

LOADED SOUND TEST SUMMARY SHEET

NAME OF DEVICE UNDER TEST (DUT)	Pneumatic Impact Wrench
TOOL OPERATOR	Manual Mode, Brian Kim
COMPUTER OPERATOR	Edward Zechmann
TEST DATE	4/27/2009
TEST DESCRIPTION	Sound Power Level Measurement
TEST LOCATION	UC anechoic lab
MANUFACTURER	Ingersoll-Rand
MODEL	231G
SERIAL NUMBER	1/2
MODE OF OPERATION	FULL SPEED, LOADED, WITH OPERATOR
RUN NUMBER	1
YEAR MADE	2005
DIMENSIONS (inches)	Length 7.0", Width 3.0", Height 9.0"
WEIGHT (lbs.)	5.8
TECHNICAL SPECIFICATIONS	1/2" chuck size
MOUNTING CONDITIONS	MOUNTED ON SOCKET AND DRIVE BOLT
LOADING CONDITIONS	FULL SPEED, LOADED WITH SOCKET ON BOLT
K1 (dBA)	0
K2 (dBA)	0.18
TEMPERATURE (CELSIUS)	24
HUMIDITY %	37
BAROMETRIC PRESSURE ("Hg)	30.26
TEST ENVIRONMENT	SEMI ANECHOIC, SEMI HEMISPHERICAL
TOOL TESTING STANDARD	ANSI S12.15-1992
MEASUREMENT STANDARD	ISO 3744:1994-05-01
MICROPHONE SET-UP	10-MICROPHONES
SURFACE RADIUS	2.00 meters
RATED POWER (WATTS)	4.2
ACTUAL INPUT POWER (WATTS)	N/A
VOLTAGE (VOLTS)	N/A
CURRENT (AMPS)	N/A
RATED RPM	8000
ACTUAL RPM	30
SOUND POWER LEVEL (dBA)	101.0
SOUND POWER (WATTS) A-weighted	0.01267
SWLA - k2 (dBA)	100.9
SWLA - k2 (WATTS) A-weighted	0.01216
SOUND PRESSURE LEVEL (dBA) @ 2 meters	87.0
AT THE NOMINAL HEARING ZONE OF OPERATOR	
SOUND PRESSURE LEVEL (dBA)	100.8

Average Directivity Study

TEST DATE 4/27/2009
DUT Pneumatic Impact Wrench
Manufacturer Ingersoll-Rand
Model Number 231G
Serial Number 1/2
Mode FULL SPEED, LOADED, WITH OPERATOR
Run Number 1

A-weighted Sound Pressure Level

	Position1	Position2
Mic #	dBA	dBA
0	88.4	87.9
1	87.9	86.7
2	87.5	85.3
3	83.1	86.6
4	86.4	87.0
5	87.2	83.7
6	87.0	86.6
7	85.0	88.1
8	88.6	87.2
9	88.7	84.0
10	100.8	99.6
dB difference	5.7	4.3

A-weighted Directivity Index

Mic #	dBA	dBA
0	1.4	1.6
1	0.9	0.4
2	0.6	-1.0
3	-3.9	0.3
4	-0.6	0.7
5	0.3	-2.6
6	0.0	0.3
7	-2.0	1.8
8	1.6	0.9
9	1.8	-2.3

SOUND DATA SHEET

PRODUCT INFORMATION

TEST CONDITIONS

TEST DATE	4/27/2009		
DUT	Pneumatic Impact Wrench	Actual Power (watt)	N/A
Manufacturer	Ingersoll-Rand	Voltage (Volts)	N/A
Model Number	231G	Current (Amps)	N/A
Serial Number	1/2	Actual RPM	30
Mode of Operation	FULL SPEED, LOADED, WITH OP	Temperature (Deg. F)	24
Run Number	1	Humidity (%)	37

Measurement Data

Baro. Press. (inch of Hg) 30.26

Linear (unweighted) Position 1

Sound Power (dB)	101.75	102.65	101.36	100.46	101.73	102.30	101.74	102.16	101.79	102.12
Sound Power (Watts)	0.01496	0.01843	0.01368	0.01113	0.01488	0.01697	0.01493	0.01644	0.01511	0.01629
Sound Pressure (dB)	87.75	88.65	87.36	86.46	87.72	88.29	87.74	88.16	87.79	88.12

Linear (unweighted) Position 2

Sound Power (dB)	101.25	100.94	101.13	100.96	101.40
Sound Power (Watts)	0.01333	0.01243	0.01298	0.01246	0.01381
Sound Pressure (dB)	87.25	86.94	87.13	86.95	87.40

A-weighted Position 1

Sound Power (dBA)	101.24	102.08	100.88	99.89	101.12	101.65	101.12	101.61	101.15	101.55
Sound Power (Watts)	0.01331	0.01615	0.01226	0.00974	0.01294	0.01464	0.01296	0.01448	0.01302	0.01429
Sound Pressure (dBA)	87.24	88.08	86.88	85.88	87.12	87.65	87.12	87.60	87.15	87.55

A-weighted Position 2

Sound Power (dBA)	100.65	100.39	100.48	100.30	100.74
Sound Power (Watts)	0.01162	0.01095	0.01116	0.01070	0.01186
Sound Pressure (dBA)	86.65	86.39	86.48	86.29	86.74

Calculations

Average A-weighted Sound Data

Sound Power (dBA)	101.03
Sound Power (Watts)	0.0127
Sound Pressure (dBA)	87.03

Std. Deviation SWLA	0.5947
95 % Confidence Level	0.3293
Mean SPLA-k2	86.85

LOADED VIBRATIONS TEST SUMMARY SHEET

NAME OF DEVICE UNDER TEST (DUT)
TOOL OPERATOR (SUBJECT OF TEST)
COMPUTER OPERATOR
TEST DATE

Pneumatic Impact Wrench
Manual Mode, Brian Kim
Edward Zechmann
4/27/2009

TEST DESCRIPTION
TEST LOCATION
MANUFACTURER
MODEL
SERIAL NUMBER
MODE OF OPERATION
RUN NUMBER
YEAR MADE
DIMENSIONS (inches)
WEIGHT (lbs.)
TECHNICAL SPECIFICATIONS
MOUNTING CONDITIONS
LOADING CONDITIONS
TEMPERATURE (CELSIUS)
HUMIDITY %
BAROMETRIC PRESSURE ("Hg)

Human Exposure to Vibrations
UC ANECHOIC LAB
Ingersoll-Rand
231G
1/2
FULL SPEED, LOADED, WITH OPERATOR
1
2005
Length 7.0", Width 3.0", Height 9.0"
5.8
1/2" chuck size
MOUNTED ON SOCKET AND DRIVE BOLT
FULL SPEED, LOADED WITH SOCKET ON BOLT
24
37
30.26

TEST ENVIRONMENT
MEASUREMENT STANDARD
ACCELEROMETER SETUP
SETUP DIAGRAM
LOCATION ACCEL 1
ORIENTATION ACCEL 1
LOCATION ACCEL 2
ORIENTATION ACCEL 2
ADAPTER TYPE
OPERATOR PRESSURE
HAND GRIP FORCE

SEMI ANECHOIC, SEMI HEMISPHERICAL
ISO 5349-1 and ISO 5349-2
2 - ACCELEROMETERS
impact_wrench_2_sv_accel_setup.doc
right hand, right handle, on top of tool, near trigger
X toward right side of tool, Y toward front of tool, Z toward top of tool
left hand, on front of tool, near middle of tool
X toward right side of tool, Y toward bottom of tool, Z toward front of tool
Accel 1-side adapter, Accel 2-side adapter
Bending over the tool, both hands gripping tool
Band clamp over rubber mechanical low-pass filter

RATED POWER (WATTS)
ACTUAL INPUT POWER (WATTS)
VOLTAGE (VOLTS)
CURRENT (AMPS)
RATED RPM
ACTUAL RPM

4.2
N/A
N/A
N/A
8000
30

Vibrations
Accelerometer 1
X, Y, Z arms m/s^2 weighted
X, Y, Z arms m/s^2 linear
Total arms m/s^2 (weighted, linear)

6.6, 7.5, 14.5
60.2, 153.3, 160.4
17.6, 230.5

Accelerometer 2
X, Y, Z arms m/s^2 weighted
X, Y, Z arms m/s^2 linear
Total arms m/s^2 (weighted, linear)

8, 13, 6.9
120.8, 180.1, 158.7
16.8, 269.1

VIBRATIONS DATA SHEET

TEST DATE	4/27/2009		
DUT	Pneumatic Impact Wrench	Actual Power (watt)	N/A
Manufacturer	Ingersoll-Rand	Voltage (Volts)	N/A
Model Number	231G	Current (Amps)	N/A
Serial Number	1/2	Actual RPM	30
Mode of Operation	FULL SPEED, LOADED, WITH C		Temperature
Run Number	1	Humidity (%)	37

Accelerometer 1	arms weighted m/s ²														
Axis	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
X	8.0	7.2	7.1	6.6	5.8	6.0	5.6	5.9	6.5	7.0	6.1	6.4	6.4	6.9	6.9
Y	7.8	8.2	8.2	8.4	7.4	7.9	7.8	7.3	7.0	6.7	7.8	7.2	7.2	7.2	6.5
Z	14.1	16.9	14.5	14.8	13.5	15.1	16.0	14.8	14.2	13.7	15.3	14.5	13.6	14.1	11.9
Total arms	18.0	20.1	18.1	18.2	16.5	18.0	18.7	17.5	17.1	16.8	18.2	17.5	16.7	17.3	15.2

Accelerometer 1	arms linear m/s ²														
X	80.3	62.4	65.9	63.5	48.8	49.1	47.8	48.1	49.0	55.1	64.3	68.0	64.0	65.4	71.0
Y	176.2	173.4	169.2	167.6	145.8	158.7	153.7	145.7	150.3	143.2	145.2	143.4	141.9	147.0	138.7
Z	140.5	168.8	163.7	165.5	149.1	159.1	178.6	169.6	153.3	152.6	178.6	171.2	160.1	156.7	139.3
Total arms	239.2	250.0	244.5	244.0	214.2	230.0	240.5	228.7	220.2	216.4	239.0	233.4	223.3	224.6	209.0

Accelerometer 2	arms weighted m/s ²														
Axis	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
X	11.8	7.9	9.1	8.5	7.3	6.5	6.7	7.2	7.4	8.6	8.1	8.0	7.7	7.3	8.2
Y	19.4	18.8	16.1	14.7	14.5	14.3	12.2	12.5	11.5	12.1	9.7	9.5	9.7	10.2	9.5
Z	8.3	8.1	7.6	7.8	7.5	7.4	6.7	6.6	6.8	6.5	6.7	6.1	5.9	5.9	5.8
Total arms	24.2	22.0	20.0	18.7	17.9	17.3	15.5	15.9	15.2	16.2	14.3	13.9	13.7	13.9	13.8

Accelerometer 2	arms linear m/s ²														
X	131.6	126.1	125.2	126.1	121.3	116.5	110.4	112.7	114.1	117.2	126.7	125.0	119.1	119.7	121.1
Y	243.3	228.7	213.1	209.3	169.0	170.5	168.7	170.7	164.2	161.8	163.0	156.7	160.8	162.0	159.5
Z	202.3	180.4	176.0	176.9	155.1	152.9	150.5	152.3	150.2	152.5	150.4	145.2	146.6	144.2	145.5
Total arms	342.6	317.4	303.4	301.7	259.5	257.0	251.6	255.1	250.1	251.3	255.4	247.5	248.0	247.8	247.5

Average arms						
Weighted m/s ²	Accel 1	Accel 2	Linear	Accel 1	Accel 2	
X	6.6	8.0	X	60.2	120.8	
Y	7.5	13.0	Y	153.3	180.1	
Z	14.5	6.9	Z	160.4	158.7	
Total arms m/s ²	17.6	16.8		230.5	269.1	
Std. Deviation	1.1	3.2		12.3	31.0	
95 % Confidence Level	0.6	1.8		6.8	17.1	