

Incinerator Air Blower Repetitive Failures

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Objectives

- Sharing trouble shooting / experience on blower failures.
- To address similar issues / failures due to over-size / over-capacity equipments
- Reference for blowers selection at project stage.

Contents

- ✓ Problem
- ✓ Event Summary
- ✓ Observations and Findings
- ✓ Root Cause Failure Factors
- ✓ Solutions
- ✓ Selection and Implementation
- ✓ New Blower – Site Performance
- ✓ Lessons Learnt
- ✓ Conclusion

Problem

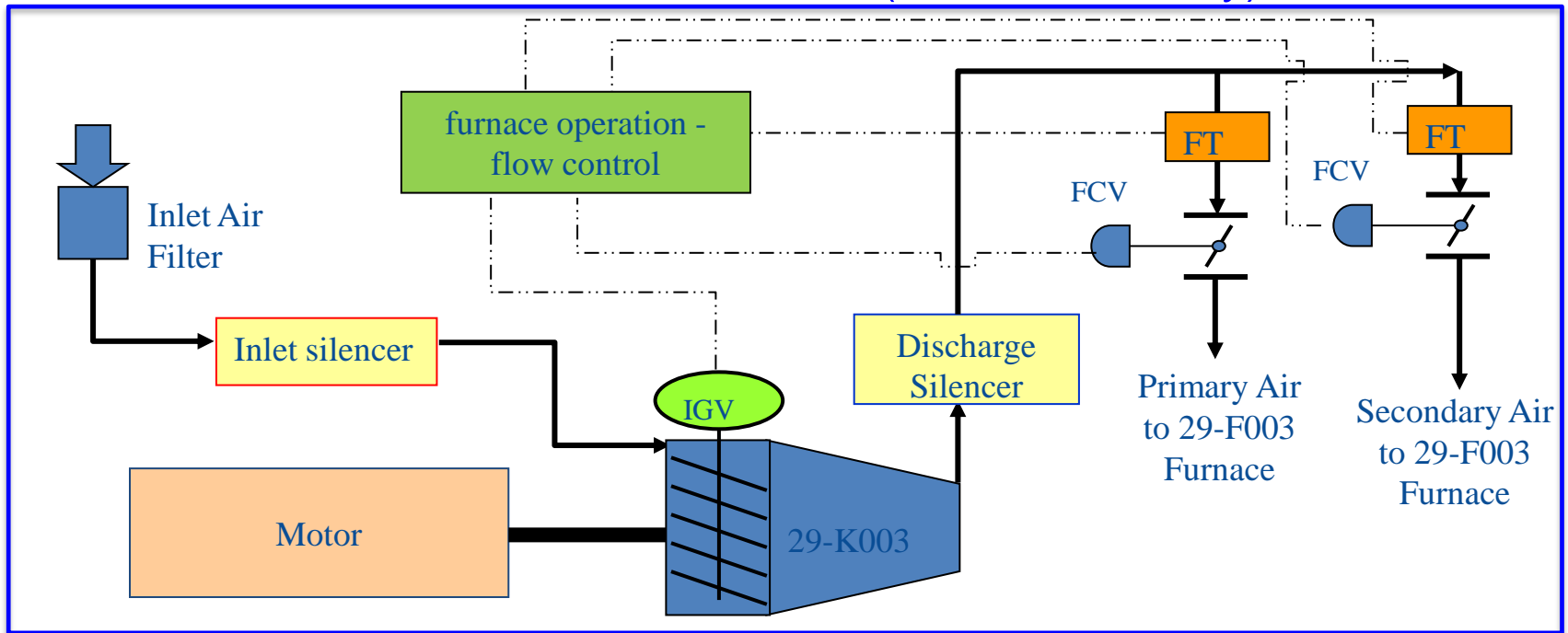
- Low discharge pressure and abnormal sound.
- High casing and inlet duct vibration, whereas bearing vibrations were normal.
- Multiple cracks on casing internal partitions, diffuser rings and IGVs.
- Crack and rubbing marks on rotor impeller.

Events' Summary

- Blower was commissioned in 2007.
- High vibration was found in the furnace during commissioning time, and warranty claim was raised.
- Furnace high vibration warranty claim issue closed during commissioning by reducing 50% of blower capacity.
- Three failures occurred as:
 - 2009 : Catastrophic failure
 - 2011 : Major failure
 - 2013 : Minor failure
- Failure description: Complete casing internal, discharge duct, IGV blades found cracked and dislocated. Plus surface crack on impeller.

Equipment Details

Incinerator Air Blower (Sulfur Recovery)



Type	:	Centrifugal Fan, double side suction
Driver	:	Motor
Rated Power	:	930 KW
RPM	:	1500
Rated Flow	:	4830 M3/Min.
Suc. Pressure	:	Atm
Disch. Pressure	:	630 mm H2O G
Rotor Length & Wheel Dia.	:	4215 & 1680 mm

Observations and Findings



Casing internal damages / cracks

Observations and Findings



IGV blade broken



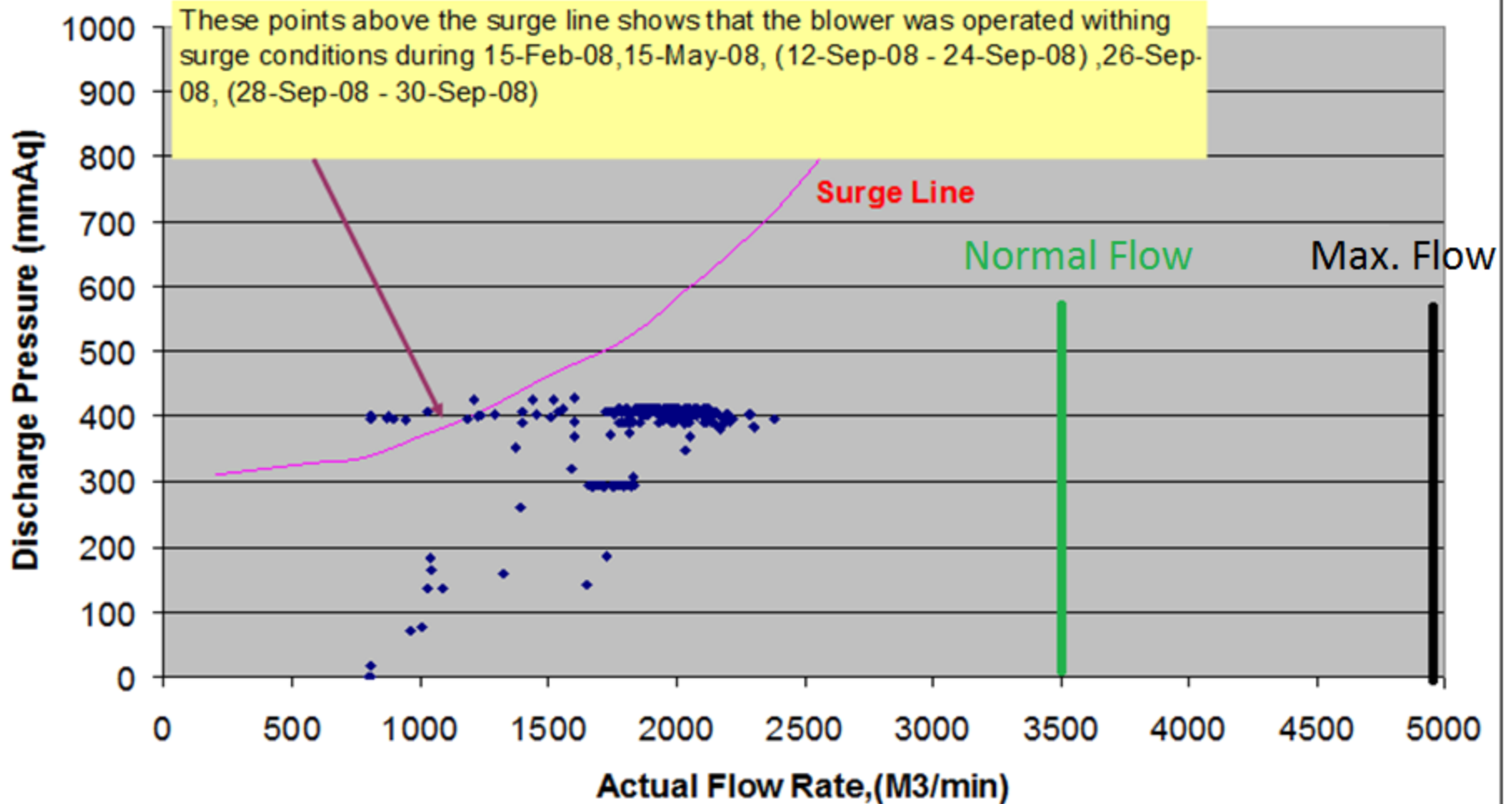
Broken blade inside casing

Root Cause Failure Factors

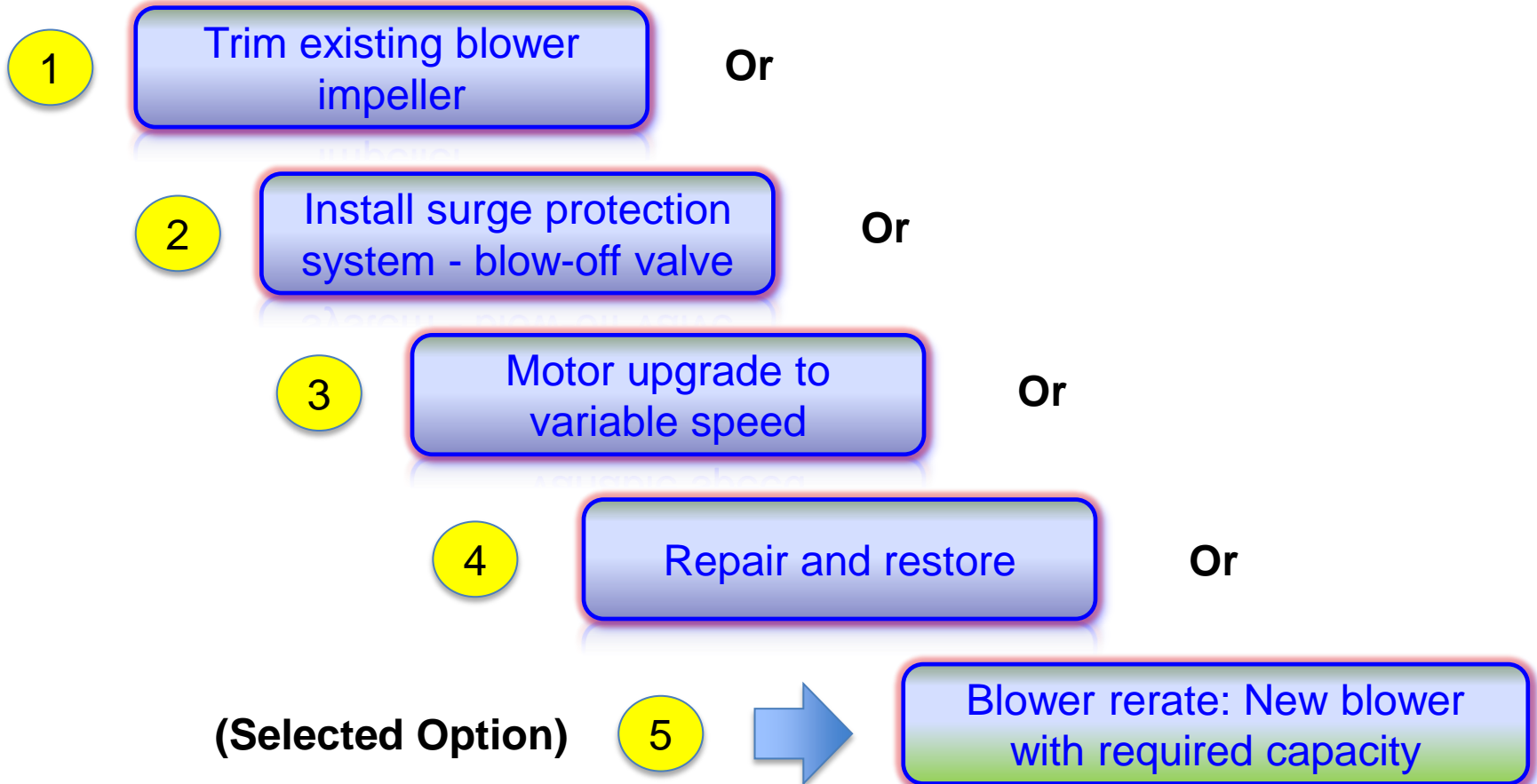
- Blower operation in unstable region (surge conditions), leading to resonance and cyclic fatigue.
- Insufficient surge protection control system.
- IGV system used for furnace flow demand not for blower surge protection.

Root Cause Failure Factors

Incinerator Air Blower (Old)



Solutions : Available options

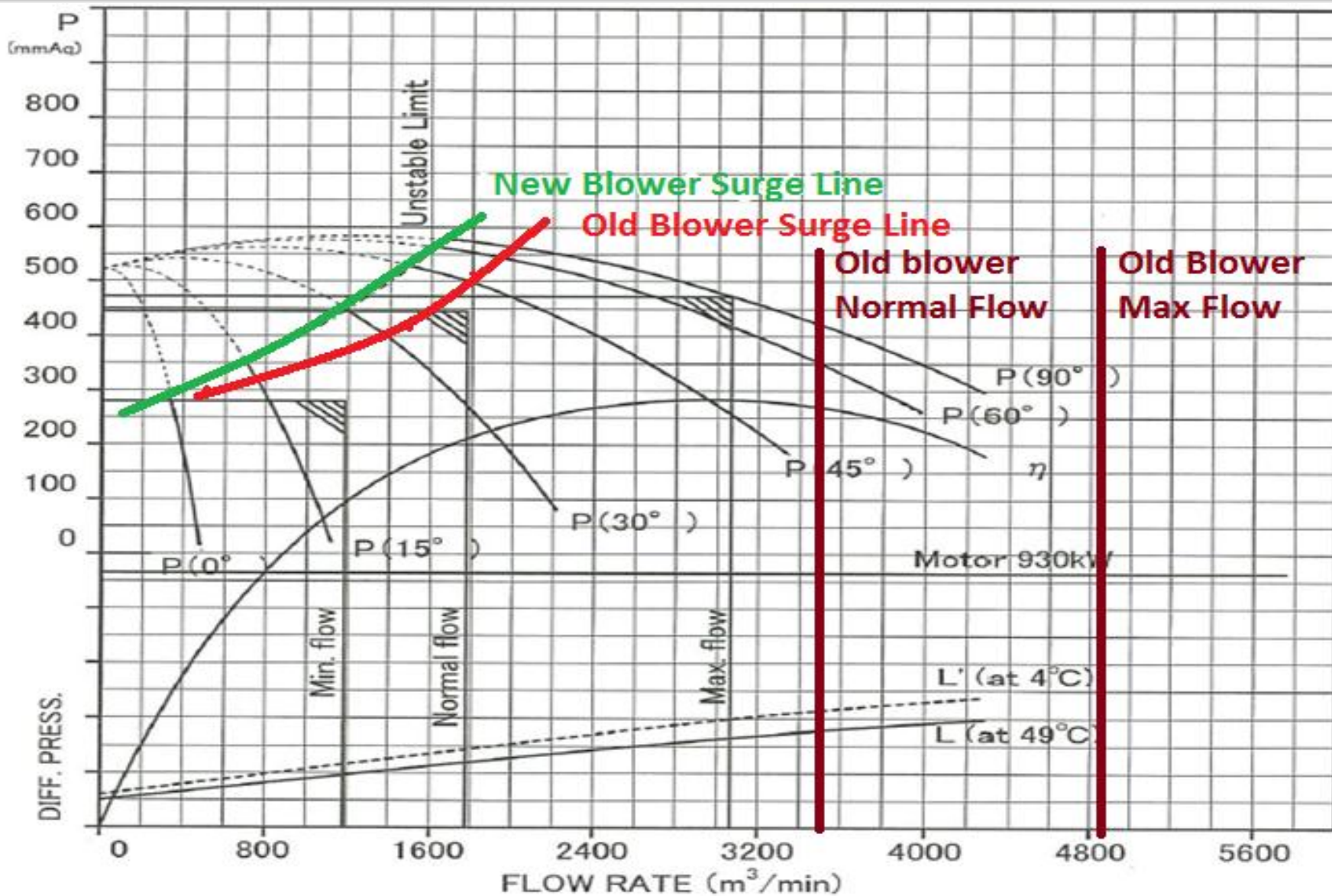


Selection and Implementation

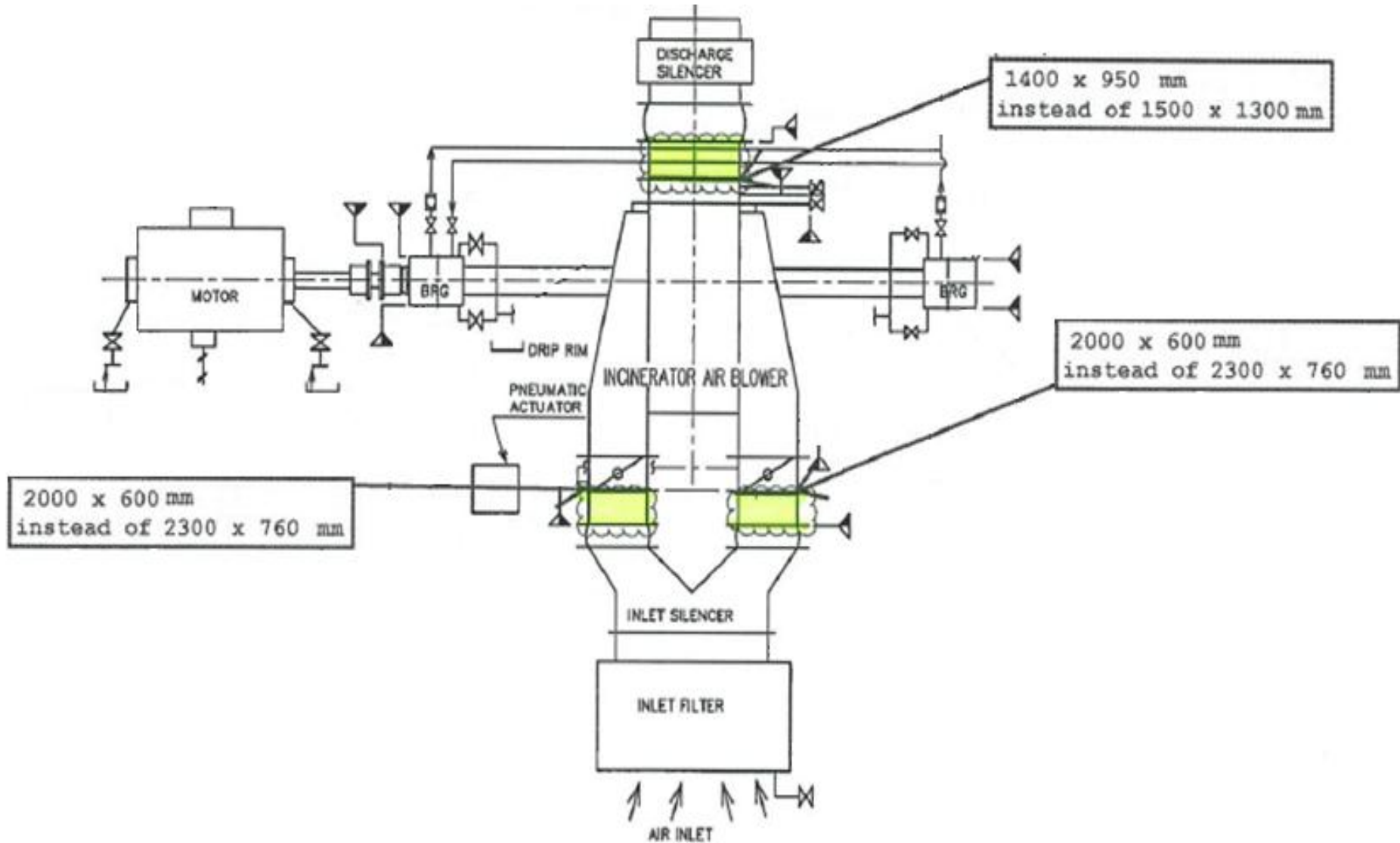
Blower Rerate:-

- New blower max capacity is 3066 m³/min (old was 4830 m³/min).
- No major site modification:
 1. Same foot print, coupling and suction and discharge duct with transition pieces.
 2. Existing motor.
 3. No change in air inlet filtration unit.

New Blower Performance Curve



New Blower Drawing



New Blower FAT



New Blower - Site Performance

Operation data

IGV opening % DCS / degree local	Motor current (Amps)			Flow (Nm ³ /hrs)		Disch. press (mbarg) 29PC-0561
				29FC-0561	29FC-0562	
00% / 00°	26	27	27	28500		5.5
23% / 18°	31	31	31	62000		6.61
35% / 30°	35	35	35	70000	25000	39.36
50% / 45°	42	42	42	66200	87700	34.44
70% / 63°	43	43	43	67500	104600	35.36
100% / 90°	43	43	43	66500	111200	34.24

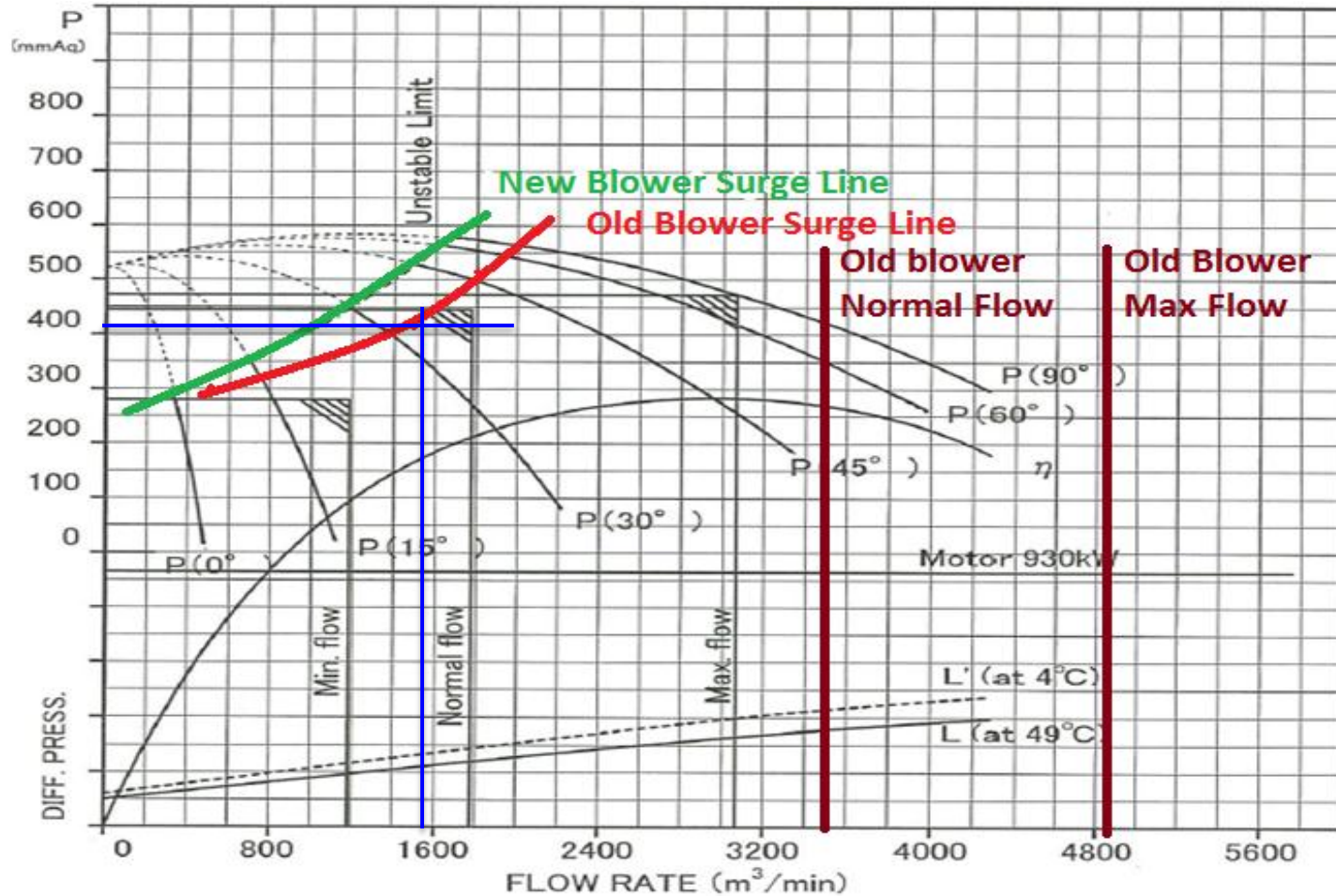
Vibration data

	Measurement points	IGV 30° open	IGV 63° open	IGV 90° open	Back to IGV 45° open	After 24hrs running with IGV 45° open
Elect motor	Casing- NDE horizontal (mm/s)	0.75	0.77	0.82	0.75	0.75
	Casing- NDE vertical (mm/s)	0.28	0.26	0.24	0.25	0.2
	Casing- DE horizontal (mm/s)	0.7	0.77	0.78	0.73	0.68
	Casing- DE vertical (mm/s)	0.3	0.34	0.3	0.4	0.3
	Casing- DE axial (mm/s)	0.38	0.39	0.38	0.35	0.37
Blower	Casing- DE horizontal (mm/s)	0.58	0.76	0.8	0.7	0.6
	Casing- DE vertical (mm/s)	0.34	0.5	0.5	0.45	0.4
	Casing- NDE horizontal (mm/s)	0.63	0.53	0.55	0.5	0.4
	Casing- NDE vertical (mm/s)	0.37	0.38	0.4	0.44	0.5
	Casing- NDE axial (mm/s)	0.3	0.4	0.35	0.4	0.3

New Blower Operating Point

New Blower normal continuous operation is at:

- Flow = 85 to 95 KNm³/hr (1416 to 1583 Nm³/min) and
- Dish Pressure = 40 mbarG (407.89 mmAq)



Lessons Learnt

1. Blower operation below rated capacity near minimum flow region in response to downstream requirement is not good practice; unless blower surge control protection system is in place.
2. Blower casing and suction duct vibration, resonance monitoring beyond bearing vibrations must be part of preventive maintenance programmed.
3. Blower and duct internals strengthening by adding stiffeners resulted effectively in reducing resonance effects as an immediate / short term measures.
4. Process load conditions, driver selection, equipment capacity / sizing aspects needs to be carefully analyzed during project stage.
5. Project control (MAC, SAT, handover) are critical for project to be successful.

Conclusion

- New blower assembled and commissioned successfully in March 2014.
- No site modification.
- Blower resonance and high vibration issues have been resolved.
- Blower performance found satisfactory in all mode of furnace operation.

Thank You
