CASE STUDY

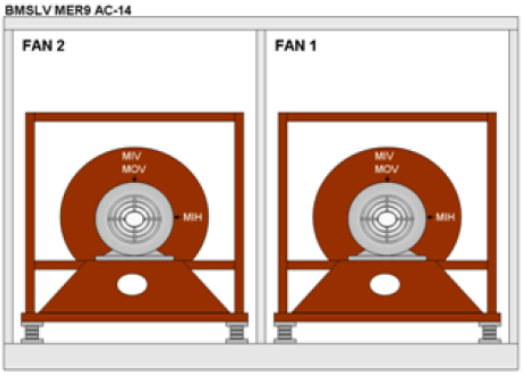
IVC
TECHNOLOGIES

Title: Air Handling Unit

Industry: Pharmaceutical | Machine: Air Handling Unit| Technology: Vibration Analysis

Purpose: This case study highlights testing performed on an air handling unit needed to run two supply fans at capacity in support of air flow requirements for enclosed areas within a pharmaceutical facility.

Overview: The site was in the process of commissioning an air handling unit (AC-14) to support and meet the air flow requirement of the enclosed areas which needed to be on-line. The unit had two direct-coupled fans each with a 150-hp motor. The unit appeared to be fine when running one fan, but when the second fan was also running, at certain set points, vibration issues occurred.



VIBRATION TEST RESULT (RUNNING THE FAN ONE AT A TIME)

Table 1

MEASUREMENT POINT	VFD SPEED	SUPPLY FAN # 2	SUPPLY FAN # 1
MOV MOTOR OUTBOARD VERTICAL	55.6 HZ	OFF	.190 In/Sec
MIV MOTOR INBOARD VERTICAL	55.6 HZ	OFF	.127 In/Sec
MIH MOTOR INBOARD HORIZONTAL	55.6 HZ	OFF	.068 In/Sec

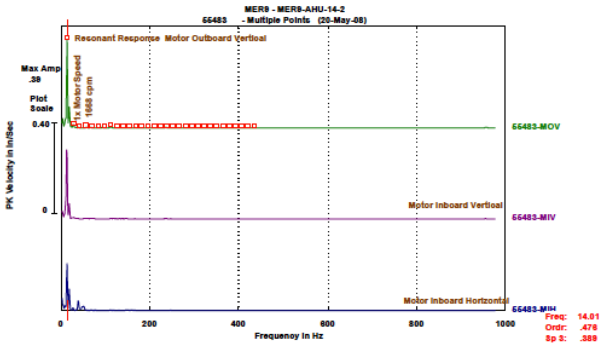
Table 2

MEASUREMENT POINT	VFD SPEED	SUPPLY FAN # 2	SUPPLY FAN # 1
MOV MOTOR OUTBOARD VERTICAL	59.9 HZ	.240 In/Sec	OFF
MIV MOTOR INBOARD VERTICAL	59.9 HZ	.091 In/Sec	OFF
MIH MOTOR INBOARD HORIZONTAL	59.9 HZ	.081 In/Sec	OFF

VIBRATION TEST RESULT (RUNNING THE TWO FANS TOGETHER)

Table 3

MEASUREMENT POINT	VFD SPEED	SUPPLY FAN # 2	SUPPLY FAN # 1
MOV MOTOR OUTBOARD VERTICAL	55.6 HZ	.456 In/Sec	.255 In/Sec
MIV MOTOR INBOARD VERTICAL	55.6 HZ	.347 In/Sec	.174 In/Sec
MIH MOTOR INBOARD HORIZONTAL	55.6 HZ	.260 In/Sec	.096 In/Sec



Analysis: When each fan was tested one at a time, fan #1 and #2 both showed notable low levels of vibration amplitudes across the motor (Table 1, and 2). However, when the two fans were turned on together at operating speed, fan #2 appeared to have a slight increase of vibration amplitudes in all three measurement points while fan #1 amplitudes remained almost the same (Table 3). The highest amplitude appeared in the motor outboard vertical at 0.456 in/s with the dominant peak at 841 cpm which indicated a probable structural resonance vibration. Spectral data also showed no other signs mechanical problems in the system.

Recommendation: Inspect the frame structure and the dynamic absorber of fan #2. Inform the supplier about the current condition. Continue to monitor and if possible, get inside the unit while both fans are running. A bump test should be performed to further locate and analyze the resonance vibration.

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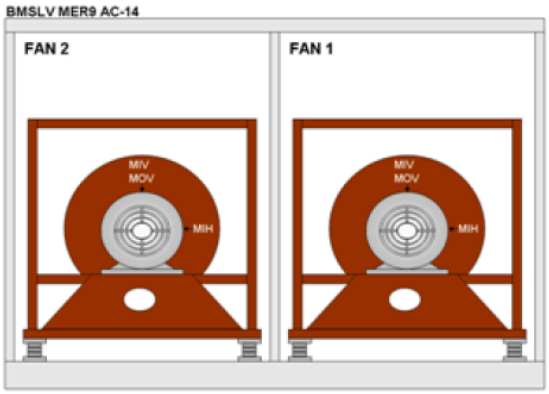

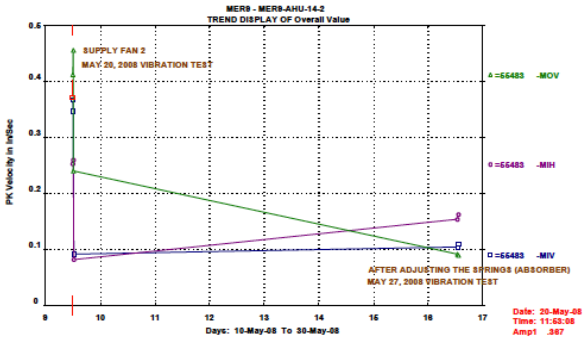

VIBRATION TEST RESULT (May 27, 2008)

1ST READING	SUPPLY FAN 2				SUPPLY FAN 1			
POINT	SPEED	OPEN	AMPS	VIBE	SPEED	OPEN	AMPS	VIBE
MOV	63 HZ	45%		0.09 in/s	63 HZ	45%		0.37 in/s
MIV	63 HZ	45%		0.15 in/s	63 HZ	45%		0.24 in/s
MIH	63 HZ	45%		0.10 in/s	63 HZ	45%		0.25 in/s
REMARK	AFTER ADJUSTING THE SF2 SPRINGS							

2ND READING	SUPPLY FAN 2				SUPPLY FAN 1			
POINT	SPEED	OPEN	AMPS	VIBE	SPEED	OPEN	AMPS	VIBE
MOV	63 HZ	50%		0.08 in/s	63 HZ	50%		0.46 in/s
MIV	63 HZ	50%		0.16 in/s	63 HZ	50%		0.25 in/s
MIH	63 HZ	50%		0.10 in/s	63 HZ	50%		0.15 in/s
REMARK	AFTER ADJUSTING THE SF2 SPRINGS							

VIBRATION TEST RESULT (May 27, 2008)

3RD READING	SUPPLY FAN 2				SUPPLY FAN 1			
POINT	SPEED	OPEN	AMPS	VIBE	SPEED	OPEN	AMPS	VIBE
MOV	63 HZ	50%	107 A	0.08 in/s	63 HZ	70%	131 A	0.46 in/s
MIV	63 HZ	50%	107 A	0.16 in/s	63 HZ	70%	131 A	0.25 in/s
MIH	63 HZ	50%	107 A	0.10 in/s	63 HZ	70%	131 A	0.14 in/s
REMARK	AFTER ADJUSTING THE SPRINGS							

4TH READING	SUPPLY FAN 2				SUPPLY FAN 1			
POINT	SPEED	OPEN	AMPS	VIBE	SPEED	OPEN	AMPS	VIBE
MOV					58 HZ			0.29 in/s
MIV					58 HZ			0.24 in/s
MIH					58 HZ			0.11 in/s
REMARK	NOT RUNNING				AFTER ADJUSTING THE SPRINGS			

Analysis: The first vibration reading showed a significant decrease of amplitudes on supply fan #2 after adjusting its six spring absorbers, most notably from 0.45 in/s to 0.09 in/s on point MOV. However, when the damper positions of the two fans were opened 45%, 50%, and 70%, the amplitudes on supply fan #1 started to increase while the amplitudes on supply fan #2 remained steady. Subsequent readings showed reduced vibration levels on supply fan #1 when supply fan #2 was turned off. Additional bump tests and analysis were performed to look for natural frequencies that would interfere with the normal operation of the fan. No significant issues were noted.

Findings: The spring absorber loading and damper positions played a significant role in vibration levels. Most of the springs needed to be properly adjusted and any damaged ones were scheduled for repair or replacement. Once the the springs were no longer an issue, it was determined that if abnormal levels are present during future readings, the damper position should be noted and addressed if it's more than transient in nature.

Case Study Note: After another few test of running the unit at different damper settings to get the unit running on both fans, the supplier/contractor was able to get the damper position with proper flow rates they needed to run both fans. Resonant vibrations also reduced significantly upon verification of flow rates.

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