400 ℃ and 27.6% above 350℃.

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

Diesel Particulate Filter

an effective way to control solid particulate

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