Advanced Test & Balance Report Review

Scott Fielder

National Comfort Institute, Inc.

National Comfort Institute, Inc.

AHR EXPO
ORLANDO • FEB 3-5 • 2020

National Balancing Council™

The Final TAB Report

This is the final product of the TAB Professional.

When the painter is done, the walls change color.

When the electrician is finished, the lights come on.

When the TAB Professional is complete, we hand over a stack of paper and ask to be paid thousands of dollars.

This better be a REALLY good stack of paper.

The Final TAB Report

The final TAB Report is a POWERFUL Document!

It Proves Substantial Completion.

Retention for ALL Trades is often held up by the Final TAB Report.

The Certificate of Occupancy is often pending a final TAB Report.

The final TAB Report can be the difference between Liquidated Damages or completion.

It’s not uncommon for TAB Reports to be subpoenaed during legal proceedings.

Preliminary TAB Report Review

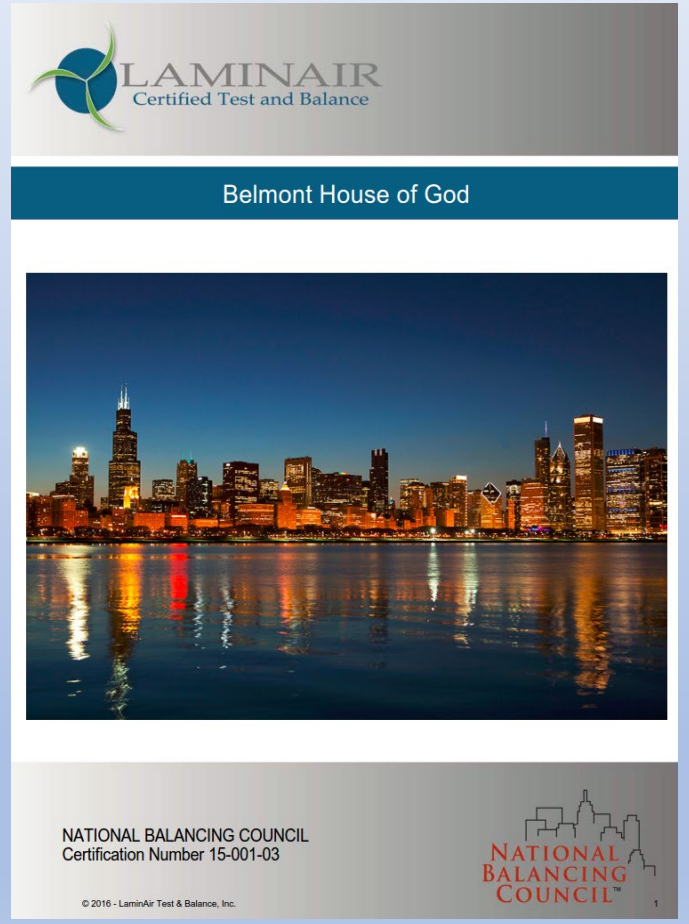
When the TAB Report is first received, there are a handful of things that can be determined at a glance, in order to determine if there are any potential problems.

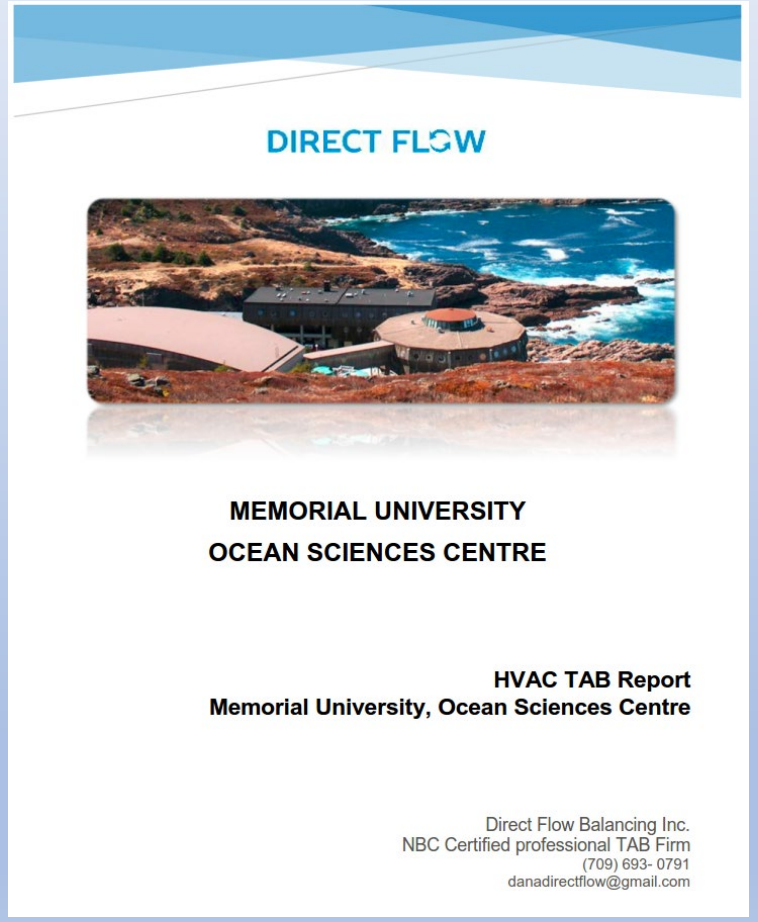
There are several elements that should stand out, prior to a thorough review of the data.

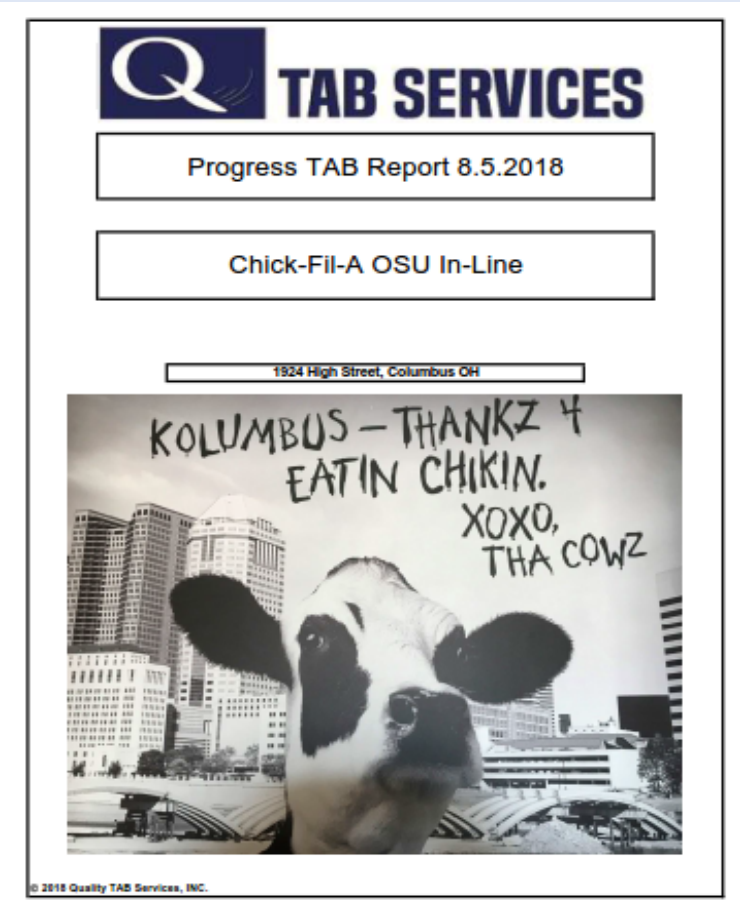
What follows are some highlights of what to look for upon initial receipt of the TAB Report.

Overall Professionalism

Sample TAB Report Covers that demonstrate time and care was put into compiling and published the data.

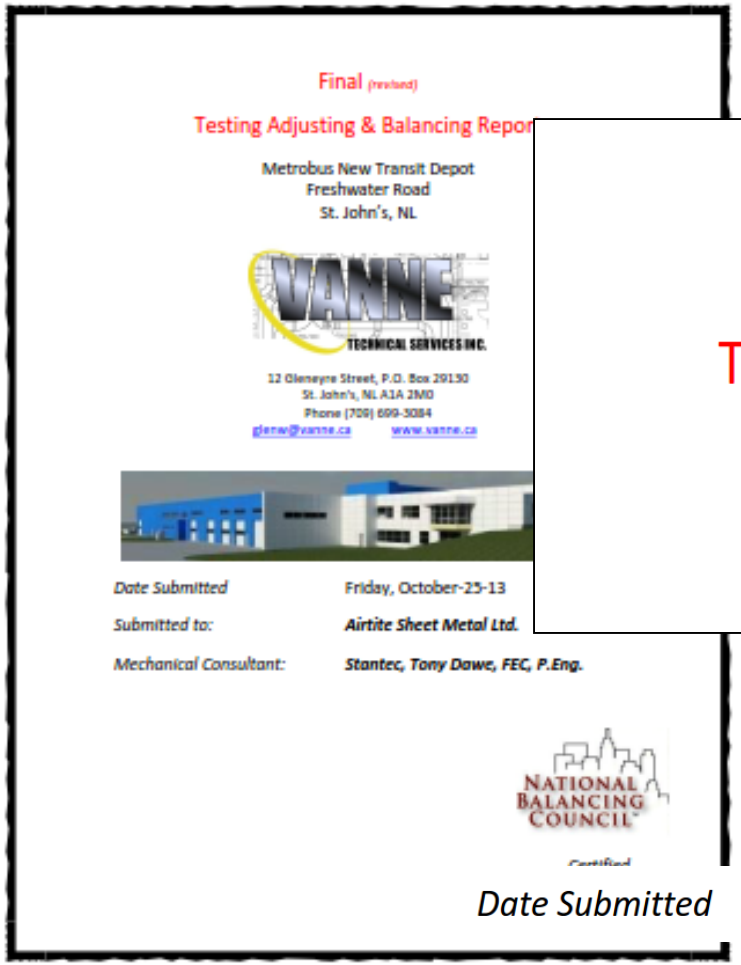






Overall Professionalism

Look for terms such as “Preliminary”, “Progress” or


Final (revised)

Testing Adjusting & Balancing Repor

Metrobus New Transit Depot
Freshwater Road
St. John's, NL

VANNE TECHNICAL SERVICES INC.

12 Glenayre Street, P.O. Box 29130
St. John's, NL A1A 2M0
Phone (709) 699-3084
glenw@vanne.ca www.vanne.ca

Date Submitted Friday, October-25-13

Submitted to: Airtite Sheet Metal Ltd.

Mechanical Consultant: Stantec, Tony Dawe, FEC, P.Eng.

NATIONAL BALANCING COUNCIL

Certified

Final *(revised)*

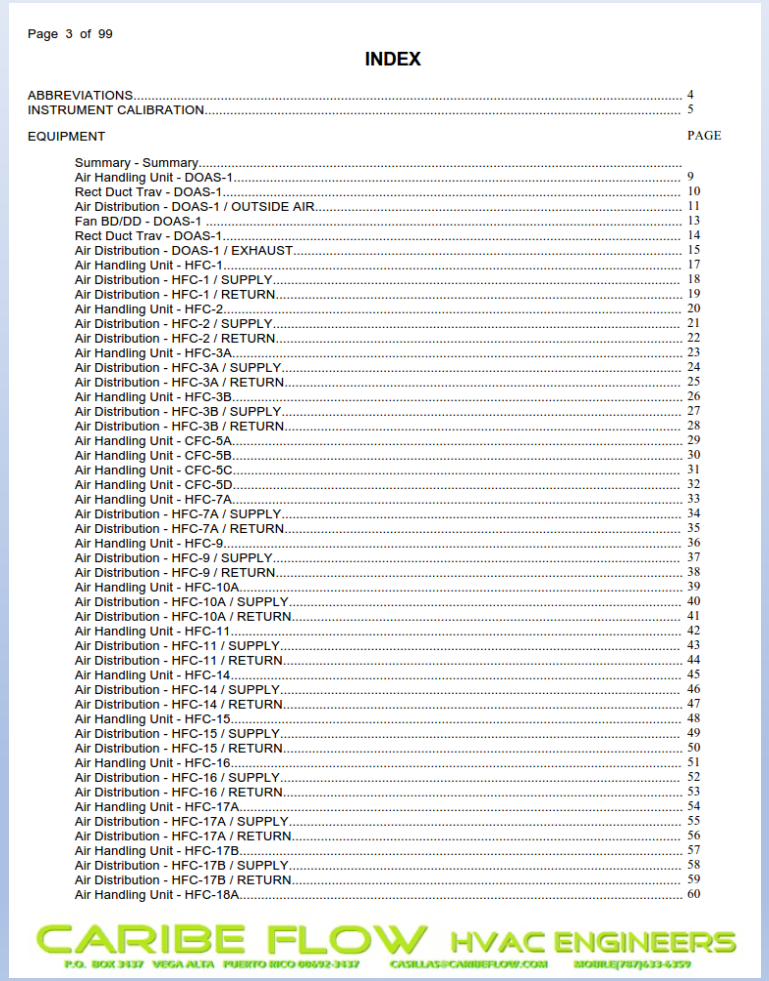
Testing Adjusting & Balancing Report

Metrobus New Transit Depot
Freshwater Road
St. John’s, NL

Date Submitted	Friday, October-25-13

Overall Professionalism

Does the TAB Report have a Table of Contents, Abbreviations, Executive Summary, and other details?



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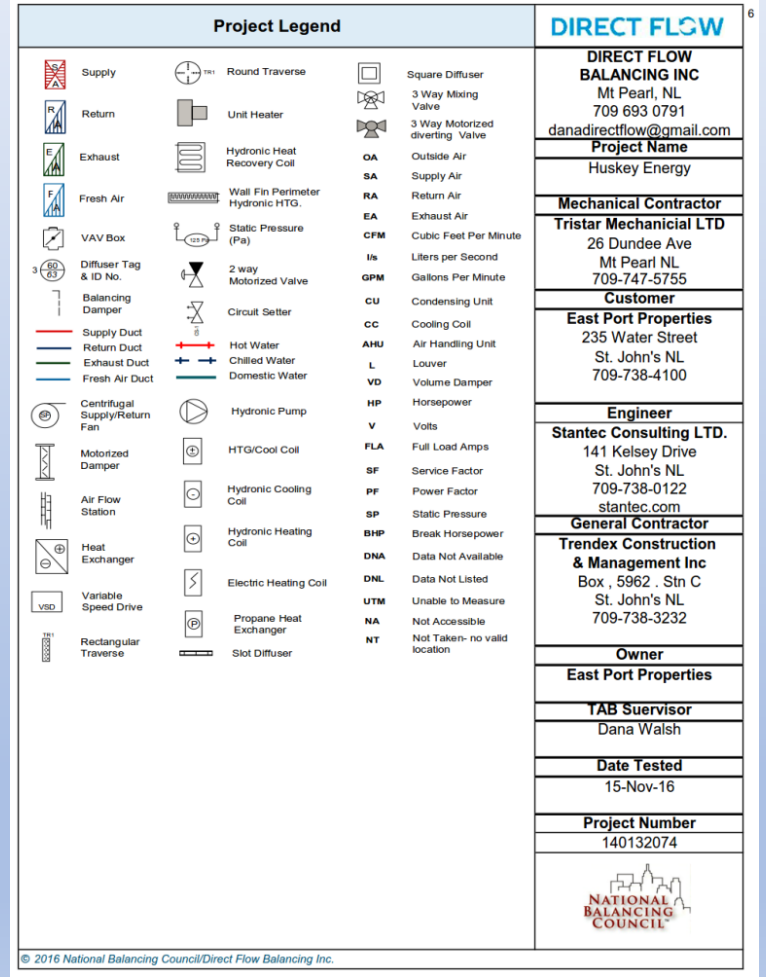
CARIBE FLOW HVAC ENGINEERS

P.O. BOX 3437 VEGA ALTA PUERTO RICO 00692-3437 CASILLAS@CARIBEFLOW.COM MOBILE(787)633-6359



Project Legend

Supply
Return
Exhaust
Fresh Air
VAV Box
Diffuser Tag & ID No.
Balancing Damper
Supply Duct
Return Duct
Exhaust Duct
Fresh Air Duct
Centrifugal Supply/Return Fan
Motorized Damper
Air Flow Station
Heat Exchanger
Variable Speed Drive
Rectangular Traverse
Round Traverse
Unit Heater
Hydronic Heat Recovery Coil
Wall Fin Perimeter Hydronic HTG.
Static Pressure (Pa)
2 way Motorized Valve
Circuit Setter
Hot Water
Chilled Water
Domestic Water
Hydronic Pump
HTG/Cool Coil
Hydronic Cooling Coil
Hydronic Heating Coil
Electric Heating Coil
Propane Heat Exchanger
Slot Diffuser
Square Diffuser
3 Way Mixing Valve
3 Way Motorized diverting Valve

OA	Outside Air
SA	Supply Air
RA	Return Air
EA	Exhaust Air
CFM	Cubic Feet Per Minute
l/s	Liters per Second
GPM	Gallons Per Minute
CU	Condensing Unit
CC	Cooling Coil
AHU	Air Handling Unit
L	Louver
VD	Volume Damper
HP	Horsepower
V	Volts
FLA	Full Load Amps
SF	Service Factor
PF	Power Factor
SP	Static Pressure
BHP	Break Horsepower
DNA	Data Not Available
DNL	Data Not Listed
UTM	Unable to Measure
NA	Not Accessible
NT	Not Taken- no valid location

DIRECT FLOW

DIRECT FLOW BALANCING INC
Mt Pearl, NL
709 693 0791
danadirectflow@gmail.com

Project Name
Huskey Energy

Mechanical Contractor
Tristar Mechanicial LTD
26 Dundee Ave
Mt Pearl NL
709-747-5755

Customer
East Port Properties
235 Water Street
St. John's NL
709-738-4100

Engineer
Stantec Consulting LTD.
141 Kelsey Drive
St. John's NL
709-738-0122
stantec.com

General Contractor
Trendex Construction & Management Inc
Box , 5962 . Stn C
St. John's NL
709-738-3232

Owner
East Port Properties

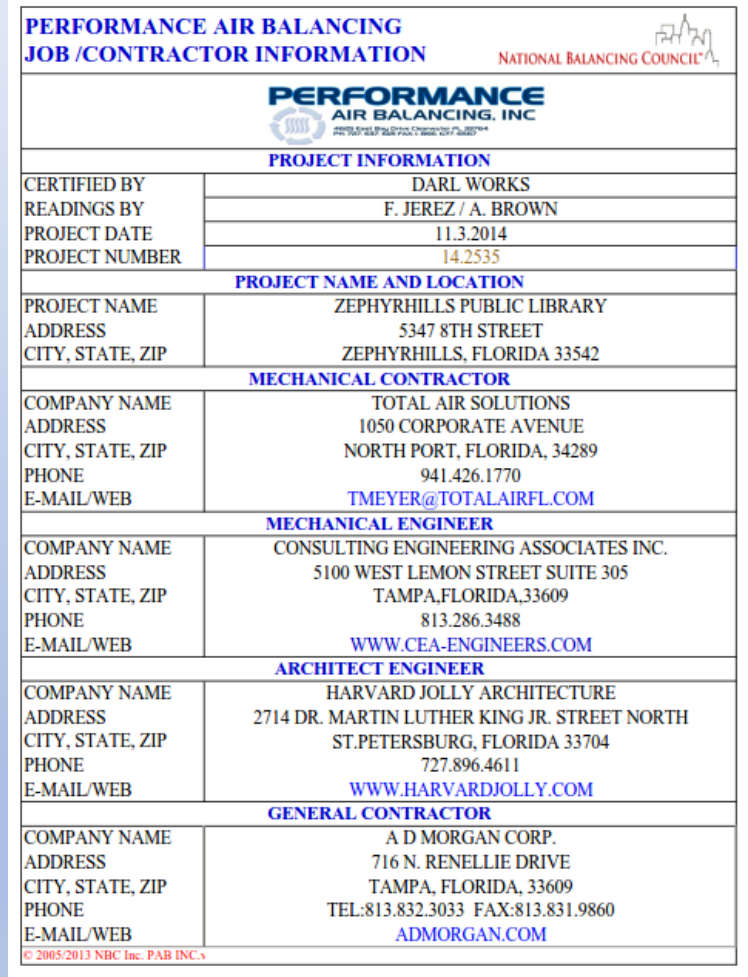
TAB Suervisor
Dana Walsh

Date Tested
15-Nov-16

Project Number
140132074

NATIONAL BALANCING COUNCIL

6



PERFORMANCE AIR BALANCING
JOB /CONTRACTOR INFORMATION

NATIONAL BALANCING COUNCIL

PERFORMANCE AIR BALANCING, INC

PROJECT INFORMATION

CERTIFIED BY	DARL WORKS
READINGS BY	F. JEREZ / A. BROWN
PROJECT DATE	11.3.2014
PROJECT NUMBER	14.2535

PROJECT NAME AND LOCATION

PROJECT NAME	ZEPHYRHILLS PUBLIC LIBRARY
ADDRESS	5347 8TH STREET
CITY, STATE, ZIP	ZEPHYRHILLS, FLORIDA 33542

MECHANICAL CONTRACTOR

COMPANY NAME	TOTAL AIR SOLUTIONS
ADDRESS	1050 CORPORATE AVENUE
CITY, STATE, ZIP	NORTH PORT, FLORIDA, 34289
PHONE	941.426.1770
E-MAIL/WEB	TMEYER@TOTALAIRFL.COM

MECHANICAL ENGINEER

COMPANY NAME	CONSULTING ENGINEERING ASSOCIATES INC.
ADDRESS	5100 WEST LEMON STREET SUITE 305
CITY, STATE, ZIP	TAMPA,FLORIDA,33609
PHONE	813.286.3488
E-MAIL/WEB	WWW.CEA-ENGINEERS.COM

ARCHITECT ENGINEER

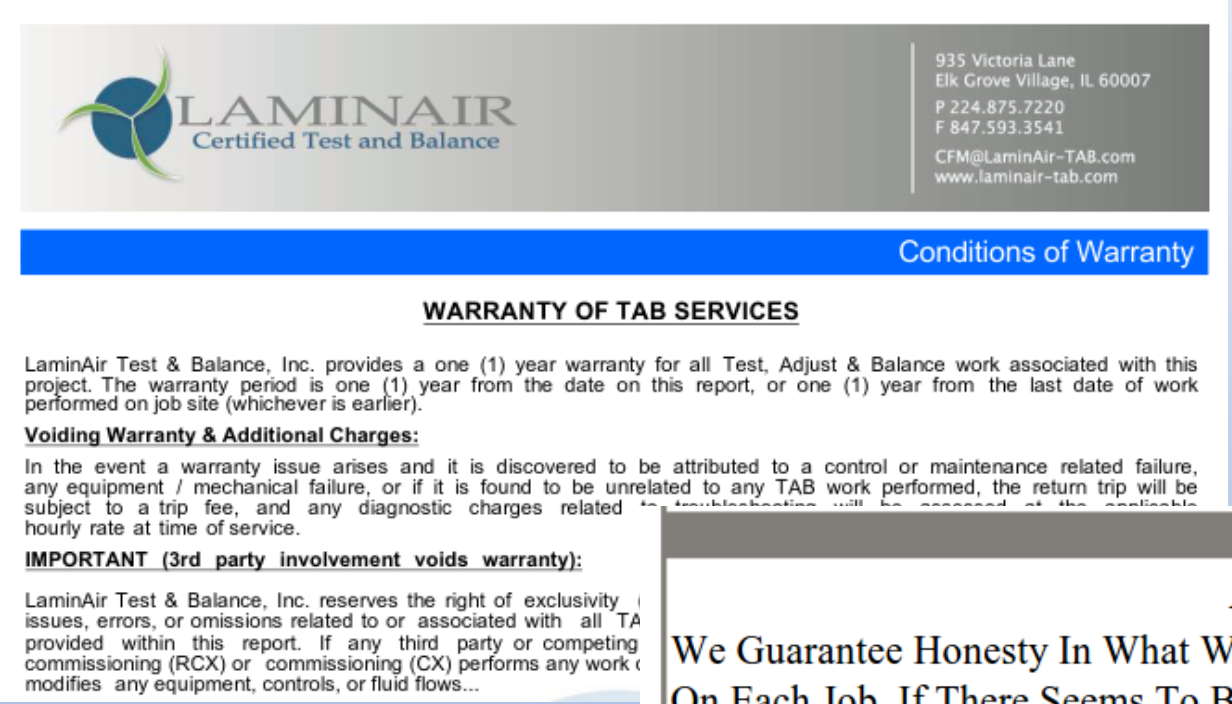
COMPANY NAME	HARVARD JOLLY ARCHITECTURE
ADDRESS	2714 DR. MARTIN LUTHER KING JR. STREET NORTH
CITY, STATE, ZIP	ST.PETERSBURG, FLORIDA 33704
PHONE	727.896.4611
E-MAIL/WEB	WWW.HARVARDJOLLY.COM

GENERAL CONTRACTOR

COMPANY NAME	A D MORGAN CORP.
ADDRESS	716 N. RENELLIE DRIVE
CITY, STATE, ZIP	TAMPA, FLORIDA, 33609
PHONE	TEL:813.832.3033 FAX:813.831.9860
E-MAIL/WEB	ADMORGAN.COM

Overall Professionalism

Does it have a warranty statement? Regardless of Certification Requirements, TAB professionals should warranty their work, and are required to by most specifications.



LAMINAIR
Certified Test and Balance

935 Victoria Lane
Elk Grove Village, IL 60007
P 224.875.7220
F 847.593.3541
CFM@LaminAir-TAB.com
www.laminair-tab.com

Conditions of Warranty

WARRANTY OF TAB SERVICES

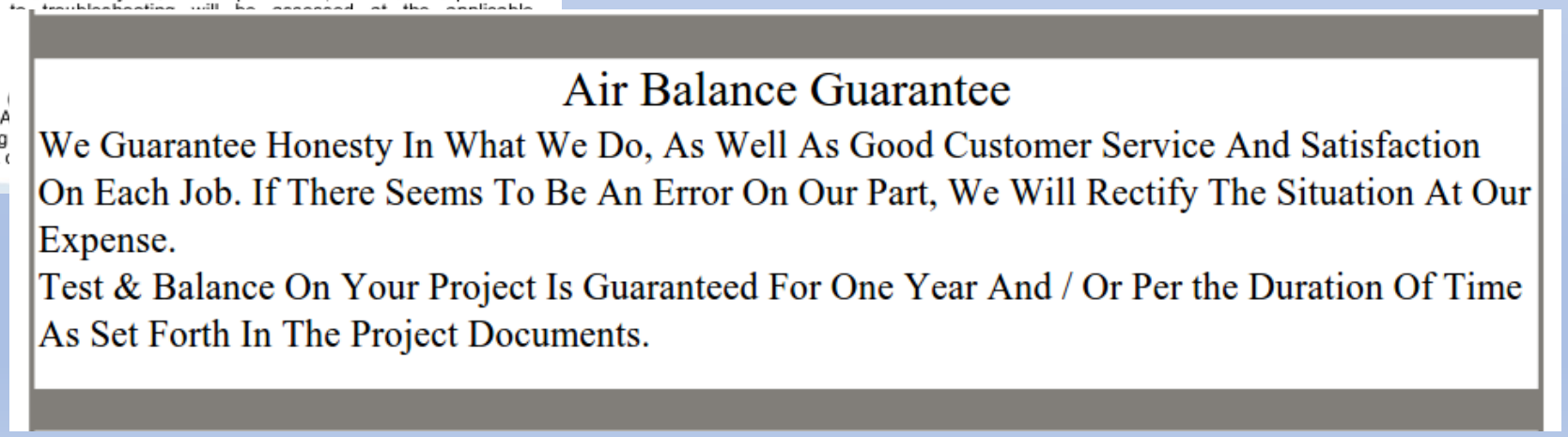
LaminAir Test & Balance, Inc. provides a one (1) year warranty for all Test, Adjust & Balance work associated with this project. The warranty period is one (1) year from the date on this report, or one (1) year from the last date of work performed on job site (whichever is earlier).

Voiding Warranty & Additional Charges:

In the event a warranty issue arises and it is discovered to be attributed to a control or maintenance related failure, any equipment / mechanical failure, or if it is found to be unrelated to any TAB work performed, the return trip will be subject to a trip fee, and any diagnostic charges related to troubleshooting will be assessed at the applicable hourly rate at time of service.

IMPORTANT (3rd party involvement voids warranty):

LaminAir Test & Balance, Inc. reserves the right of exclusivity to issues, errors, or omissions related to or associated with all TAB provided within this report. If any third party or competing commissioning (RCX) or commissioning (CX) performs any work or modifies any equipment, controls, or fluid flows...



Air Balance Guarantee

We Guarantee Honesty In What We Do, As Well As Good Customer Service And Satisfaction On Each Job. If There Seems To Be An Error On Our Part, We Will Rectify The Situation At Our Expense.

Test & Balance On Your Project Is Guaranteed For One Year And / Or Per the Duration Of Time As Set Forth In The Project Documents.

Is It A Certified TAB report?

The report should bare the stamp of a certified TAB Supervisor. The stamp should have the following information:

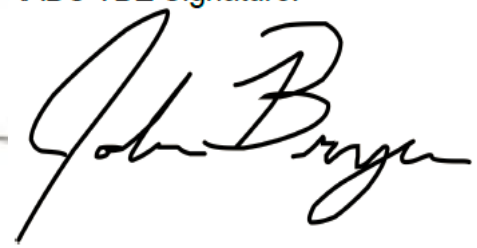
1. **Certifying Organization**
2. **Name of Certified TAB Supervisor**
3. **Certification Number**
4. **Certification Expiration**

Is It A Certified TAB report?

Examples of Valid Certifications

Submitted & Certified By: **Caribe Flow HVAC Engineers, Inc**
Certification Number: **19-09-58**
Report Date:**11/07/2019**

AABC TBE Signature:



T & B ENGINEER: Stephen K. Melink, PE

DATE 7/13/2011

Is It A Certified TAB report?

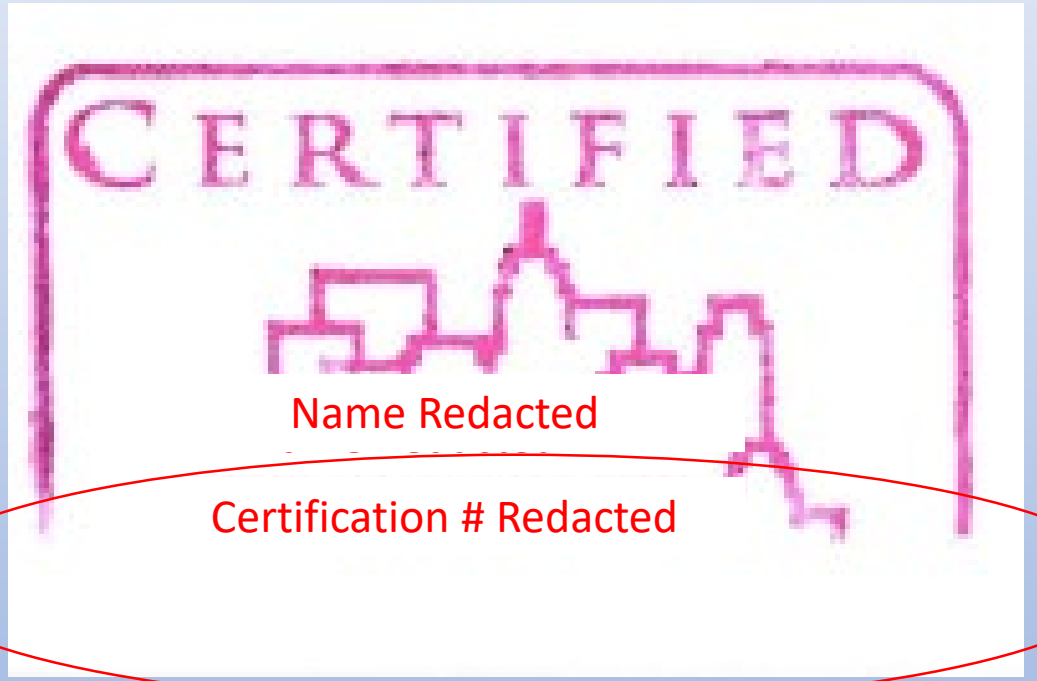
Examples of INVALID Certifications

Is It A Certified TAB report?

Examples of INVALID Certifications

Certification Expiration Date is whited out.

Bottom Border is missing..



Is It A Certified TAB report?

Examples of INVALID Certifications

No Expiration Date

No Certifying Organization

How To Read & Interpret a TAB Report Certification

- All certifying organizations have standards and requirements as to what must appear in that report.
- Most specifying Engineers and design teams state what information they require in the TAB report.
- Many chain stores, corporations and other entities have specific requirements as to what they want to see included.
- The certification also provides recourse to the end user via the TAB professionals certifying organization.

Distribution List

Distribution list includes the team members who should receive copies of the certified TAB report.

1. TAB Firm
2. Mechanical Contractor
3. General Contractor
4. Design Team
5. Owner
6. Any other relevant parties as dictated by the scope of work (Cx Agent, Controls Contractor, Authority Having Jurisdiction, Bonding Agency, etc.)

Distribution

PROJECT:	Melink Corporation 1234
LOCATION:	5140 River Valley Road, Milford, OH 45150
ARCHITECT:	Architects LLC
MECH. ENGINEER:	David Smith
GEN. CONTRACTOR:	Diego Associates

Standard Distribution lists.

Project:
East Coast Wings and Grill
2637 East Stone Drive, Suite F
Kingsport TN, 37660

Architect/Engineer:
MBI (michael brady Inc.)
299 N. Weisgarber RD
Knoxville, TN 37919
P: (865) 584-0999

HVAC Contractor:
S.B. White Co., Inc.
226 East Market Street
Johnson City, TN 37601
P: (423) 926-8127

TAB Contractor:
Provision Environmental Systems & Testing LLC
1117 Dennis Lane
Surgoinsville, TN 37873
P: (423) 754-3736

Distribution List - Further Examples

Marco	**Marco Group** 76 O'Leary Avenue St. John's, NL (709) 754-3737	**General Contractor**
	Air-Tite Sheet Metal 138 Groves Rd St. John's NL (709) 726-7007 Norman Lucas GSC	**Mechanical Engineer**
PHBGROUP	**PHB Group Inc.** 99 Airport Road St. John's NL (709) 576-8612	**Architect**
ST. JOHN'S	**City of St. John's** St. John's Transportation Commission	**Owner**

EXHAUST FAN NO	CA	EXHAUS LOCATION	BASEMENT
TEST DATE	15-6-2014	SERVED AREA	TOILETS

Instrument Calibration List

Required by ALL Certifying Organizations and should include all required instrumentation, with the following data.

1. Instrument
2. Make
3. Model
4. Serial Number
5. Function
6. Calibration Date

Instrument Calibration List - Incomplete

INSTRUMENT LIST

INSTRUMENT	MANUFACTURER	MODEL	SERIAL NO.	RANGE	CALIBRATION DATE
HYDRODATA	SHORTRIDGE	HDM-250	W99056	-10 – 150 psi	12/10/2018
FLOWHOOD	SHORTRIDGE	8400	M88606	25 – 2500 cfm	11/14/2018
MULTIMETER	SHORTRIDGE	ADM-870		0.0001 – 60.00 in.w.c	
VANE/ ANEMOMETER	ALNOR	RVA801	A00732	50-2500fpm	06/19/2018
TACHOMETER	SHIMPO	MT-200	B168B5011p	0 – 99,999 rpm	07/10/2018
VOLT METER	FLUKE	336	83706361	0-600VAC	03/01/2019
TEMP METER	COOPER ATKINS	SRH77A	011118017	-40 – 300 F	03/11/2019

Regardless of TAB Certification, list doesn't meet ANY of the TAB Certifying organization's requirements.

Instrument Calibration List -Complete

PROJECT: First Apostolic Church Maryville, TN

INSTRUMENT	MODEL NO.	SERIAL NO.	APPLICATION	DATES OF USE	CAL. DATE
Airflow					
Shortridge ADM	660C	M15136	Airflow	6/14/2017 - 9/25/2017	2/3/2017

PROJECT: First Apostolic Church Maryville, TN

INSTRUMENT	MODEL NO.	SERIAL NO.	APPLICATION	DATES OF USE	CAL. DATE
RPM					
Shimpo	DT-207LR	D1720222R	RPM	6/14/2017 - 9/25/2017	6/29/2017
Water					
Alnor	HM665	71509009	Water Pressures / Water Pressures	N/A	2/1/2017
Evergreen	S-DP-125	1600136	Water Flow / Water Pressures	N/A	11/16/2016
Dynasonics	DUFX-D1	33209	Water Flow	N/A	9/6/2016

Outstanding Deficiencies

Ideally, any deficiencies or “punch items” preventing the completion of TAB will be corrected prior to issuing the TAB report.

When this is not the case, all outstanding items MUST be included in the TAB report.

These items should be addressed in the general remarks, in a compiled list, and on the units they concern through out the report.

They are often ignored by the end user.

Outstanding Deficiencies

Should first appear in “General Remarks” or an “Executive Summary”

Observations Ventilation

The Geo-Thermal wells were balanced to design with the loop recirculation at the buffer tanks only. The system was not tested on-line with the rest of the hydronic system due to issues with the main diverting valve. The 3-way diverting valve is having trouble with the close-off pressure overcoming the discharge head of P17 and P18. This will be addressed in the near future and the circuit setters associated with this loop should be re-tested.

The Chillers was not functional at the time of final TAB services and therefore will have to be checked after a successful start of the 2 chillers. Associated coiling coils will need to be re-checked also.

IN-Floor Radiant Heating was originally balanced and failed to meet design. The system was flushed and the trapped air was purged before the re-testing was finished. System balanced to design after the maintenance was performed on the IFRH panels. All flows were tested to design spec and recorded.

VAV Reheats were adjusted to their minimum flows but accurate flows were not possible to record. The circuit setters were 20 mm and are over-sized to the design flows and the head pressures were too low to record from the manufactures specifications. The main loop circuit setters were able to be adjusted for the sections associated which should allow for close to design flow.

Unit Heaters, Radiant Panels & Perimeter heating was adjusted at the circuit setters and were close to design, no issues to report. Several Radiant Htg. Panel circuit setters should be sized down from the line size to obtain the flows submitted. To obtain specified flows in l/s there will be a need to size down to 12 mm from 20 mm. CS-83 should be sized up to 75 mm to accommodate the calculated flow.

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Outstanding Deficiencies – Executive Summary Examples

PERFORMANCE AIR BALANCING, INC

On 10.14.2014 to 10.16.2014, a Test and Balance was performed at the BACK HALL COMMAND SUITES BUILDING 24701 FORT GORDON, GEORGIA. The following report will be an accurate record of what we found, what procedures were performed, and our final test results. Our report will also reflect accurate values, not only CFM, but percentages of required supply values of each of the room and open areas. We documented the electrical, motor / fan RPM, temperatures wet bulb / dry bulb, ambient temperature and interior humidity to show how well the unit is conditioning the air.

The chilled water pump CP-2 was tested with no outstanding issues. The circuit setters that serve each AHU were also tested and balanced to specified water flows indicated on the drawings and submittals.

AHU-1: This unit is operating at 114% of design airflow with the motor sheave is adjusted to the minimum position. The unit's supply grilles were balanced proportionally with the actual airflows recorded.

AHU-2: This unit was not installed

AHU-3: This unit was relocated to RM. 224. The unit was balanced to the total airflow indicated on the drawing schedule now that the unit consists of only four grilles and not eight as shown on drawing M1-5.

AHU-4: This unit was tested and balanced to the airflow indicated on the drawing with no outstanding issues.

AHU-5: This unit is operating at 140% of design airflow with the motor sheave adjusted to the minimum position. The unit's supply grilles were balanced proportionally with the actual airflows recorded.

General Remarks

FORWARD:
Testing, adjusting and balancing performed to National Balancing Council (NBC) procedural standards has been completed on the mechanical system referenced in this report, also reflected in NBC's 230593.

Unless otherwise noted, all listed equipment, systems and controls were tested in full load demand configuration.

All specific project notes and deficiencies related to this project are enclosed in the following report pages. Any open issue items (deficiencies) listed herein have been previously forwarded to the appropriate personnel for resolution. This report reflects the current status of all tested equipment at the time of project test completion.

GENERAL PROJECT REMARKS:

Test and balance of the air systems and associated equipment at 1911 Glacier Park Ave, Naperville, IL 60540 was performed between the dates of December 30th and December 31st, 2015. Testing was scheduled after duct system installation completion and was performed on pre-existing equipment (not installed by mechanical).

Existing equipment was not specifically maintained by mechanical before test and balance work commenced, but appeared to be in good working order and previously / recently maintained, as the equipment appeared to be in good working order.

No TAB work was previously performed.

The HVAC system economizer was found inoperable. Mechanical assisted in locking blades in position to set outside air. Blade position was marked to facilitate proper setting after repairs are made. The outside air was measured to be within 10% of the design specified on ventilation schedule on the M-1 plans.

The HVAC system is at maximum performance capability. Blower motor pulley has been adjusted to maximum potential. System is short of design rated air flow capability specified on ventilation schedule. Recommendations were made to increase blower motor pulley size to Browning 1VP75 with a 1 3/8" bore and Browning BK90 belt size on the current drive package. With these changes, the HVAC system will only produce at maximum pulley setting a total of 7097 CFM, which is 88.7% of the design CFM of 8000 for the system within full load amps for the current motor.

Air flow readings represented in report are short of design rated air flows. Verification of the hood readings via ductwork traverse strongly suggests / indicates duct leakage is responsible for system deficiency (low air flow).

January 14, 2016: Mechanical contractor informed us the owner made adjustments to dampers. We will confirm on return visit.

Outstanding Deficiencies

After being referenced in the General Remarks / Executive Summary, Outstanding Deficiencies should appear in an itemized manner, preferably with pictures. The example below uses Airnab reporting software.

Deficiency ID:	0010	Status:	Open	Deficiency Priority:	
Equipment:	RTU-03 Storage				Created Date: 27-Jan-16 Due Date:

Issue Description:

Unit has excess particulates building up on filters and coils resulting in less air flow and increased strain on overall system.

Issue Type:	Incomplete	Job Tag:	Repair Estimate:
Role Assignment:	Company Project Manager	Cross Ref#:	Replacement Cost:
User Assignment:			
Comments / Signature:			

Issue Photos:

Name:	.jpg	Name:	.jpg	Name:	.jpg
Captured:	1/29/2016 9:53 PM	Captured:	1/29/2016 9:53 PM	Captured:	1/29/2016 9:53 PM
Caption:		Caption:		Caption:	

Green South Energy Page 10 of 15

Outstanding Deficiencies

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Comments / Signature:			

Issue Photos:

Name:	.jpg	Name:	.jpg	Name:	.jpg
Captured:	1/29/2016 9:53 PM	Captured:	1/29/2016 9:53 PM	Captured:	1/29/2016 9:53 PM
Caption:		Caption:		Caption:	

Outstanding Deficiencies

This example with corresponding pictures was created using Excel and Power Point.

NATIONAL BALANCING COUNCIL	Project: Silent Hill Assisted Living	Project Number: 1409
	Location: Centralia, PA	Owner: Umbrella Corporation
	Mechanicial Contractor: Weyland A / C	Date: 10.21.15
	Certified TAB Firm: Brawndo TAB	Certified TAB Techinican: M. McFly

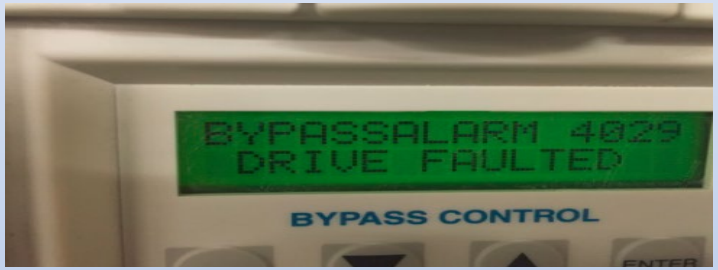
TAB Deficiency Report

ITEM No.	SYSTEM	DATE	ISSUE	STATUS	CONTRACTOR REMARKS
001	Pump-1	10.21.15	Pump will not run in hand or automatic. Error message at VFD reads "Bypass Alarm 4029 Drive Faulted."	Open	
002	HX-1	10.21.15	There are no test ports installed at heat exchanger. Test ports required by detail 3 on page M-503 of mechanical draws. Can not test at this time.	Open	
003	AHU-2	10.21.15	Insulation for chilled water piping is incomplete & has been wrapped in silver tape. Does not impact TAB, but will cause condensation issues.	Open	

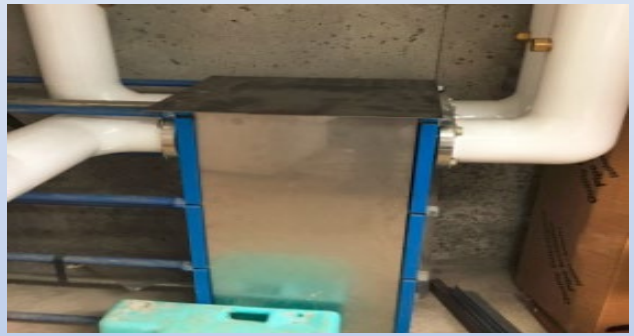
TAB DEFICIENCY REPORT

The following pictures / details correspond with the line items from TAB Deficiency Report Dated

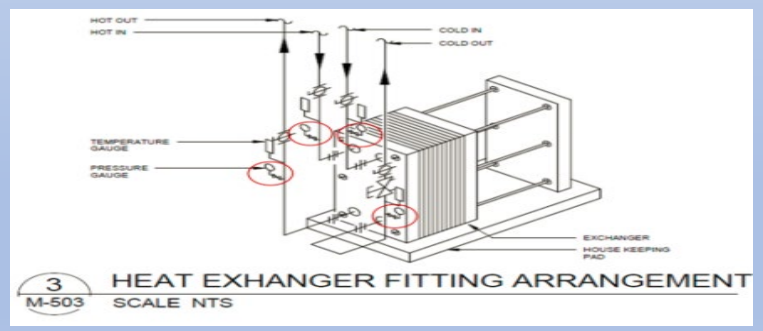
NATIONAL BALANCING COUNCIL	Project: Silent Hill Assisted Living	Project Number: 1409
	Location: Centralia, PA	Owner: Umbrella Corporation
	Mechanicial Contractor: Weyland A / C	Date: 10.21.15
	Certified TAB Firm: Brawndo TAB	Certified TAB Techinican: M. McFly
TAB Deficiency Report		



ITEM #1



ITEM #2

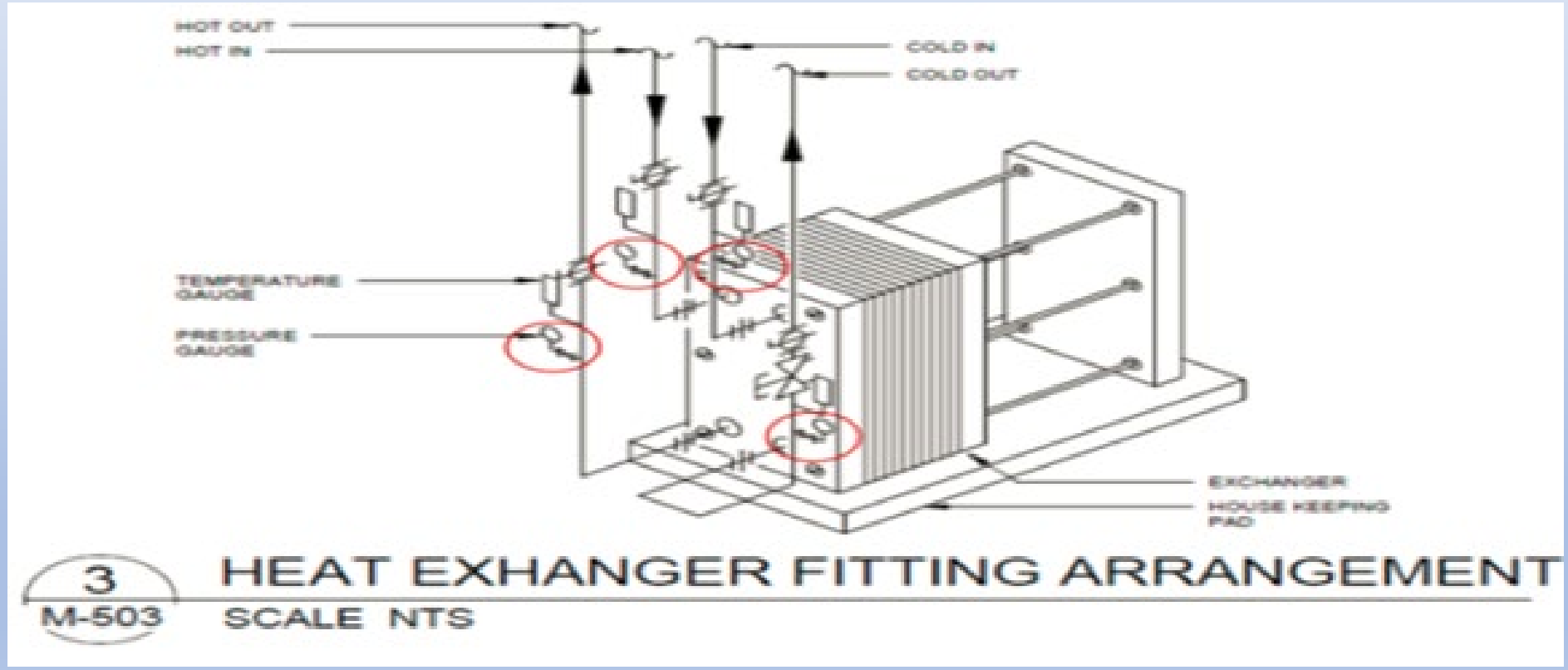


ITEM #2

ITEM #3

Outstanding Deficiencies

Mechanical Details are useful references that assist the end user in understanding the deficiency and clarifying what actions the contractors need to take.



Is the airflow operating within the design %?

Standard inlet / outlet data sheet with design %.
At a glance, even the untrained eye can see if the values are within +/- 10% or 5% of design values.

AREA SERVED	OUTLET			DESIGN	PRELIMINARY		FINAL		REMARKS
	NO.	TYPE	SIZE	CFM	CFM	%	CFM	%	
CVS-1									
CHEMO 128	1	SUPPLY	10	360	210	58%	354	98%	
TOTALS				**360**	**210**	**58%**	**354**	**98%**	
CVS-2									
ANTI - RM	1	SUPPLY	10	215	206	96%	199	93%	
ANTI - RM	2	SUPPLY	10	270	315	117%	275	102%	
CLEAN ROOM	3	SUPPLY	10	270	336	124%	243	90%	
CLEAN ROOM	4	SUPPLY	10	270	275	102%	281	104%	
CLEAN ROOM	5	SUPPLY	10	270	171	63%	245	91%	
TOTALS				**1295**	**1303**	**101%**	**1243**	**96%**	

Is the airflow operating within the design %?

Sample hydronic data sheet.

HYDRONIC DATA Test Report

Location	UNIT	DRV Dia.	DES. FLOW	TURNS		Pressure Drop	ACT. FLOW	%
		inch	GPM	Kvs	Turn	KPA	GPM	
RISER 03 & 05								
Floor-1105	FCU-F-11-2	3/4	3.6	6.4	5.9	3.2	3.3	92%
Floor-1005	FCU-F-10-1	1/2	2.4	2.12	4	6	2.35	98%
Floor-1003	FCU-F-10-2	1/2	2.4	2.12	4	6.3	2.38	99%
Room-905	FCU-F-9-1	1/2	2.4	2.56	4.5	4.6	2.41	100%
Room-903	FCU-F-9-2	1/2	2.4	2.64	4.7	4.2	2.37	99%
Room-805	FCU-F-8-1	1/2	2.4	1.65	3.5	9.3	2.32	97%
Room-803	FCU-F-8-2	1/2	2.4	1.65	3.5	10	2.37	99%
Room-705	FCU-F-7-1	1/2	2.4	1.65	3.5	12	2.42	101%
Room-703	FCU-F-7-2	1/2	2.4	1.65	3.5	11.7	2.43	101%
Room-605	FCU-F-6-1	1/2	2.4	0.65	1	68	2.41	100%
Room-603	FCU-F-6-2	1/2	2.4	2.12	4	7	2.42	101%
Room-505	FCU-F-5-1	1/2	2.4	1.65	3.5	10.8	2.4	100%
Room-503	FCU-F-5-2	1/2	2.4	2.12	4	5.9	2.35	98%
Room-405	FCU-F-4-1	1/2	2.4	1.65	3.5	6.6	2.4	100%

AZ.TEC. BALANCING

DATE: **24-Aug-2015**

PROJECT:
EKO HOTEL

Lagos-Nigeria

SERVING:

ALL FLOORS

LOCATION:

RISER : 03&05

Is the airflow operating within the design %?

Sample hydronic data sheet.

HYDRONIC DATA Test Report

Location	UNIT	DRV Dia.	DES. FLOW	TURNS		Pressure Drop	ACT. FLOW	%
		inch	GPM	Kvs	Turn	KPA	GPM	
RISER 03 & 05								
Floor-1105	FCU-F-11-2	3/4	3.6	6.4	5.9	3.2	3.3	92%
Floor-1005	FCU-F-10-1	1/2	2.4	2.12	4	6	2.35	98%
Floor-1003	FCU-F-10-2	1/2	2.4	2.12	4	6.3	2.38	99%
Room-905	FCU-F-9-1	1/2	2.4	2.56	4.5	4.6	2.41	100%
Room-903	FCU-F-9-2	1/2	2.4	2.64	4.7	4.2	2.37	99%
Room-805	FCU-F-8-1	1/2	2.4	1.65	3.5	9.3	2.32	97%
Room-803	FCU-F-8-2	1/2	2.4	1.65	3.5	10	2.37	99%
Room-705	FCU-F-7-1	1/2	2.4	1.65	3.5	12	2.42	101%
Room-703	FCU-F-7-2	1/2	2.4	1.65	3.5	11.7	2.43	101%
Room-605	FCU-F-6-1	1/2	2.4	0.65	1	68	2.41	100%
Room-603	FCU-F-6-2	1/2	2.4	2.12	4	7	2.42	101%
Room-505	FCU-F-5-1	1/2	2.4	1.65	3.5	10.8	2.4	100%
Room-503	FCU-F-5-2	1/2	2.4	2.12	4	5.9	2.35	98%
Room-405	FCU-F-4-1	1/2	2.4	1.65	3.5	6.6	2.4	100%

AZ.TEC. BALANCING

DATE: **24-Aug-2015**

PROJECT:
EKO HOTEL

Lagos-Nigeria

SERVING:

ALL FLOORS

LOCATION:

RISER : 03&05

Is the airflow operating within the design %?
If not, is there a remark?

Fan Test

	FC 2			FC 3*		
	205.1			ELEV. RM. 115		
ING	205.1			KITCHEN CEILING		
T PRODUCTS	FUJITSU			TRANE		
A0A	ASU36RLXB			4UXD2042A10N0AB		
0	FTA005267			874145000046		
al	%	Design	Actual	%	Design	Actual	%
		900	825	92%	1200	NVL	
5	99%	900	825	92%	1200	1027	86%
2	98%	900	825	92%	1200	1027	86%
3	102%	N/A	N/A		N/A	N/A	

Remarks / Notes:

* Unable to obtain the design CFM. Direct-Drive fan motor is adjusted to high-speed.

Is the Data within Design?

FAN	DESIGN	ACTUAL
SUPPLY AIR CFM	2000	2000
RETURN AIR CFM	2000	1385 **
OUTSIDE AIR CFM	600	615
FAN SPEED		962
STATIC PRESSURE +		?

Data outside of design values with remark explaining why.

REMARKS
** Balanced RA low to account for OA

Is the Data within Design?

Data outside of design values with remark explaining why.

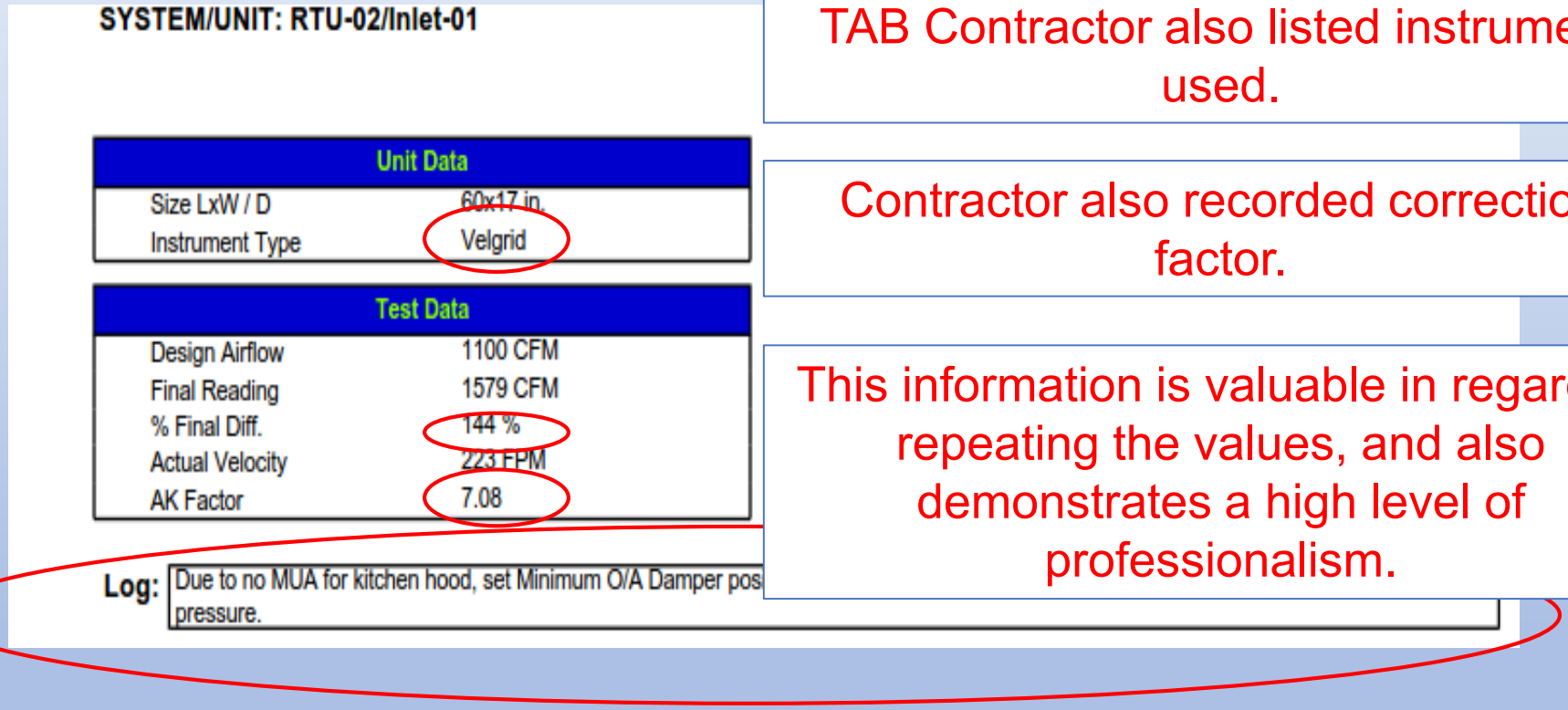
SYSTEM/UNIT: RTU-02/Inlet-01

Unit Data	
Size LxW / D	60x17 in.
Instrument Type	Velgrid

Test Data	
Design Airflow	1100 CFM
Final Reading	1579 CFM
% Final Diff.	144 %
Actual Velocity	223 FPM
AK Factor	7.08

Log: Due to no MUA for kitchen hood, set Minimum O/A Damper position to maximum open to ensure overall building pressure maintains a + pressure.

Is the Data within Design?



SYSTEM/UNIT: RTU-02/Inlet-01

Unit Data	
Size LxW / D	60x17 in.
Instrument Type	Velgrid

Test Data	
Design Airflow	1100 CFM
Final Reading	1579 CFM
% Final Diff.	144 %
Actual Velocity	223 FPM
AK Factor	7.08

Log: Due to no MUA for kitchen hood, set Minimum O/A Damper pos
pressure.

TAB Contractor also listed instrument used.

Contractor also recorded correction factor.

This information is valuable in regard to repeating the values, and also demonstrates a high level of professionalism.

Balancing +/- 5%

Common requirement in multiple specifications.

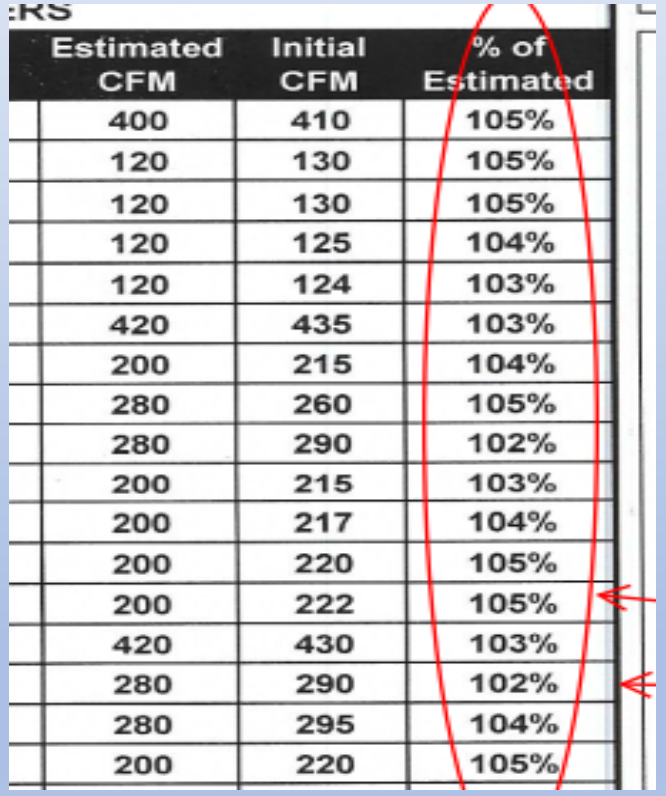
Highly possible, and even *effortless* using the correct methodology.

Some flow hoods even have an algorithm that assists in balancing +/- 5%.

Some flow hoods round up to the nearest 5 CFM value, so please be aware of this.

Balancing +/- 5%

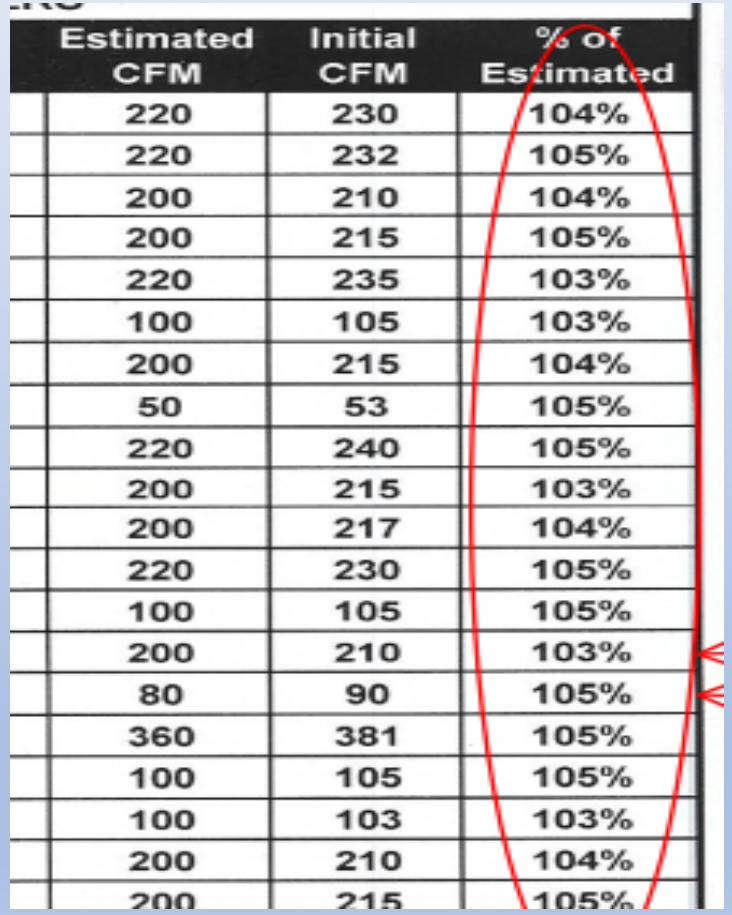
- However balancing +/- 3%.....



Estimated CFM	Initial CFM	% of Estimated
400	410	105%
120	130	105%
120	130	105%
120	125	104%
120	124	103%
420	435	103%
200	215	104%
280	260	105%
280	290	102%
200	215	103%
200	217	104%
200	220	105%
200	222	105%
420	430	103%
280	290	102%
280	295	104%
200	220	105%

Balancing +/- 5%

- Or balancing +/- 2%.....



Estimated CFM	Initial CFM	% of Estimated
220	230	104%
220	232	105%
200	210	104%
200	215	105%
220	235	103%
100	105	103%
200	215	104%
50	53	105%
220	240	105%
200	215	103%
200	217	104%
220	230	105%
100	105	105%
200	210	103%
80	90	105%
360	381	105%
100	105	105%
100	103	103%
200	210	104%
200	215	105%

As stated, I typically balance to plus or minus 5% as a matter of habit and practice.

I've trained hundreds of professionals to balance in like fashion, and I know many who do so.

However, I have to be suspect of +/- 3% and +/- 2%.

As a reviewing professional, I CAN NOT Review this data and state this information is false, without physically verifying the data in the field.

However.....

Balancing +/- 5%

- On the same project where the total actual CFM equals total Design CFM, EXACTLY, and Actual TSP equals Design CFM EXACTLY……

SYSTEM SUMMARY	DESIGN	ACTUAL	VARIANCE
Fan CFM at Total SP			
Supply CFM	4000	4000	
Supply Loss (max)			
Return CFM			
Return Loss (max)			
Total Duct Loss (max)			
SYSTEM PRESSURES			
Static Pressure Supply (+)		+	
Static Pressure Return (-)		–	
Total Static Pressure	0.60	0.60	
Fan Speed			
SYSTEM TEMPERATURES			
Avg. Ret. Grille Temp.			
Avg. Sup. Grille Temp.			
System Temp Change			
SENSIBLE BTU DELIVERY			
1.08 X CFM X ΔT			

SYSTEM SUMMARY	DESIGN	ACTUAL	VARIANCE
Fan CFM at Total SP			
Supply CFM	3200	3200	
Supply Loss (max)			
Return CFM			
Return Loss (max)			
Total Duct Loss (max)			
SYSTEM PRESSURES			
Static Pressure Supply (+)		+	
Static Pressure Return (-)		–	
Total Static Pressure	0.60	0.60	
Fan Speed			
SYSTEM TEMPERATURES			
Avg. Ret. Grille Temp.			
Avg. Sup. Grille Temp.			
System Temp Change			
SENSIBLE BTU DELIVERY			
1.08 X CFM X ΔT			

Balancing +/- 5%

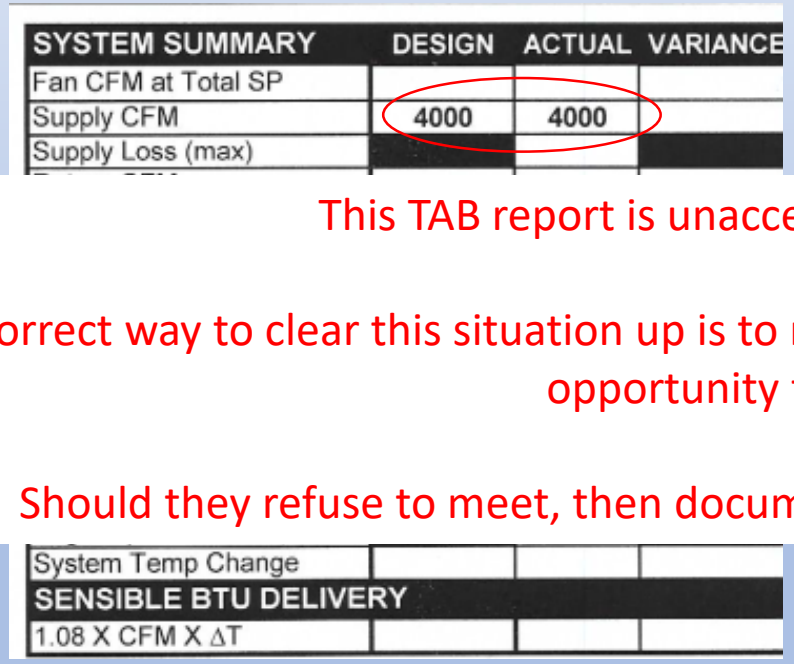
- Now let us look at all of the blanks in the unit data…..

SYSTEM SUMMARY	DESIGN	ACTUAL	VARIANCE
Fan CFM at Total SP			
Supply CFM	4000	4000	
Supply Loss (max)			
Return CFM			
Return Loss (max)			
Total Duct Loss (max)			
SYSTEM PRESSURES			
Static Pressure Supply (+)		+	
Static Pressure Return (-)		–	
Total Static Pressure	0.60	0.60	
Fan Speed			
SYSTEM TEMPERATURES			
Avg. Ret. Grille Temp.			
Avg. Sup. Grille Temp.			
System Temp Change			
SENSIBLE BTU DELIVERY			
1.08 X CFM X ΔT			

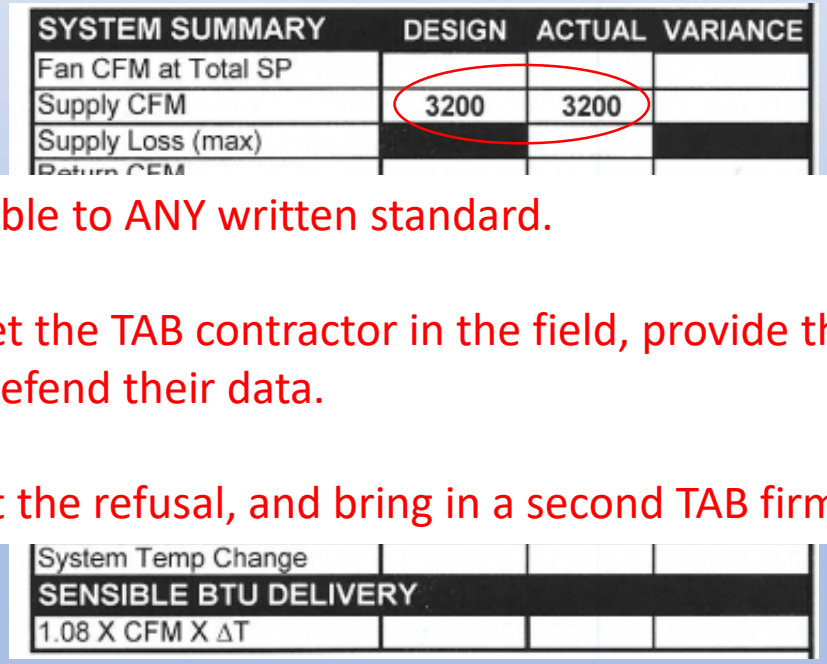
SYSTEM SUMMARY	DESIGN	ACTUAL	VARIANCE
Fan CFM at Total SP			
Supply CFM	3200	3200	
Supply Loss (max)			
Return CFM			
Return Loss (max)			
Total Duct Loss (max)			
SYSTEM PRESSURES			
Static Pressure Supply (+)		+	
Static Pressure Return (-)		–	
Total Static Pressure	0.60	0.60	
Fan Speed			
SYSTEM TEMPERATURES			
Avg. Ret. Grille Temp.			
Avg. Sup. Grille Temp.			
System Temp Change			
SENSIBLE BTU DELIVERY			
1.08 X CFM X ΔT			

Balancing +/- 5%

- On the same project where the total actual CFM equals total Design CFM, EXACTLY, and Actual TSP equals Design CFM EXACTLY……



SYSTEM SUMMARY	DESIGN	ACTUAL	VARIANCE
Fan CFM at Total SP			
Supply CFM	4000	4000	
Supply Loss (max)			
System Temp Change			
SENSIBLE BTU DELIVERY			
1.08 X CFM X ΔT			



SYSTEM SUMMARY	DESIGN	ACTUAL	VARIANCE
Fan CFM at Total SP			
Supply CFM	3200	3200	
Supply Loss (max)			
System Temp Change			
SENSIBLE BTU DELIVERY			
1.08 X CFM X ΔT			

This TAB report is unacceptable to ANY written standard.

The correct way to clear this situation up is to meet the TAB contractor in the field, provide them the opportunity to defend their data.

Should they refuse to meet, then document the refusal, and bring in a second TAB firm.

Project With 17 Systems & 117 Outlets

F- 2

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
250	233	233
250	243	243
250	257	246
275	267	267
175	171	171

February 1st

F-3

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
300	282	282
300	312	312
300	277	277
300	291	291

F-5

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
250	244	244
250	236	236
250	258	258
250	237	237
250	241	241
200	177	177

F-8,9

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
275	288	288
275	304	304
200	118	189
425	417	417
425	433	433
425	397	397
150	162	162
200	191	191
NA	268	268

Project With 17 Systems & 117 Outlets

F- 2

	DESIGN CFM	PRELIMINARY CFM	FINAL CFM
	250	233	233
	250		
	250		
	275		
	175		

February

F-3

	DESIGN CFM	PRELIMINARY CFM	FINAL CFM
	300	282	282

	DESI		
	250	244	244
	250	236	236
	250	258	258
	250	237	237
	250	241	241
	200	177	177

	200	118	189
	425	417	417
	425	433	433
	425	397	397
	150	162	162
	200	191	191
	NA	268	268

41% of the systems were found to be already balanced or match the preliminary readings.

44% of all air outlets were found to be balanced during preliminary readings.

Project With 17 Systems & 117 Outlets

Then we have this….

FC 11

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
250	244	244
350	339	339
250	238	238
200	104	186
50	89	42
250	344	262
250	133	263
250	240	258

F-12

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
300	282	282
350	312	342
350	296	348
175	167	167
75	82	82
350	224	341

Project With 17 Systems & 117 Outlets

4 out of 17 Systems showed some preliminary values changed, while other remained the same. This simply isn't possible on a unitary constant volume system.

FC 11

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
250	244	244
350	339	339
250	238	238
200	104	186
50	89	42
250	344	262
250	133	263
250	240	258

F-12

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
300	282	282
350	312	342
350	296	348
175	167	167
75	82	82
350	224	341

Project With 17 Systems & 117 Outlets

FC 11

DESIGN CFM	PRELIMINARY CFM	FINAL CFM
250	244	244
350	339	339
250	238	238
200	104	186
50	89	42
250	344	262
250	133	263
250	240	258

CFM

Corresponding Mechanical Drawings

Perhaps the number one complaint from design teams / end users is the lack of labeled mechanical drawings in the TAB report

The drawings are the one document that pull all of the data together and provide a visual point of reference.

The drawings are one of the most practical elements in a TAB report.

Most commonly, the MEP drawings are numbered by the TAB professional and included in the final report.

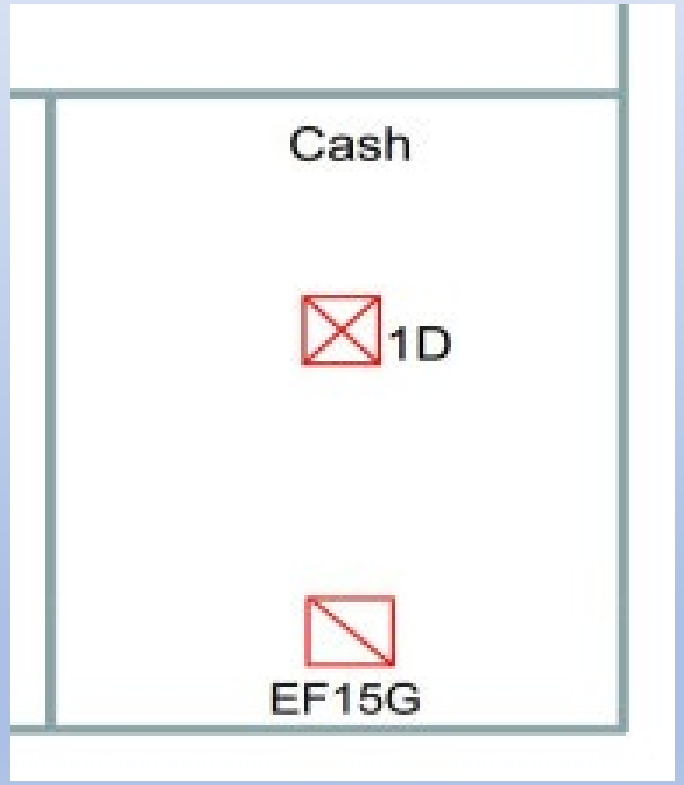
If the drawings are not available, or field conditions required multiple changes not reflected on the MEP drawings, the TAB professional has a variety of other options to fulfil this responsibility.

Corresponding Mechanical Drawings

Mechanical Drawings 101 – Without learning every symbol used on MEP drawings, the following two symbols are the most common and allow the owners or other end users not in the trades to better understand the drawings at a glance.

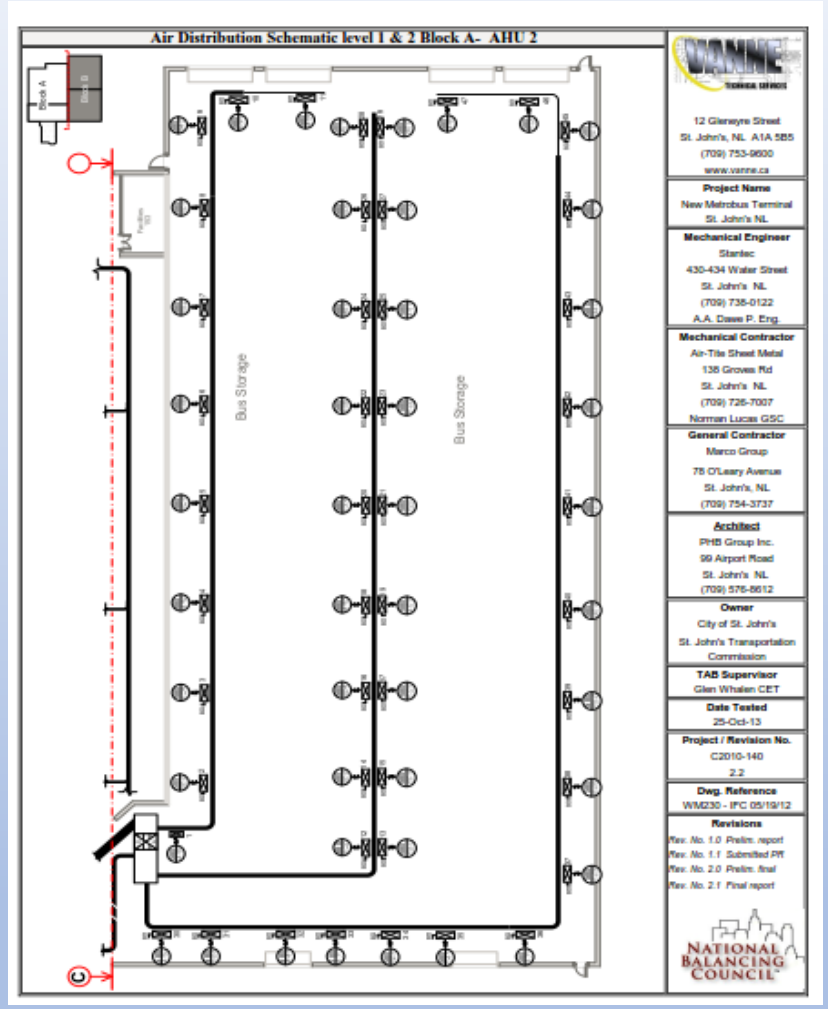
Supply Grille Register Diffuser
(Outlet)

Return / Exhaust GRD
(Inlet)

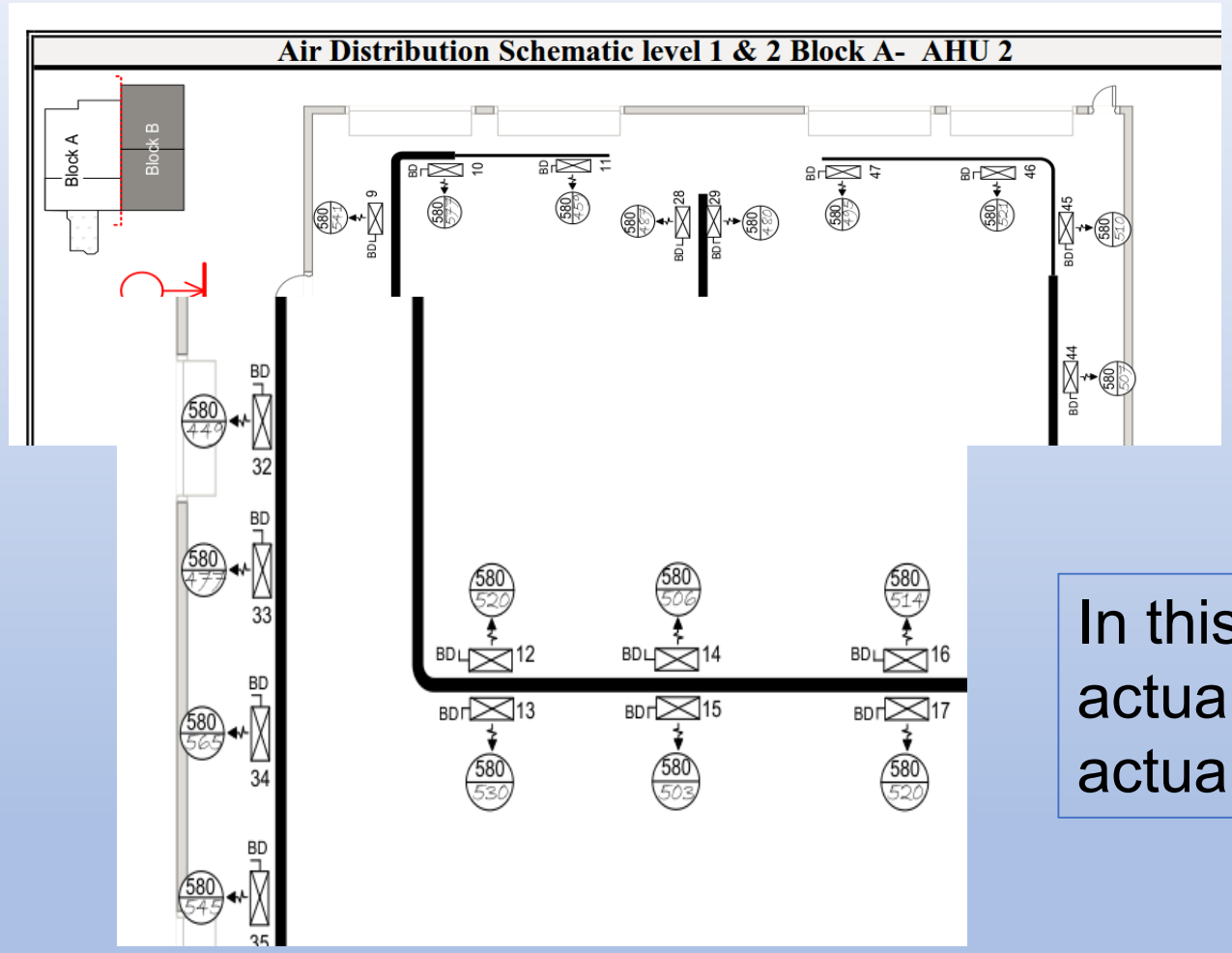


Corresponding Mechanical Drawings

Sample of Mechanical Drawings generated by the TAB Contractor.

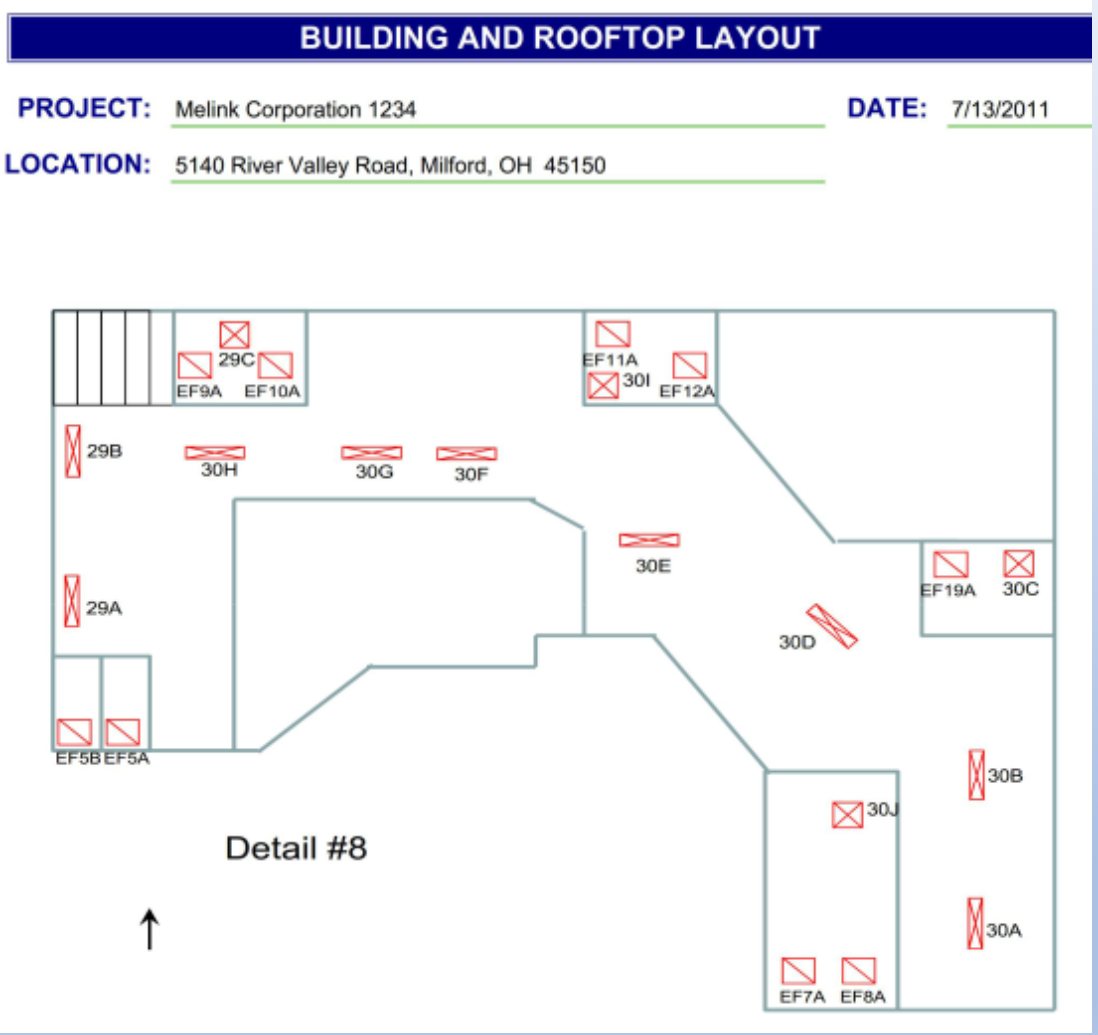


Corresponding Mechanical Drawings



In this example, the TAB contractor actually took the time to include the actual CFM by each device.

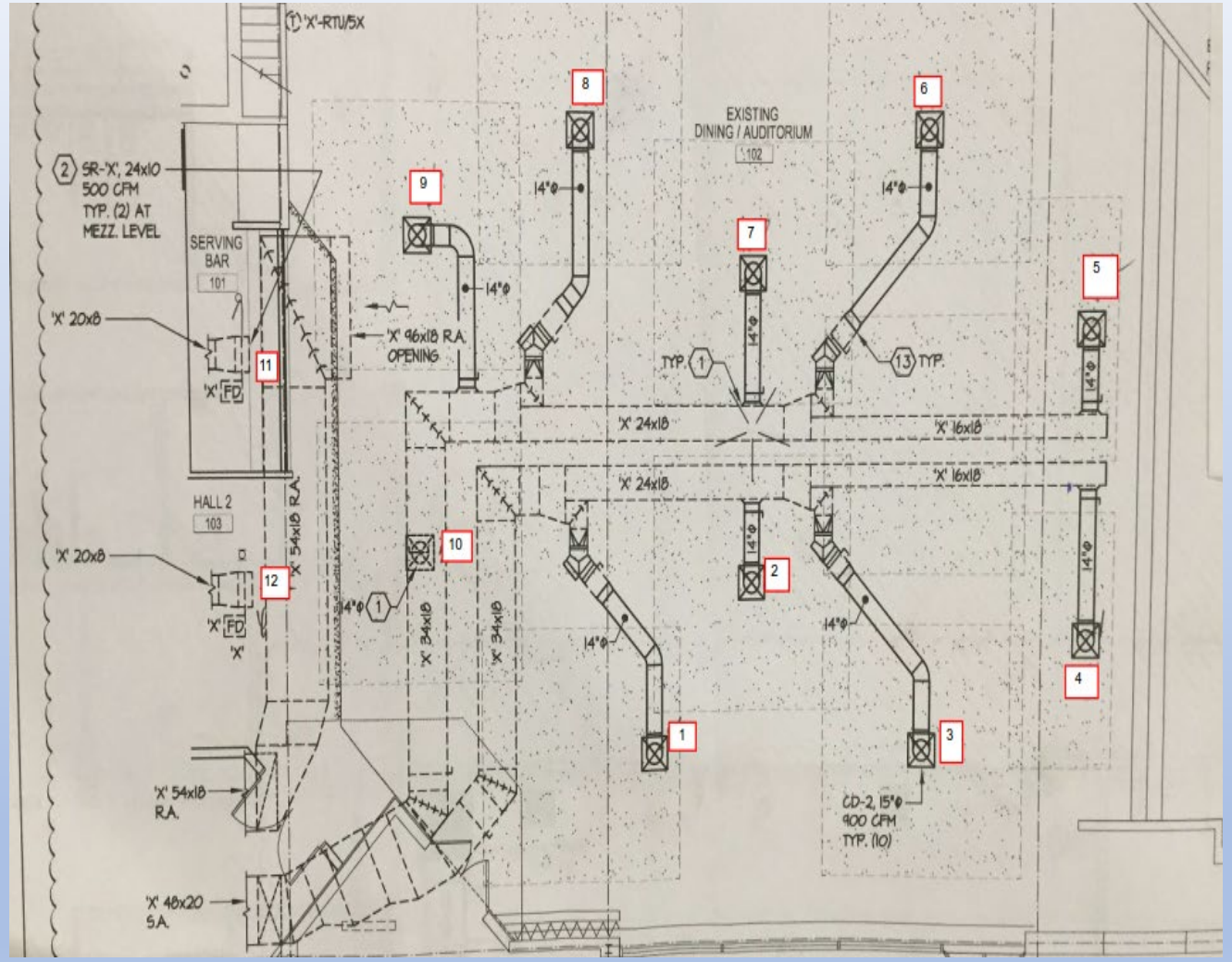
How To Read & Interpret a TAB Report



Generated by the TAB contractor for existing building where no mechanical drawings could be provided.

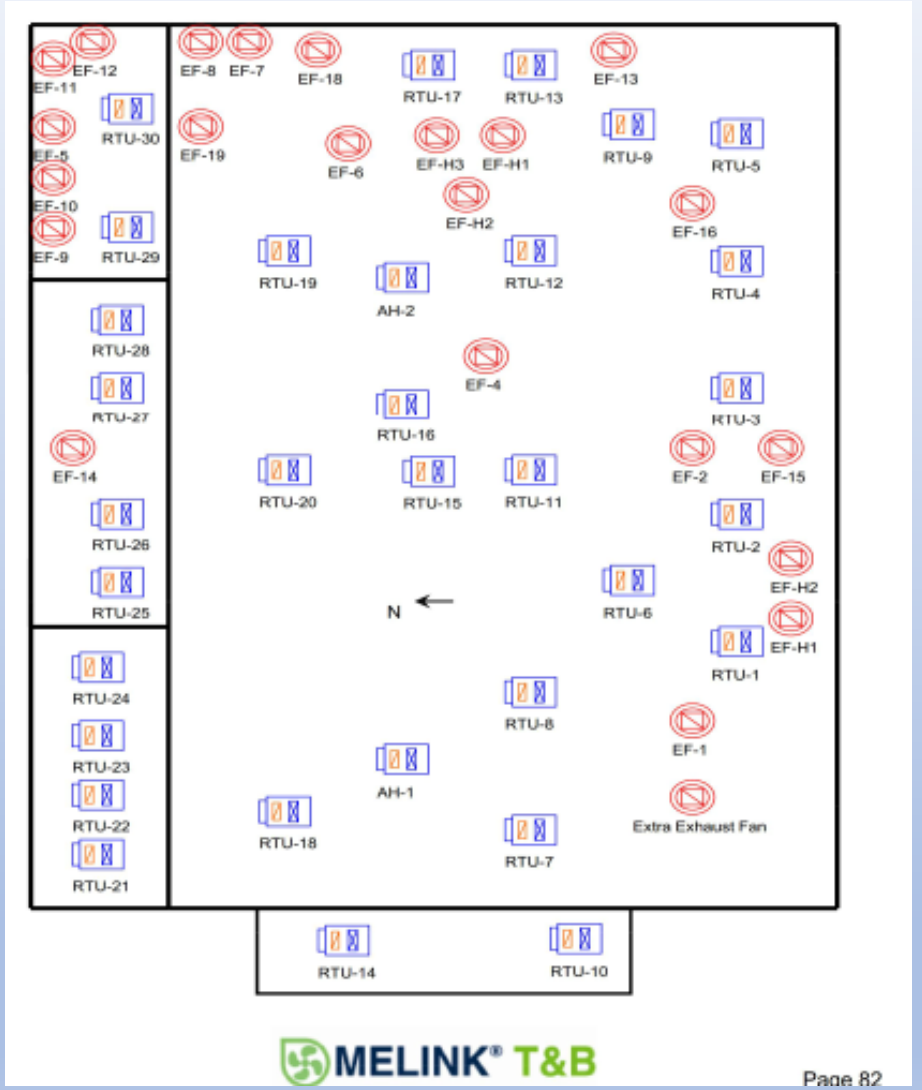
Must Include Mechanical Drawings

In this example, the TAB firm was not permitted to removed existing prints from job site. The TAB Professional took a pictures with their phone, converted to .pdf file and numbered the prints.



Must Include Mechanical Drawings

TAB contractor generated roof plan.

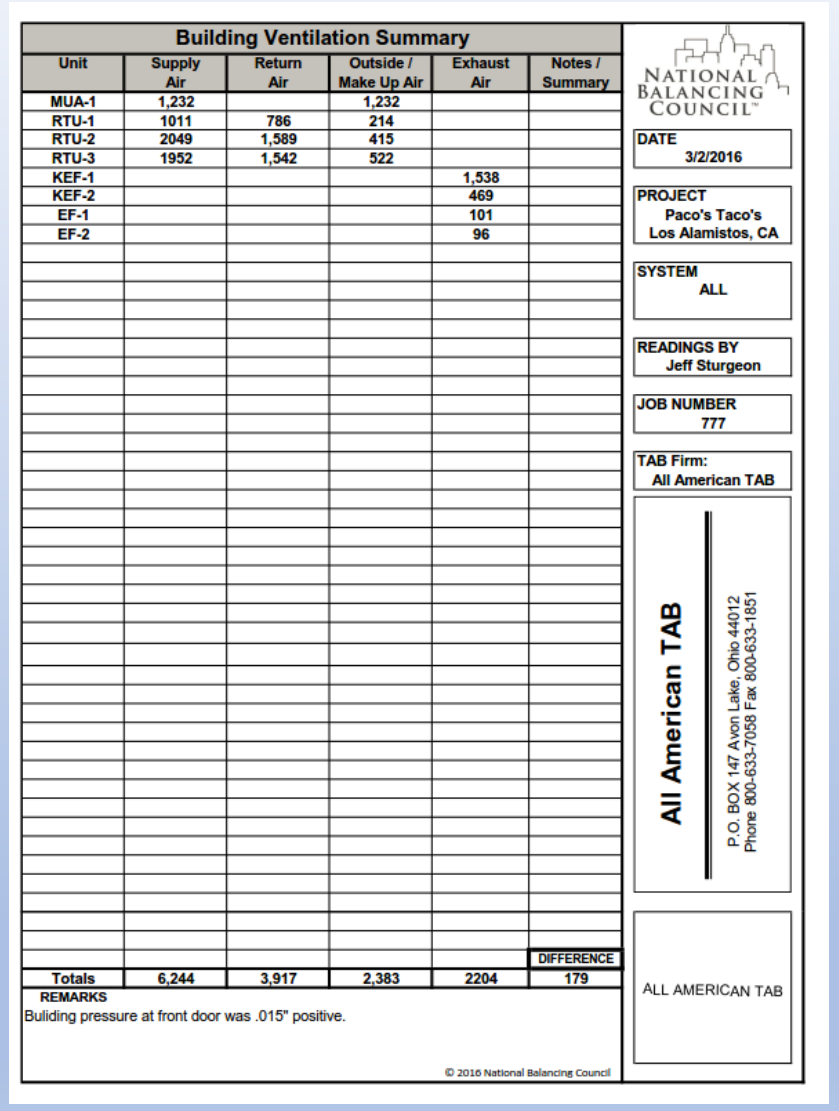


Additional Items

Building Ventilation Summary –

Perfect for restaurants but works with any building.

Some restaurant chains require this form.



Building Ventilation Summary

Unit	Supply Air	Return Air	Outside / Make Up Air	Exhaust Air	Notes / Summary
MUA-1	1,232		1,232		
RTU-1	1011	786	214		
RTU-2	2049	1,589	415		
RTU-3	1952	1,542	522		
KEF-1				1,538	
KEF-2				469	
EF-1				101	
EF-2				96	
					DIFFERENCE
Totals	6,244	3,917	2,383	2204	179

REMARKS

Buliding pressure at front door was .015" positive.

NATIONAL BALANCING COUNCIL™

DATE 3/2/2016

PROJECT Paco's Taco's Los Alamistos, CA

SYSTEM ALL

READINGS BY Jeff Sturgeon

JOB NUMBER 777

TAB Firm: All American TAB

All American TAB

P.O. BOX 147 Avon Lake, Ohio 44012
Phone 800-633-7058 Fax 800-633-1851

ALL AMERICAN TAB

Additional Items

Building Ventilation Summary designed to mirror the MEP Ventilation Schedule. This is useful in any building, but even more so in restaurants and even required by some chains.

Building Ventilation Summary

Unit	Supply Air	Return Air	Outside / Make Up Air	Exhaust Air	Notes / Summary
MUA-1	1,232		1,232		
RTU-1	1011	786	214		
RTU-2	2049	1,589	415		
RTU-3	1952	1,542	522		
KEF-1				1,538	
KEF-2				469	
EF-1				101	
EF-2				96	
					DIFFERENCE
Totals	6,244	3,917	2,383	2204	179

NATIONAL BALANCING COUNCIL™

DATE
3/2/2016

PROJECT
Paco's Taco's
Los Alamistos, CA

ALL AMERICAN TAB

REMARKS
Buliding pressure at front door was .015" positive.

Additional Items

Facilities Manager Preventive Maintenance Summary.
This documents is perhaps the most useful item in a TAB report for any facilities maintenance staff.

Facilities Manager PM Summary

Unit	Number Belts	Belt Size	Number Filters	Filter Size	Number Filters	Filter Size	Filter Type
RTU-1	1	BX36	2	16x20x1			Media
RTU-2	1	BX48	4	20x20x2			Pleated
RTU-3	1	BX48	4	20x20x2			Pleated
EF-1	1	A16					
EF-2	1	A-24					

NATIONAL BALANCING COUNCIL™

DATE
4.26.16

PROJECT
Dollar Max
San Angelo, TX

REMARKS
New filters were last installed on 4.21.16.

ELITE TAB

Advanced TAB Report Review

- My current position, I see 3 to 30 TAB reports, every week.
- I’m always stunned by what get’s through.
- I keep a log of odd things that pop up in TAB reports, when I can.
- I can’t believe what get’s missed in TAB reports going out the door, regardless of certification, or by design teams or by owners.
- What follows is simple tricks, using formulas, charts, fan curves, and simple logic and statistics that will allow for better TAB report review, quicker project close out, and less call backs and warranty issues.

Verifying Actual Fan RPMs

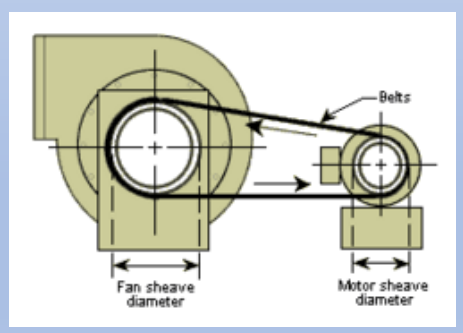
Three Common Mistakes in Collecting Data on Belt Driven Fans:

1. Recording the Motor Pulley as the Fan Sheave, and vice versa
2. Recording the Actual Motor RPM as Actual Fan RPM, and vice versa
3. Bad reading on the Fan RPMs

Common Mistake with Motor and Fan Pulleys / Sheaves

On belt-driven fans, the fan pulley/sheave is typically larger than the motor pulley/sheave. It is not uncommon for these values to be swapped in the final TAB report.

If this is noticed, apply the Max Fan RPM formula against the recorded RPMs and drive package. If it doesn't work, swap the numbers for the pulleys / sheaves and run the formula again.



Common Mistake with Motor and Fan Pulleys / Sheaves

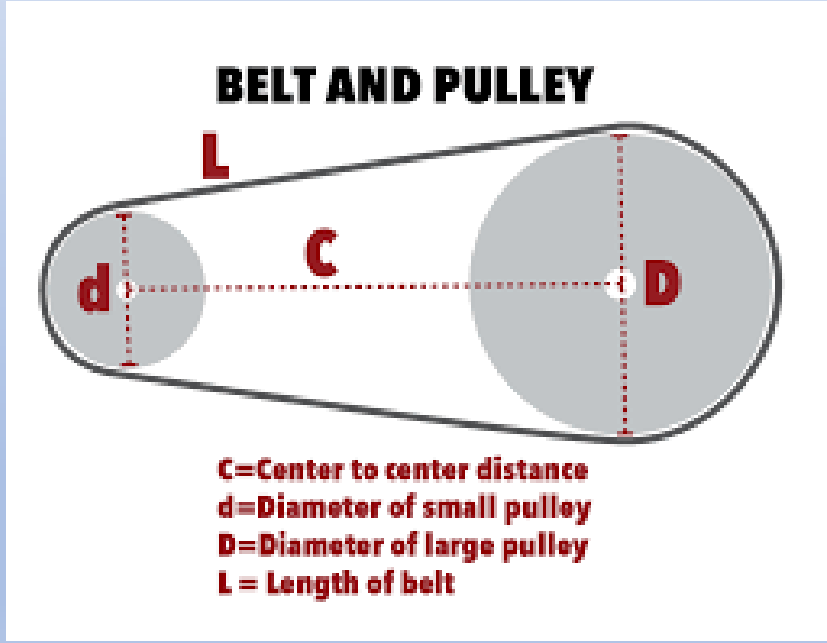
Note: On standard, roof mounted exhaust fans the pulley / sheave sizes are typically closer in size than belt driven RTUs / AHUs etc.

The fan pulley / sheave is still typically larger and the same Max Fan RPM Formula applies.

Common Mistake with Motor and Fan Pulleys / Sheaves

When belt data is missing, confusing or not logical, apply the belt sizing formula to confirm…

Apply the Belt Sizing Formula to see if the data makes sense…



Belt Length Formula

$$Belt\ Length = 2C + [1.57 \times (D_1 + D_2)] + 1”$$

Where:

C = Distance Between Shafts

D_1 = Diameter of the small pulley

D_2 = Diameter of the large pulley

Belt Length Formula

Example:

C = Distance Between Shafts (18”)

D_1 = Diameter of the small pulley (4”)

D_2 = Diameter of the large pulley (7”)

$$2C + [1.57 \times (D_1 + D_2)] + 1” = \text{New Belt Length}$$

$$2\ (18”) + 1.57 \times (\ 4” + 7”\ ) + 1” =$$

$$36” + (1.57 \times 11”) + 1” =$$

$$36” + 17.27” + 1” = 54.27” \text{ New Belt Length}$$

Use the manufacturer’s catalog and translate the calculated size into a model number.

Verifying Actual Fan RPMs

Motor Sheave Diameter / Fan Sheave Diameter X Motor RPM = Max Fan RPM

Example:

4” Motor Sheave / 8” Fan Sheave X 1750 Motor RPM =

.5 X 1750 = 875 Max Fan RPM with that Drive Package

Verifying Actual Fan RPMs

MODEL	EM32181	FAN MOTOR	RATED	ACTUAL
MOTOR PULLEY		Fan Motor Horsepower	5	4.03
DIAMETER	4 in	Fan Motor RPM	1750	1726
SHAFT	0.5 in	Fan Motor Voltage	230	228
FIXED / ADJ	Adjustable	Fan Motor Amperage	13.2	8.1
BELT NO. & SIZE	BX-58	Fan Service Factor	1.15	1.15
FAN PULLEY		Fan RPM	unknown	230
DIAMETER	30 in	TEMPERATURES	DESIGN	ACTUAL
SHAFT	1 in	Entering Air Temperature	NA	NA

(4” / 30”) X 1726 = .1333 x 1726 = 230

M

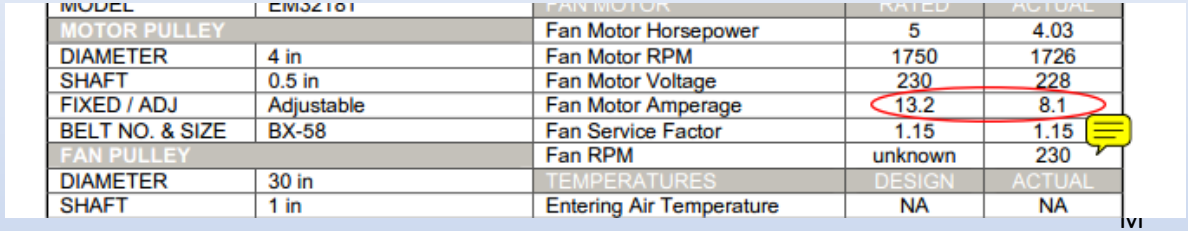
MOTOR PULLEY		Fan Motor Horsepower	1	1
DIAMETER	4 in	Fan Motor RPM	1725	1726
SHAFT	1 in	Fan Motor Voltage	115	110
FIXED / ADJ	Adjustable	Fan Motor Amperage	13.2	8.1
BELT NO. & SIZE	A92-4L-940	Fan Service Factor	1.1.0	1.15
FAN PULLEY		Fan RPM		383
DIAMETER	18 in	TEMPERATURES	DESIGN	ACTUAL

(4” / 18”) X 1726 = .222 x 1726 = 383

MODEL	2264	FAN MOTOR	RATED	ACTUAL
MOTOR PULLEY		Fan Motor Horsepower	0.5	0.5
DIAMETER	4 in	Fan Motor RPM	1725	1726
SHAFT	1 in	Fan Motor Voltage	115	110
FIXED / ADJ	Adjustable	Fan Motor Amperage	8.1	6.2
BELT NO. & SIZE	4L-690	Fan Service Factor	unknown	unknown
FAN PULLEY		Fan RPM	unknown	493
DIAMETER	14 in	TEMPERATURES	DESIGN	ACTUAL
SHAFT	1 in	Entering Air Temperature	NA	NA

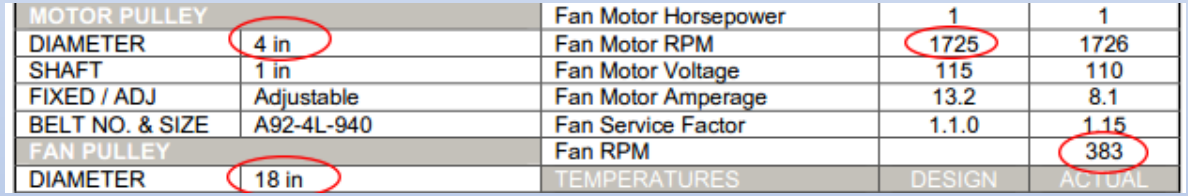
(4” / 14”) X 1726 = .286 x 1726 = 493

Verifying Actual Fan RPMs



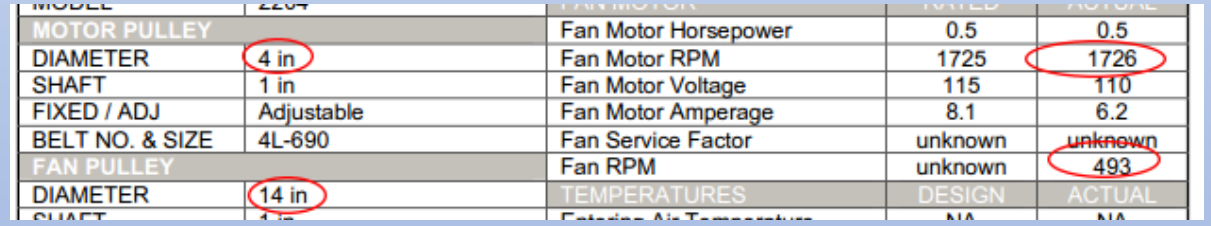
MODEL	EM32181	FAN MOTOR	RATED	ACTUAL
MOTOR PULLEY		Fan Motor Horsepower	5	4.03
DIAMETER	4 in	Fan Motor RPM	1750	1726
SHAFT	0.5 in	Fan Motor Voltage	230	228
FIXED / ADJ	Adjustable	Fan Motor Amperage	13.2	8.1
BELT NO. & SIZE	BX-58	Fan Service Factor	1.15	1.15
FAN PULLEY		Fan RPM	unknown	230
DIAMETER	30 in	TEMPERATURES	DESIGN	ACTUAL
SHAFT	1 in	Entering Air Temperature	NA	NA

It's highly unlikely that EXACTLY 1726 was read as actual motor RPMs on all 3 fans.



MOTOR PULLEY		Fan Motor Horsepower	1	1
DIAMETER	4 in	Fan Motor RPM	1725	1726
SHAFT	1 in	Fan Motor Voltage	115	110
FIXED / ADJ	Adjustable	Fan Motor Amperage	13.2	8.1
BELT NO. & SIZE	A92-4L-940	Fan Service Factor	1.1.0	1.15
FAN PULLEY		Fan RPM		383
DIAMETER	18 in	TEMPERATURES	DESIGN	ACTUAL

It's extremely improbable that ANY of the actual fan RPMs were the calculated maximum.



MODEL	2204	FAN MOTOR	RATED	ACTUAL
MOTOR PULLEY		Fan Motor Horsepower	0.5	0.5
DIAMETER	4 in	Fan Motor RPM	1725	1726
SHAFT	1 in	Fan Motor Voltage	115	110
FIXED / ADJ	Adjustable	Fan Motor Amperage	8.1	6.2
BELT NO. & SIZE	4L-690	Fan Service Factor	unknown	unknown
FAN PULLEY		Fan RPM	unknown	493
DIAMETER	14 in	TEMPERATURES	DESIGN	ACTUAL
SHAFT	1 in	Entering Air Temperature	NA	NA

It's statistically impossible for the actual fan RPMs to come out to EXACTLY the calculated maximum fan RPM 3 times in a row.

Verifying Actual Fan RPMs

2nd Example

Here we have an RTU where the grilles were read out at 168% of design cfm.

Duct traverse of RTU indicated total supply airflow of 170% of design cfm.

UNIT DATA	
Manufacturer	LENNOX
Model Number	LGH120HHBM3G
Unit Type	RTU
Sheave Size	5.6
Sheave Bore Size	1
Belt Make & Size	BROWNING / AX55
No. Filters, Type, Size	4/PLEATED/20X25X2

MOTOR DATA	
Manufacturer/Frame	INTERLINK /56HZ
Motor H.P.	2
Volts / Phase / Cycle	460/3/60
Full Load Amps	2.9
Motor RPM	1755
Sheave Size & Bore	4.8 X 7/8
Sheave Position	3 TURNS OPEN
Sheave Centers' Distance	21.75

TEST DATA	DESIGN	ACTUAL
Design CFM	3500	6058
Air Distribution Total	3500	6058
Fan RPM		
Fan RPM		1236
Discharge S.P.		0.23
Suction S.P.		0.96
Total S.P.		1.19
External S.P.	.80"wg	0.64

TEST DATA	DESIGN	ACTUAL
Motor RPM		
Motor BHP		3.05
Volts T1-T2	460	484
Volts T2-T3	460	483
Volts T1-T2	460	480
Amps T1	2.9	4
Amps T2	2.9	4.1
Amps T3	2.9	3.9

Verifying Actual Fan RPMs

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Here we have an RTU where the grilles were read out at 168% of design cfm.

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Sheave Size	5.6
Sheave Bore Size	1
Belt Make & Size	BROWNING / AX55
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Fan RPM		
Fan RPM		1236
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TEST DATA	DESIGN	ACTUAL
Motor RPM		
Motor BHP		3.05
Volts T1-T2	460	484
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Amps T1	2.9	4
Amps T2	2.9	4.1
Amps T3	2.9	3.9

Verifying Actual Fan RPMs

2nd Example

Note that the unit is over-amping, which supports the readings indicating airflow higher than design.

UNIT DATA	
Manufacturer	LENNOX
Model Number	LGH120HHBM3G
Unit Type	RTU
Sheave Size	5.6
Sheave Bore Size	1
Belt Make & Size	BROWNING / AX55
No. Filters, Type, Size	4/PLEATED/20X25X2

MOTOR DATA	
Manufacturer/Frame	INTERLINK /56HZ
Motor H.P.	2
Volts / Phase / Cycle	460/3/60
Full Load Amps	2.9
Motor RPM	1755
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Sheave Position	3 TURNS OPEN
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Design CFM	3500	6058
Air Distribution Total	3500	6058
Fan RPM		
Fan RPM		1236
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Suction S.P.		0.96
Total S.P.		1.19
External S.P.	.80"wg	0.64

TEST DATA	DESIGN	ACTUAL
Motor RPM		
Motor BHP		3.05
Volts T1-T2	460	484
Volts T2-T3	460	483
Volts T1-T2	460	480
Amps T1	2.9	4
Amps T2	2.9	4.1
Amps T3	2.9	3.9

Verifying Actual Fan RPMs

2nd Example

Also note, the missing design data.

Again, this is why submittal data is critical for successful completion of TAB.

UNIT DATA	
Manufacturer	LENNOX
Model Number	LGH120HHBM3G
Unit Type	RTU
Sheave Size	5.6
Sheave Bore Size	1
Belt Make & Size	BROWNING / AX55
No. Filters, Type, Size	4/PLEATED/20X25X2

MOTOR DATA	
Manufacturer/Frame	INTERLINK /56HZ
Motor H.P.	2
Volts / Phase / Cycle	460/3/60
Full Load Amps	2.9
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Sheave Size & Bore	4.8 X 7/8
Sheave Position	3 TURNS OPEN
Sheave Centers' Distance	21.75

TEST DATA	DESIGN	ACTUAL
Design CFM	3500	6058
Air Distribution Total	3500	6058
Fan RPM		
Fan RPM		1236
Discharge S.P.		0.23
Suction S.P.		0.96
Total S.P.		1.19
External S.P.	.60"wg	0.64

TEST DATA	DESIGN	ACTUAL
Motor RPM		
Motor BHP		3.05
Volts T1-T2	460	484
Volts T2-T3	460	483
Volts T1-T2	460	480
Amps T1	2.9	4
Amps T2	2.9	4.1
Amps T3	2.9	3.9

Verifying Actual Fan RPMs

2nd Example

SUPPLY FAN PERFORMANCE

Supply AirFlow	3500 (cfm)	TotalStaticPress	1.23 (in.WC)
Outdoor AirFlow	500 (cfm)	Wet	
ExtStaticPress Supply	0.80 (in.WC)	Gas	
SupplyFan Req'dPower	1.88 (hp)	Eco	
SupplyFan NomPower	2.00 (hp)	Air	
Supply Fan Type	CAV Belt Drive	Air	
SupplyDriveReq'd RPM	908 (rpm)	Air	
SupplyDrive Min RPM	800 (rpm)	Air Filter Thickness	2.0 (in.)
SupplyDrive Max RPM	1105 (rpm)	Number Exhaust Fans	1

TEST DATA	DESIGN	ACTUAL
Design CFM	3500	6058
Air Distribution Total	3500	6058
Fan RPM		
Fan RPM		1236

Verifying Actual Fan RPMs

2nd Example

SUPPLY FAN PERFORMANCE

Supply AirFlow	3500 (cfm)	TotalStaticPress	1.23 (in.WC)
Outdoor AirFlow	500 (cfm)	Wet Coil Static Press	0.12 (in.WC)
ExtStaticPress Supply	0.80 (in.WC)	Gas H/E Static Press	0.16 (in.WC)
SupplyFan Req'dPower	1.88 (hp)	Economizer Static Press	0.15 (in.WC)
SupplyFan NomPower	2.00 (hp)	Air Filter Qty	4
Supply Fan Type	CAV Belt Drive	Air Filter Length	20.0 (in.)
SupplyDriveReq'd RPM	908 (rpm)	Air Filter Width	25.0 (in.)
SupplyDrive Min RPM	800 (rpm)	Air Filter Thickness	2.0 (in.)
SupplyDrive Max RPM	1105 (rpm)	Number Exhaust Fans	1

Verifying Actual Fan RPMs

2nd Example

UNIT DATA	
Manufacturer	LENNOX
Model Number	LGH120HHBM3G
Unit Type	RTU
Sheave Size	5.6
Sheave Bore Size	1
Belt Make & Size	BROWNING / AX55
No. Filters, Type, Size	4/PLEATED/20X25X2

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Volts / Phase / Cycle	460/3/60
Full Load Amps	2.9
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Sheave Centers' Distance	21.75

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Fan RPM		1236
Discharge S.P.		0.23
Suction S.P.		0.96
Total S.P.		1.19
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Motor RPM		
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Volts T1-T2	460	484
Volts T2-T3	460	483
Volts T1-T2	460	480
Amps T1	2.9	4
Amps T2	2.9	4.1
Amps T3	2.9	3.9

Verifying Actual Fan RPMs

2nd Example

Grilles were read at 167% of design cfm; Unit was traversed at 173%

Actual rpm exceed design fan rpm by 136%

Actual fan rpm exceed design max fan rpm by 120%

Actual fan max rpm (4.8 / 5.6) x 1755 = 1504 package max fan rpm with installed drive package vs. submittal 1105 max fan rpm.

Unit was over amping in operation.

Conclusion - wrong drive package was installed on unit.

Verifying Actual Fan RPMs

2nd Example

UNIT DATA	
Manufacturer	LENNOX
Model Number	LGH120HHBM3G
Unit Type	RTU
Sheave Size	5.6
Sheave Bore Size	1
Belt Make & Size	BROWNING / AX55
No. Filters, Type, Size	4/PLEATED/20X25X2

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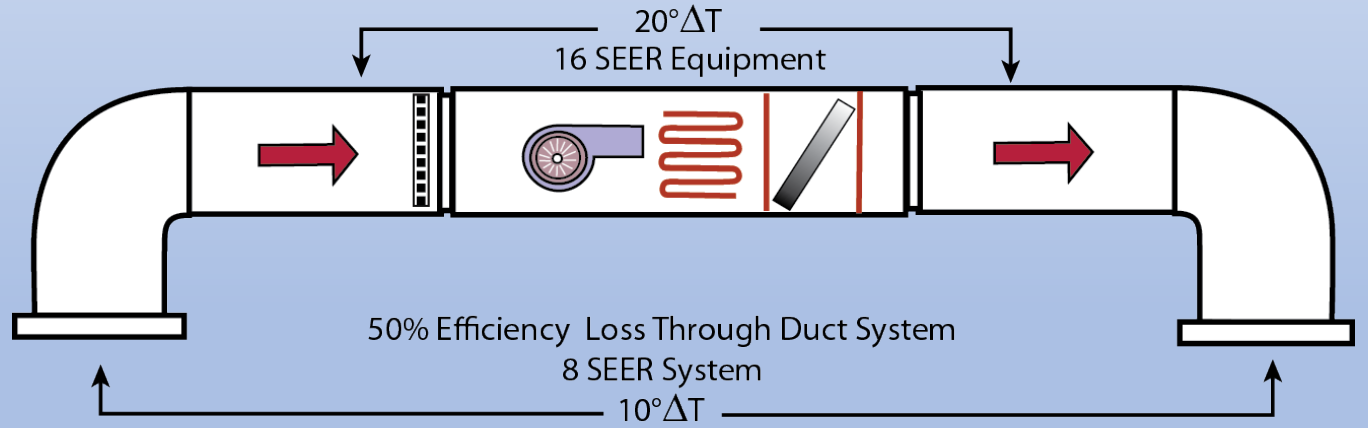
Amps T1	2.9	4
Amps T2	2.9	4.1
Amps T3	2.9	3.9

Airflow and Delta - T

Standard Delta-T on a DX unit is 20º, at 400 cfm per ton of air conditioning, at 12,000 Btus.

If a TAB report states That a 5 ton DX RTU is moving 1,000 cfm, yet the TAB report shows a 20º split, and coils aren't frozen, there is something wrong with the data.



Applying Fan Curves to Review TAB Report

All too often, a unit will be under-performing or over performing, and either the manufacturer or design team will IMMEDIATELY PLOT the field data on a fan curve and respond with a statement to the effect:

“Your Data is Wrong!”

I was even teaching at a manufacturer’s location once, and I asked, “why is it that the TAB recorded data never exactly lines up with the fan curve?”

And before I could put a period on that sentence, one of the design engineers literally came out of his seat and stated…

Applying Fan Curves to Review TAB Report

…“Because your data is wrong!”

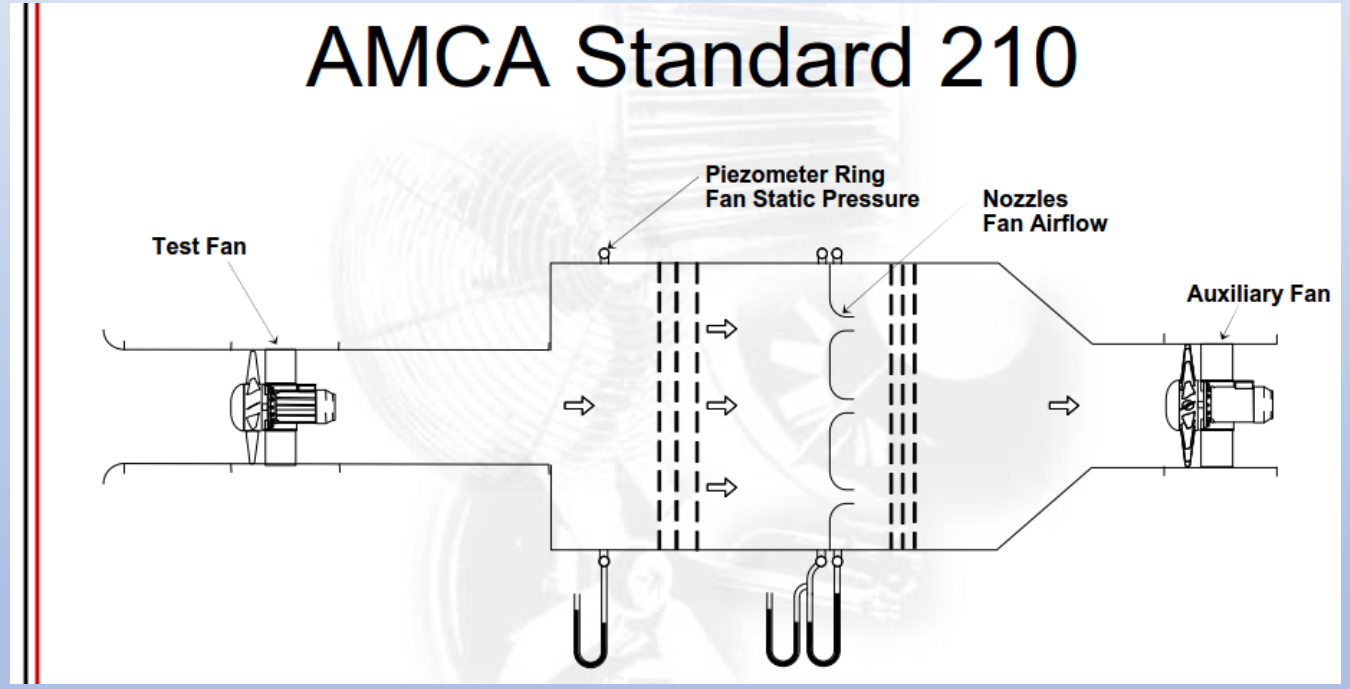
And all of their field personnel knew better.

Fan Curves are developed under laboratory conditions, under AMCA Standard 210.

Once the system is installed, in the field, multiple factors change.

Applying Fan Curves to Review TAB Report

Theory……



Applying Fan Curves to Review TAB Report

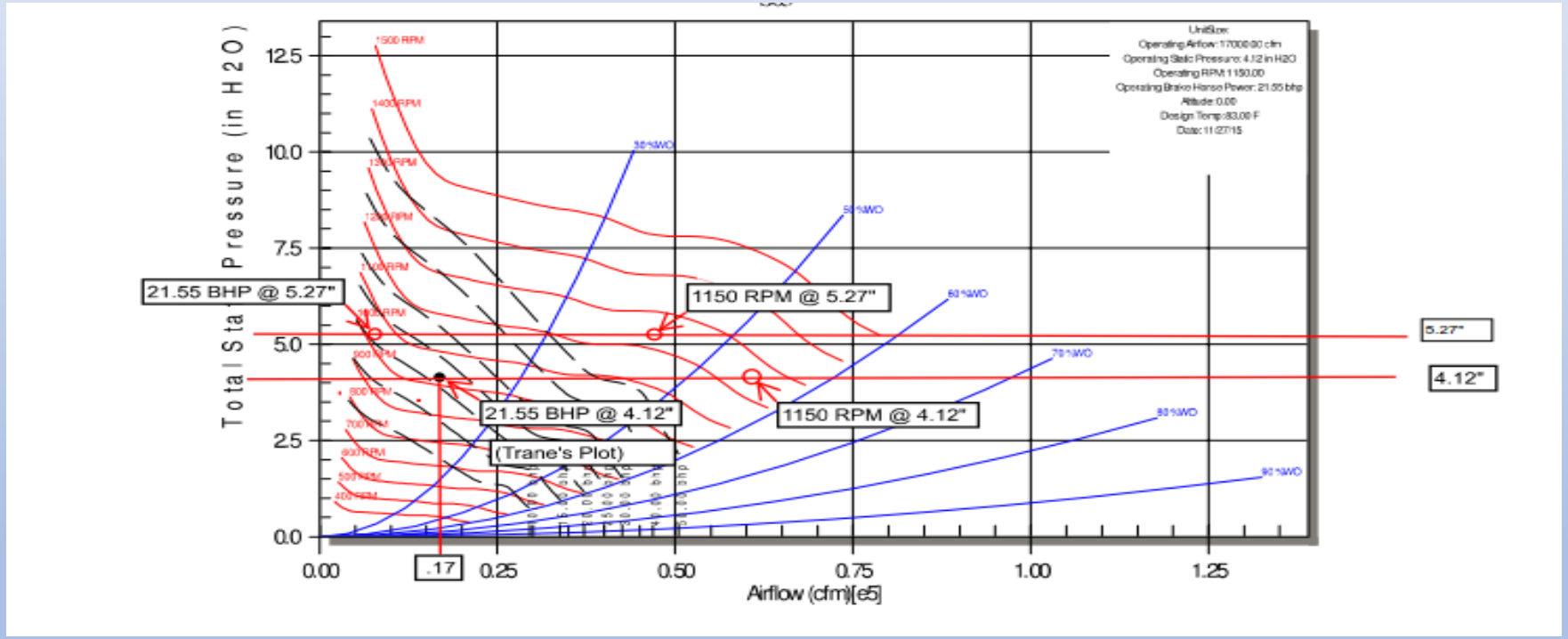
vs. Reality…

Applying Fan Curves to Review TAB Report

- Fan Curves DO NOT take into account System Effect, caused by installation conditions.
- Fan curves are still very practical in regard to TAB report review, as they provide logical parameters.
- Once installed, the fan curves / fan tables NEVER line up exactly, due to field and installation conditions.
- How was BHP determined? Was it read or calculated? Was motor tag Eff and PF used or were plug values used? If so, which one? .8 and .9? 8. and .85? .8 and .7?

Applying Fan Curves to Review TAB Report

Fan Curves / Tables provide Logical Parameters, IF the correct information is given.



Applying Fan Curves to Review TAB Report

6,000 CFM @ 1.2” SP, 857 Fan RPM, 3.89 BHP.

J15XP (15 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																					
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive						Standard 5 HP & Drive										High Static 7.5 HP & Drive							
4000	626	0.22	659	0.66	695	1.07	731	1.45	769	1.81	807	2.16	845	2.49	882	2.81	917	3.12	951	3.43	983	3.74	1011	4.05
4400	641	0.56	674	0.99	709	1.40	746	1.78	784	2.15	822	2.49	860	2.82	897	3.14	932	3.46	966	3.77	998	4.08	1026	4.39
4800	657	0.93	690	1.37	725	1.78	762	2.16	800	2.52	838	2.87	876	3.20	913	3.52	948	3.83	982	4.14	1014	4.45	1042	4.76
5200	674	1.35	708	1.78	743	2.19	780	2.58	817	2.94	855	3.28	893	3.61	930	3.94	966	4.25	1000	4.56	1031	4.87	1059	5.18
5600	693	1.81	726	2.24	762	2.65	798	3.03	836	3.40	874	3.74	912	4.07	949	4.39	985	4.71	1018	5.02	1050	5.33	1078	5.64
6000	714	2.30	747	2.74	782	3.15	819	3.53	857	3.89	895	4.24	932	4.57	969	4.89	1005	5.21	1039	5.51	1070	5.82	1099	6.14
6400	736	2.84	769	3.28	804	3.69	841	4.07	879	4.43	917	4.78	954	5.11	991	5.43	1027	5.74	1061	6.05	1092	6.36	1121	6.67
6800	759	3.42	792	3.85	828	4.26	865	4.65	902	5.01	940	5.35	978	5.68	1015	6.01	1051	6.32	1084	6.63	1116	6.94	1144	7.25
7200	784	4.03	818	4.47	853	4.87	890	5.26	927	5.62	965	5.97	1003	6.30	1040	6.62	1076	6.93	1110	7.24	1141	7.55	-	-
7600	811	4.68	844	5.11	880	5.52	916	5.90	954	6.27	992	6.61	1030	6.94	1067	7.26	1103	7.58	-	-	-	-	-	-
																			7.5 HP & Field Supplied Drive					

1. Blower performance includes 2" filters only. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine required motor sheave setting.
3. kW = BHP x 0.834.

Engineering Data Courtesy of Carrier Corp.

Applying Fan Curves to Review TAB Report

Again, theory vs. reality…. Field readings of 1.48” SP, 886 Fan RPM, 3.51 BHP

J15XP (15 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																					
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive						Standard 5 HP & Drive										High Static 7.5 HP & Drive							
4000	626	0.22	659	0.66	695	1.07	731	1.45	769	1.81	807	2.16	845	2.49	882	2.81	917	3.12	951	3.43	983	3.74	1011	4.05
4400	641	0.56	674	0.99	709	1.40	746	1.78	784	2.15	822	2.49	860	2.82	897	3.14	932	3.46	966	3.77	998	4.08	1026	4.39
4800	657	0.93	690	1.37	725	1.78	762	2.16	800	2.52	838	2.87	876	3.20	913	3.52	948	3.83	982	4.14	1014	4.45	1042	4.76
5200	674	1.35	706	1.78	743	2.19	780	2.58	817	2.94	855	3.28	893	3.61	930	3.94	966	4.25	1000	4.56	1031	4.87	1059	5.18
5600	693	1.81	726	2.24	762	2.65	798	3.03	836	3.40	874	3.74	912	4.07	949	4.39	985	4.71	1018	5.02	1050	5.33	1078	5.64
6000	714	2.30	747	2.74	782	3.15	819	3.53	857	3.89	895	4.24	932	4.57	969	4.89	1005	5.21	1039	5.51	1070	5.82	1099	6.14
6400	736	2.84	769	3.28	804	3.69	841	4.07	879	4.43	917	4.78	954	5.11	991	5.43	1027	5.74	1061	6.05	1092	6.36	1121	6.67
6800	759	3.42	792	3.85	828	4.26	865	4.65	902	5.01	940	5.35	978	5.68	1015	6.01	1051	6.32	1084	6.63	1116	6.94	1144	7.25
7200	784	4.03	818	4.47	853	4.87	890	5.26	927	5.62	965	5.97	1003	6.30	1040	6.62	1076	6.93	1110	7.24	1141	7.55	-	-
7600	811	4.68	844	5.11	880	5.52	916	5.90	954	6.27	992	6.61	1030	6.94	1067	7.26	1103	7.58	-	-	-	-	-	-
																	7.5 HP & Field Supplied Drive							

1. Blower performance includes 2" filters only. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine required motor sheave setting.
3. kW = BHP x 0.834.

Engineering Data Courtesy of Carrier Corp.

Applying Fan Curves to Review TAB Report

Again, theory vs. reality…. 1.48” SP, 886 Fan RPM, 3.51 BHP

J15XP (15 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																					
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive						Standard 5 HP & Drive										High Static 7.5 HP & Drive							
4000	626	0.22	659	0.66	695	1.07	731	1.45	769	1.81	807	2.16	845	2.49	882	2.81	917	3.12	951	3.43	983	3.74	1011	4.05
4400	641	0.56	674	0.99	709	1.40	746	1.78	784	2.15	822	2.49	860	2.82	897	3.14	932	3.46	966	3.77	998	4.08	1026	4.39
4800	657	0.93	690	1.37	725	1.78	762	2.16	800	2.52	838	2.87	876	3.20	913	3.52	948	3.83	982	4.14	1014	4.45	1042	4.76
5200	674	1.35	706	1.78	743	2.19	780	2.58	817	2.94	855	3.28	893	3.61	930	3.94	966	4.25	1000	4.56	1031	4.87	1059	5.18
5600	693	1.81	726	2.24	762	2.65	798	3.03	836	3.40	874	3.74	912	4.07	949	4.39	985	4.71	1018	5.02	1050	5.33	1078	5.64
6000	714	2.30	747	2.74	782	3.15	819	3.53	857	3.89	895	4.24	932	4.57	969	4.89	1005	5.21	1039	5.51	1070	5.82	1099	6.14
6400	736	2.84	769	3.28	804	3.69	841	4.07	879	4.43	917	4.78	954	5.11	991	5.43	1027	5.74	1061	6.05	1092	6.36	1121	6.67
6800	759	3.42	792	3.85	828	4.26	865	4.65	902	5.01	940	5.35	978	5.68	1015	6.01	1051	6.32	1084	6.63	1116	6.94	1144	7.25
7200	784	4.03	818	4.47	853	4.87	890	5.26	927	5.62	965	5.97	1003	6.30	1040	6.62	1076	6.93	1110	7.24	1141	7.55	-	-
7600	811	4.68	844	5.11	880	5.52	916	5.90	954	6.27	992	6.61	1030	6.94	1067	7.26	1103	7.58	-	-	-	-	-	-
																	7.5 HP & Field Supplied Drive							

1. Blower performance includes 2" filters only. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine required motor sheave setting.
3. kW = BHP x 0.834.

Engineering Data Courtesy of Carrier Corp.

Applying Fan Curves to Review TAB Report

Fan Curves / Tables provide Logical Parameters, IF the correct information is given.

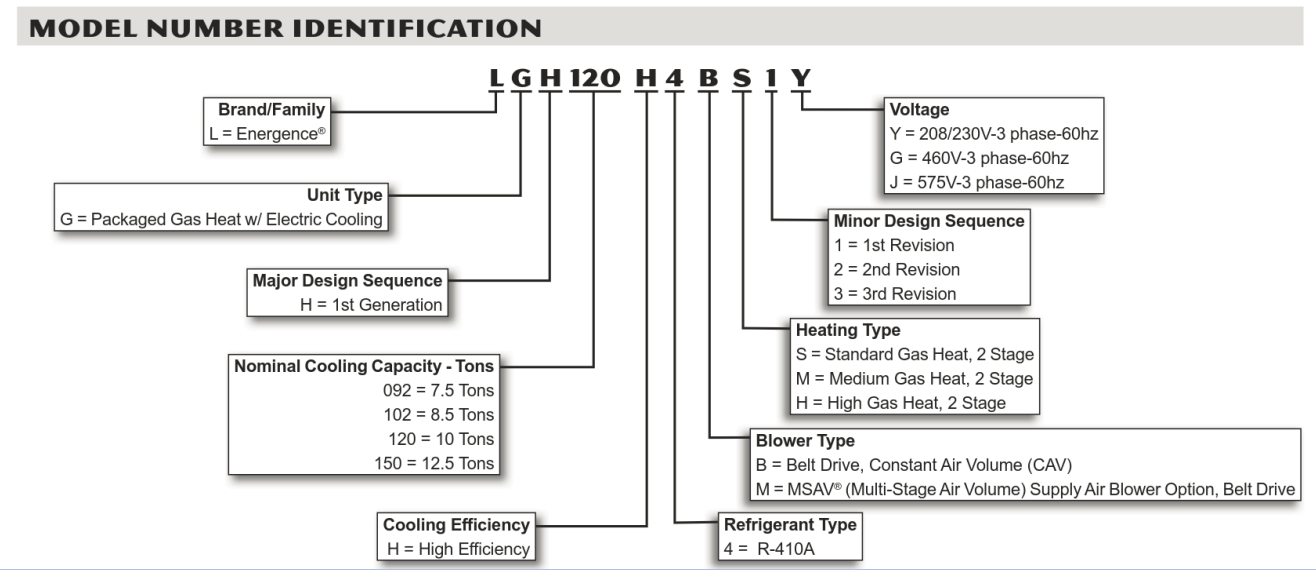
The TAB professional and Certified Supervisor, needs to know they CAN NOT rely upon a fan curve for “Verified Airflow”, due to field conditions and factors in the field.

The TAB professional MUST be aware that the AHJ, Design team and /or manufacturer is IMMEDIATELY going to apply the fan curve.

The Design Team, manufacturer, etc. need to be aware of System Effect, field installation conditions, and BTW, what formula did you us / what method did you use to calculate BHP?

The final TAB Report MUST include enough data for the TAB Supervisor, Equipment manufacture, Commissioning Agent, Design Team or other interested Parties

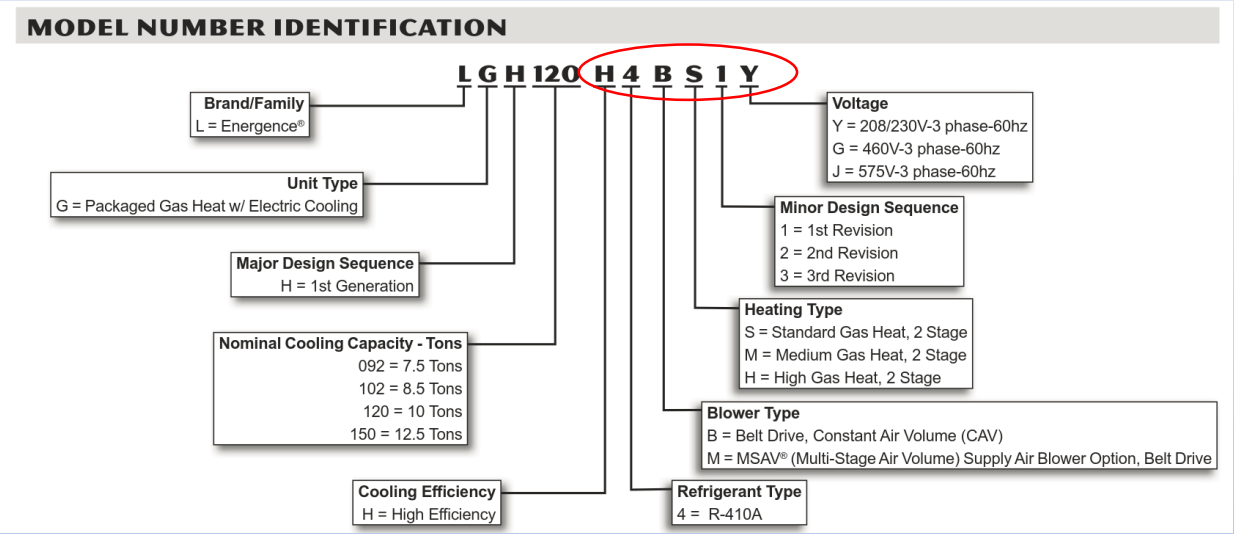
Checking Report Unit Data Against Submittals



JOB: OXFORD GRAND

UNIT	RTU# 1	RTU# 2
UNIT MFG	LENNOX	LENNOX
MODEL NO.	LGH102H4B	LGH072H4B
SERIAL NO.	5616A00537	5616A01455

Checking Report Unit Data Against Submittals



JOB: OXFORD GRAND

UNIT	RTU# 1	RTU# 2
UNIT MFG	LENNOX	LENNOX
MODEL NO.	LGH102H4B	LGH072H4B
SERIAL NO.	5616A00537	5616A01455

TAB did not obtain full model number for complete evaluation

3 MUA Units From 3 Unrelated Projects From Same Contractor

January 1st

MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	6500DD	MUA	3325	3228
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.1
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		425
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		

February 1st

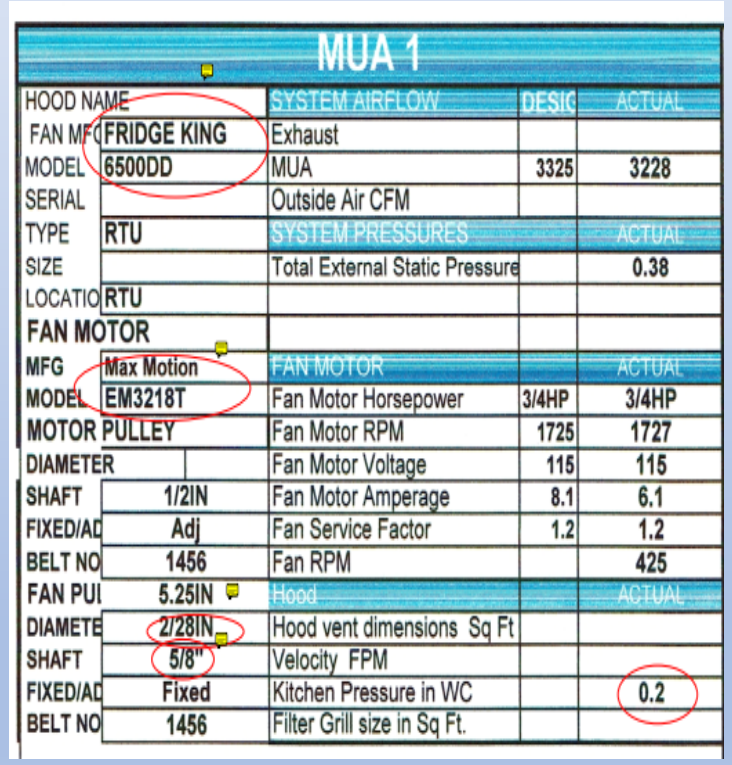
MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	4900DD	MUA	2900	2854
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	7.9
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		812
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		

March 9th

MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIGN	ACTUAL
FAN MFG	CAPTIVEAIRE	Exhaust		
MODEL	A1G10	MUA	1025	1069
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURE		ACTUAL
SIZE		Total External Static P		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepowe	1HP	1HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.8
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		514
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in W		0.2
BELT NO	1456	Filter Grill size in Sq F		

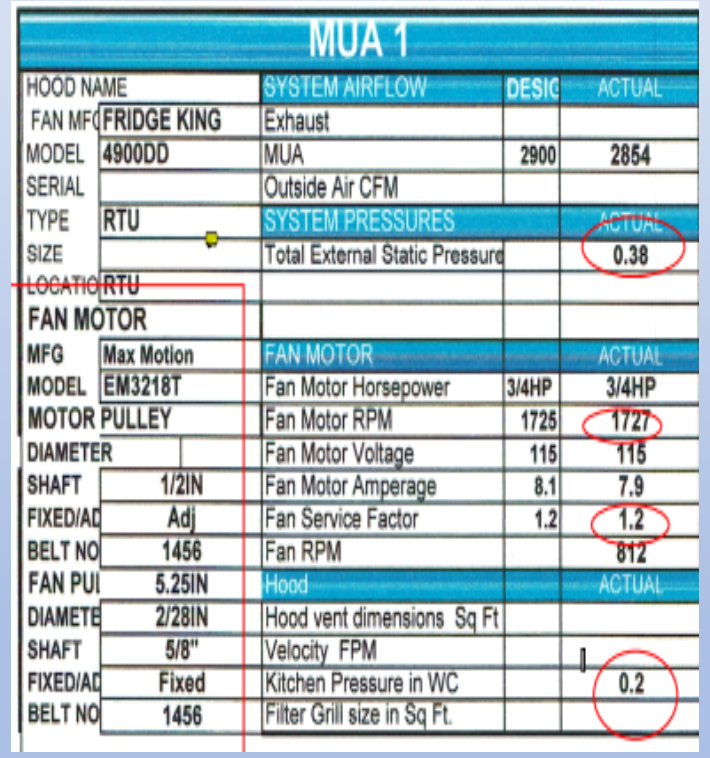
3 MUA Units From 3 Unrelated Projects From Same Contractor

January 1st



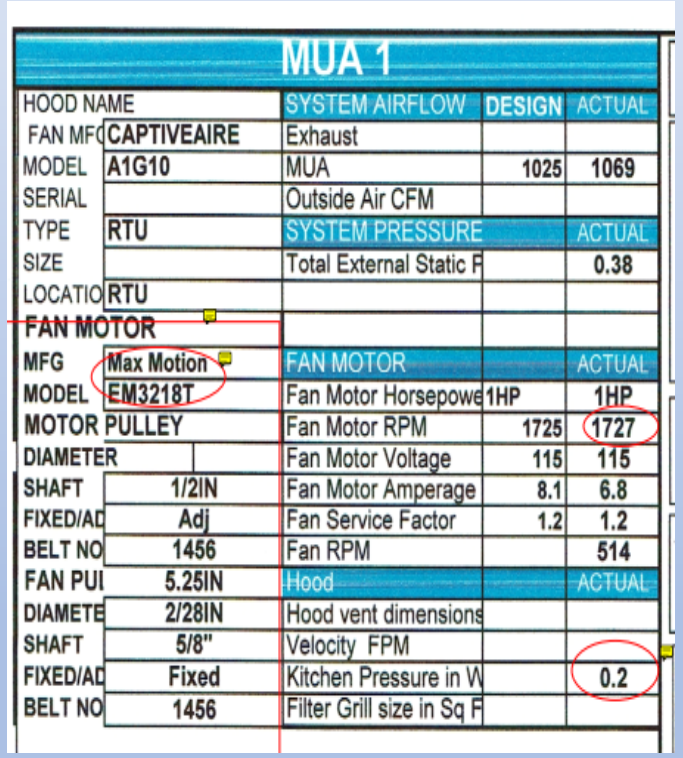
MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	6500DD	MUA	3325	3228
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.1
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		425
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		

February 1st



MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	4900DD	MUA	2900	2854
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	7.9
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		812
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		

March 9th



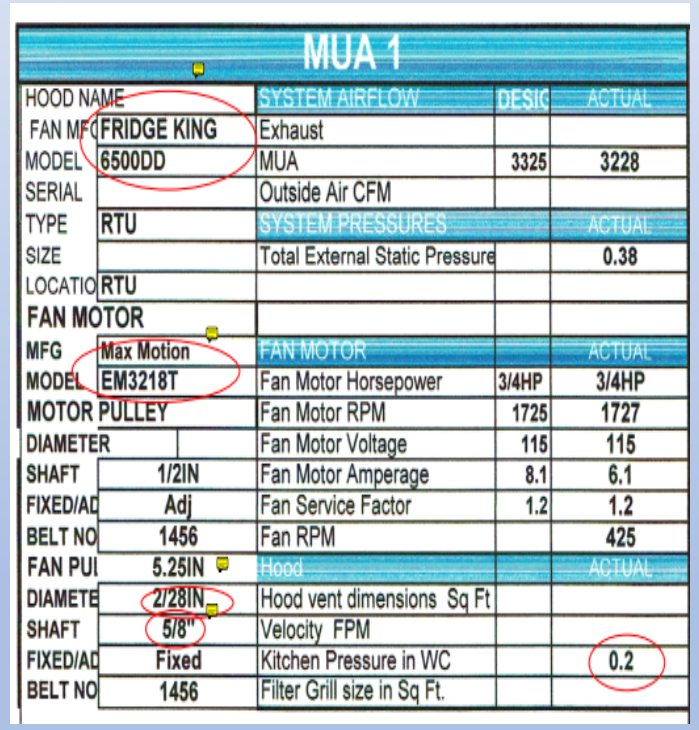
MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIGN	ACTUAL
FAN MFG	CAPTIVEAIRE	Exhaust		
MODEL	A1G10	MUA	1025	1069
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURE		ACTUAL
SIZE		Total External Static F		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepowe	1HP	1HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.8
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		514
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in W		0.2
BELT NO	1456	Filter Grill size in Sq F		

3 MUA Units From 3 Unrelated Projects From Same Contractor

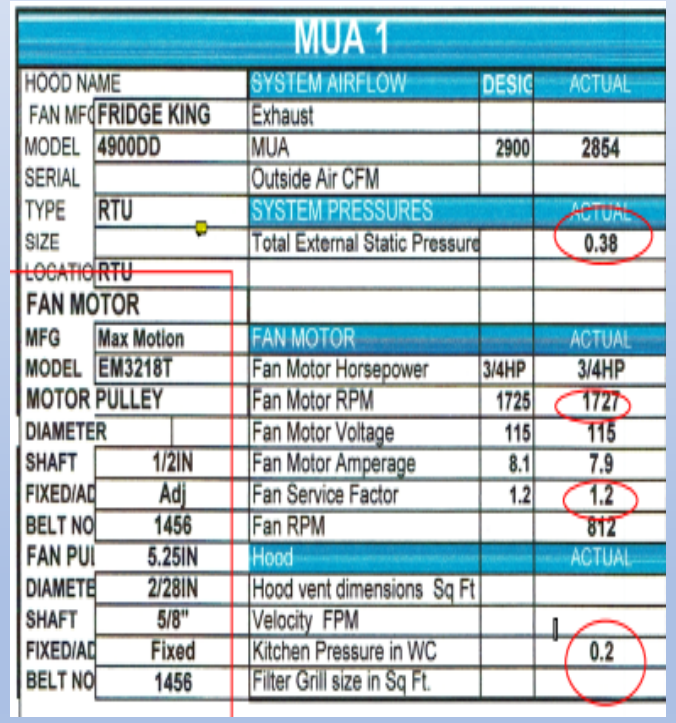
January 1st

February 1st

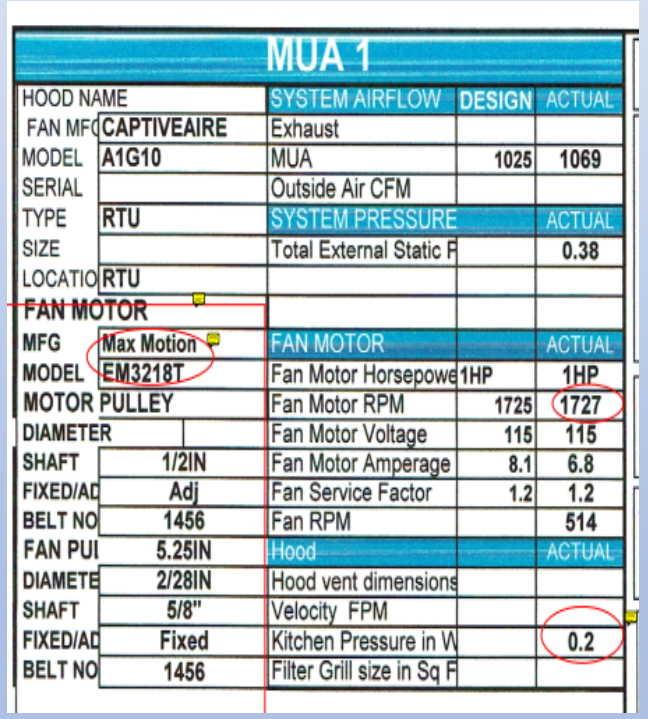
March 9th



MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	6500DD	MUA	3325	3228
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.1
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		425
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		



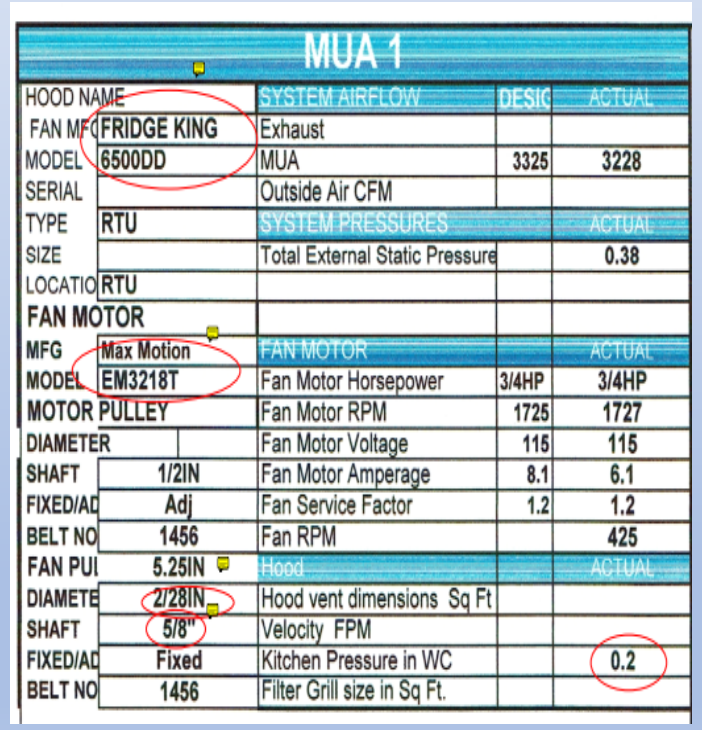
MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	4900DD	MUA	2900	2854
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	7.9
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		812
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		



MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIGN	ACTUAL
FAN MFG	CAPTIVEAIRE	Exhaust		
MODEL	A1G10	MUA	1025	1069
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURE		ACTUAL
SIZE		Total External Static F		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepowe	1HP	1HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.8
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		514
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in W		0.2
BELT NO	1456	Filter Grill size in Sq F		

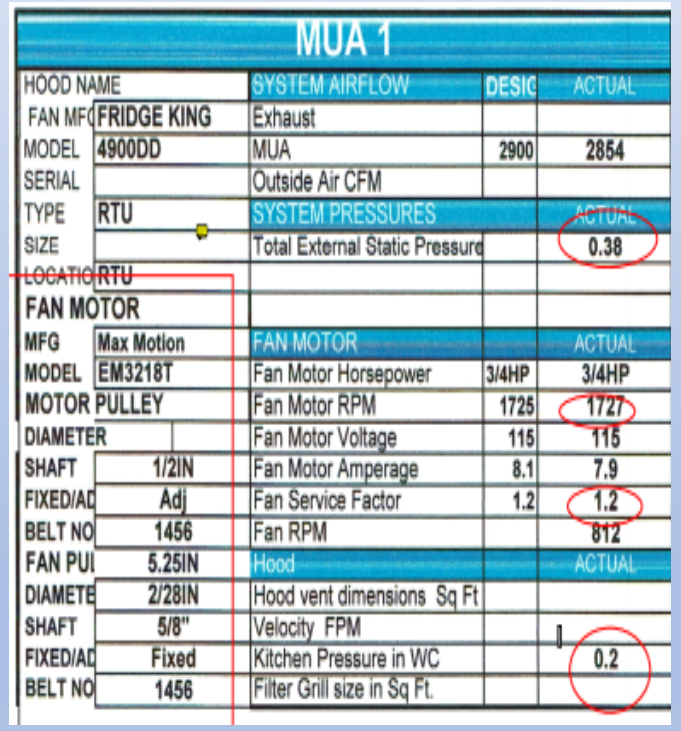
3 MUA Units From 3 Unrelated Projects From Same Contractor

January 1st



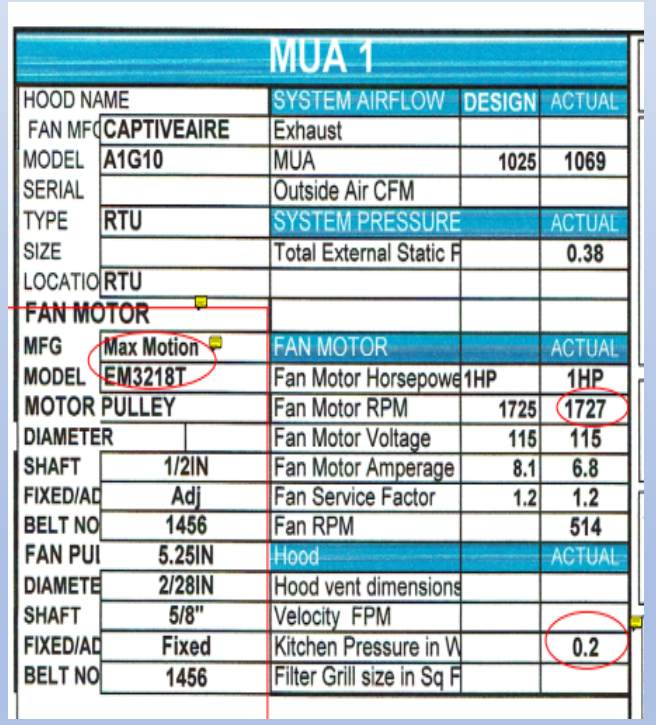
MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	6500DD	MUA	3325	3228
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.1
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		425
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		

February 1st



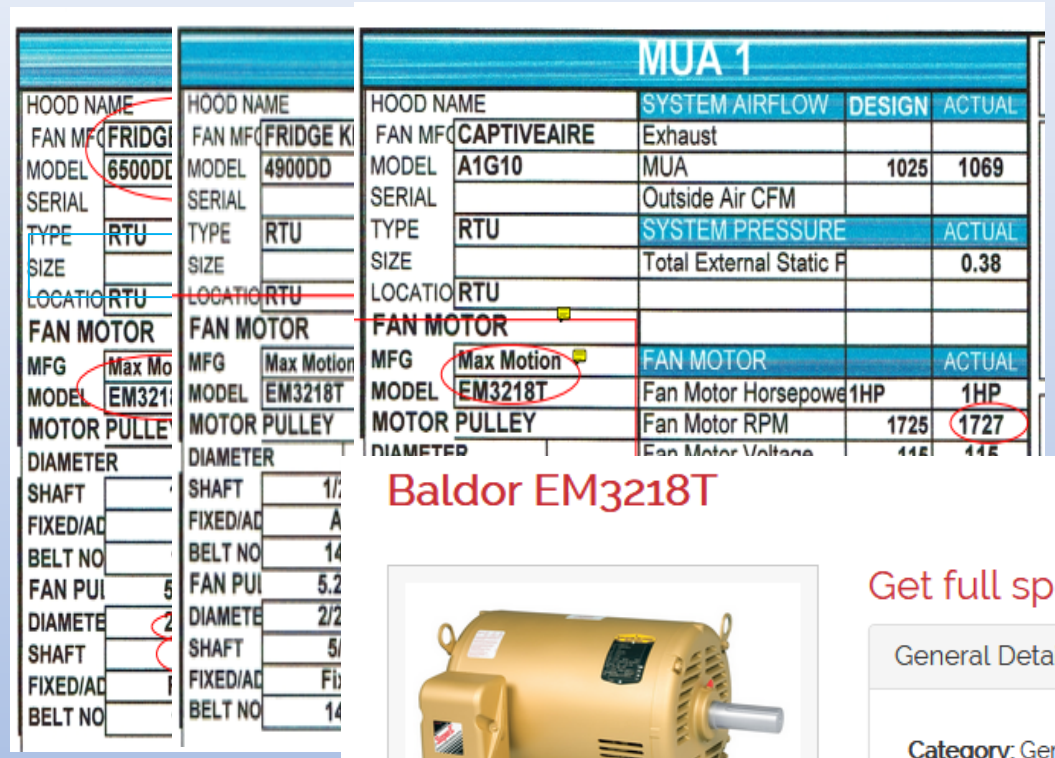
MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIG	ACTUAL
FAN MFG	FRIDGE KING	Exhaust		
MODEL	4900DD	MUA	2900	2854
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURES		ACTUAL
SIZE		Total External Static Pressure		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepower	3/4HP	3/4HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	7.9
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		812
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions Sq Ft		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in WC		0.2
BELT NO	1456	Filter Grill size in Sq Ft.		

March 9th



MUA 1				
HOOD NAME		SYSTEM AIRFLOW	DESIGN	ACTUAL
FAN MFG	CAPTIVEAIRE	Exhaust		
MODEL	A1G10	MUA	1025	1069
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURE		ACTUAL
SIZE		Total External Static F		0.38
LOCATIO	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepowe	1HP	1HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.8
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		514
FAN PUI	5.25IN	Hood		ACTUAL
DIAMETE	2/28IN	Hood vent dimensions		
SHAFT	5/8"	Velocity FPM		
FIXED/AD	Fixed	Kitchen Pressure in W		0.2
BELT NO	1456	Filter Grill size in Sq F		

3 MUA Units From 3 Unrelated Projects From Same Contractor



HOOD NAME	
FAN MFG	FRIDGI
MODEL	6500DD
SERIAL	
TYPE	RTU
SIZE	
LOCATION	RTU
FAN MOTOR	
MFG	Max Mo
MODEL	EM321
MOTOR PULLEY	
DIAMETER	
SHAFT	
FIXED/AD	
BELT NO	
FAN PUL	5
DIAMETE	2
SHAFT	
FIXED/AD	
BELT NO	

HOOD NAME	
FAN MFG	FRIDGE K
MODEL	4900DD
SERIAL	
TYPE	RTU
SIZE	
LOCATION	RTU
FAN MOTOR	
MFG	Max Motion
MODEL	EM3218T
MOTOR PULLEY	
DIAMETER	
SHAFT	1/
FIXED/AD	A
BELT NO	14
FAN PUL	5.2
DIAMETE	2/2
SHAFT	5/
FIXED/AD	Fi
BELT NO	14

MUA 1

HOOD NAME		SYSTEM AIRFLOW	DESIGN	ACTUAL
FAN MFG	CAPTIVEAIRE	Exhaust		
MODEL	A1G10	MUA	1025	1069
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURE		ACTUAL
SIZE		Total External Static P		0.38
LOCATION	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepowe	1HP	1HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115

Maxmotion EM3218T

Baldor EM3218T

Drawing

Get full specifications on Baldor EM3218T General Purpose

General Details

Category: General Purpose	**Product Line:** Super – E	**HP:** 5
KW: 3.73	**RPM:** 1800	**Voltage:** 230/460
Enclosure: ODP	**Frame:** 184T	**Motor Standards:** NEMA

3 MUA Units From 3 Unrelated Projects From Same Contractor

HOOD NAME	
FAN MFG	FRIDGE KIN
MODEL	6500DD
SERIAL	
TYPE	RTU
SIZE	
LOCATION	RTU
FAN MOTOR	
MFG	Max Motion
MODEL	EM3218T
MOTOR PULLEY	
DIAMETER	
SHAFT	1/2IN
FIXED/AD	Adj
BELT NO	1456
FAN PUL	5.25IN
DIAMETE	2/28IN
SHAFT	5/8"
FIXED/AD	Fixed
BELT NO	1456

HOOD NAME	
FAN MFG	FRIDGE KI
MODEL	4900DD
SERIAL	
TYPE	RTU
SIZE	
LOCATION	RTU
FAN MOTOR	
MFG	Max Motion
MODEL	EM3218T
MOTOR PULLEY	
DIAMETER	
SHAFT	1/2IN
FIXED/AD	Adj
BELT NO	1456
FAN PUL	5.25I
DIAMETE	2/28I
SHAFT	5/8"
FIXED/AD	Fixe
BELT NO	1456

MUA 1

HOOD NAME		SYSTEM AIRFLOW	DESIGN	ACTUAL
FAN MFG	CAPTIVEAIRE	Exhaust		
MODEL	A1G10	MUA	1025	1069
SERIAL		Outside Air CFM		
TYPE	RTU	SYSTEM PRESSURE		ACTUAL
SIZE		Total External Static P		0.38
LOCATION	RTU			
FAN MOTOR				
MFG	Max Motion	FAN MOTOR		ACTUAL
MODEL	EM3218T	Fan Motor Horsepowe	1HP	1HP
MOTOR PULLEY		Fan Motor RPM	1725	1727
DIAMETER		Fan Motor Voltage	115	115
SHAFT	1/2IN	Fan Motor Amperage	8.1	6.8
FIXED/AD	Adj	Fan Service Factor	1.2	1.2
BELT NO	1456	Fan RPM		514

Maxmotion EM3218T

Baldor, not Max Motion, makes 9 Different EM3218T models.

All models are:
.5 HP
1800 RPM
184T Frame

Baldor EM3218T

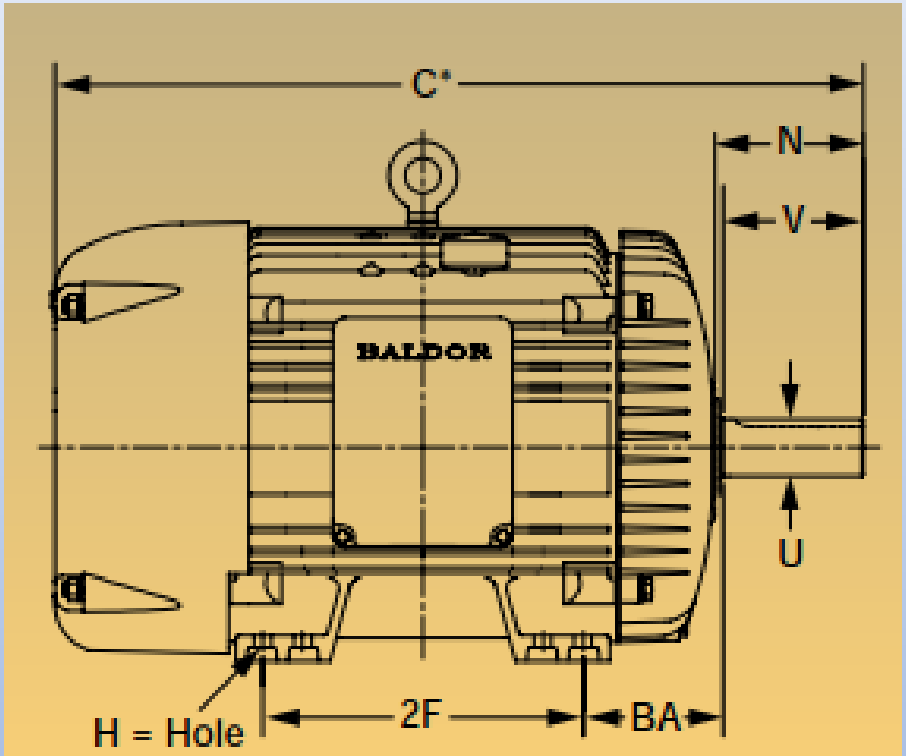
Drawing

Get full specifications on Baldor EM3218T General Purpose

General Details

Category: General Purpose	**Product Line**: Super – E	**HP**: 5
KW: 3.73	**RPM**: 1800	**Voltage**: 230/460
Enclosure: ODP	**Frame**: 184T	**Motor Standards**: NEMA

NEMA Chart

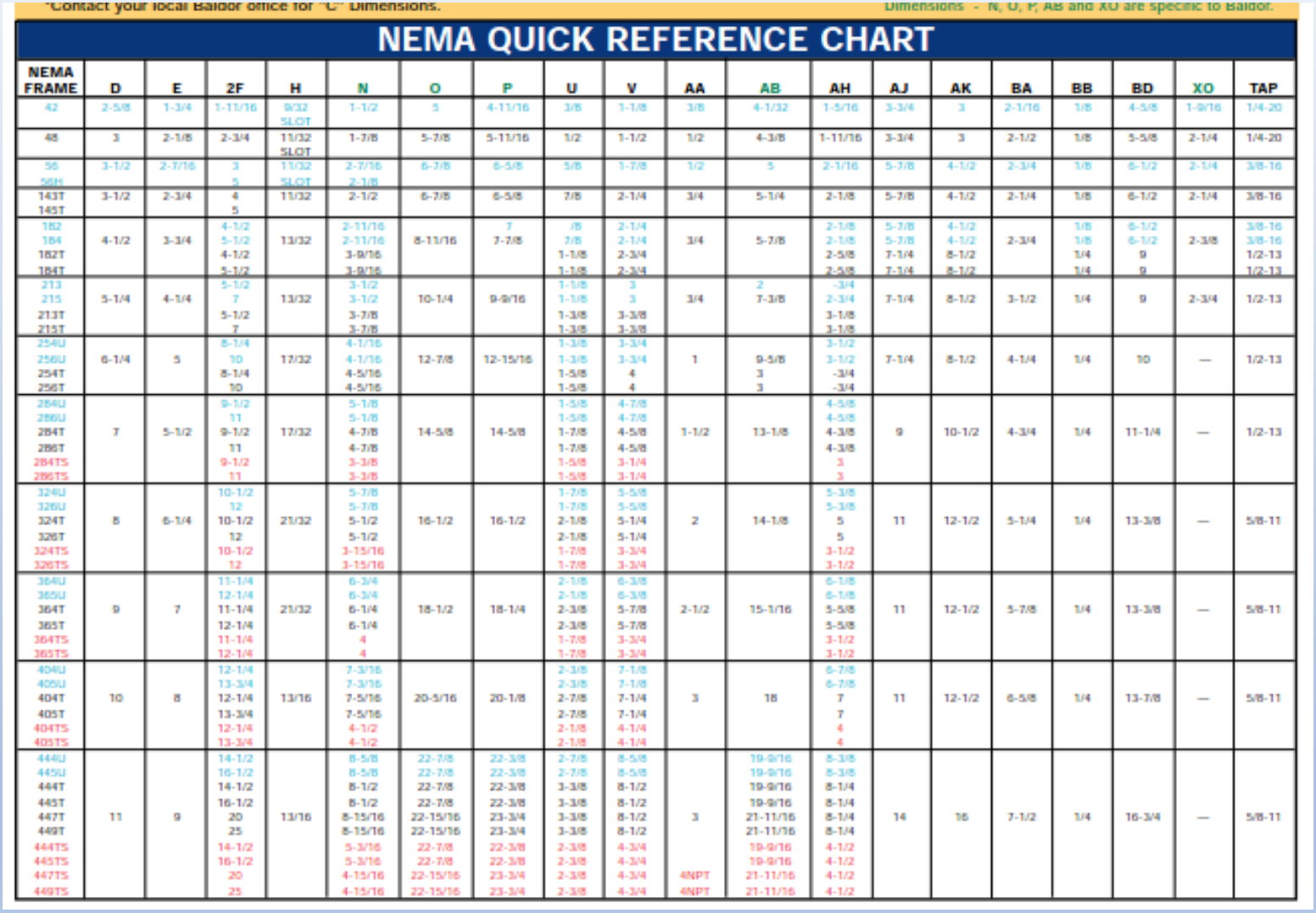


All motor frames only have ONE corresponding bore size.

This is the U- Value on The NEMA Chart

You find the frame and go across to the U column and that's the only bore size possible.

NEMA Chart



"Contact your local Baldor office for "C" Dimensions. Dimensions - N, O, P, AB and XO are specific to Baldor.

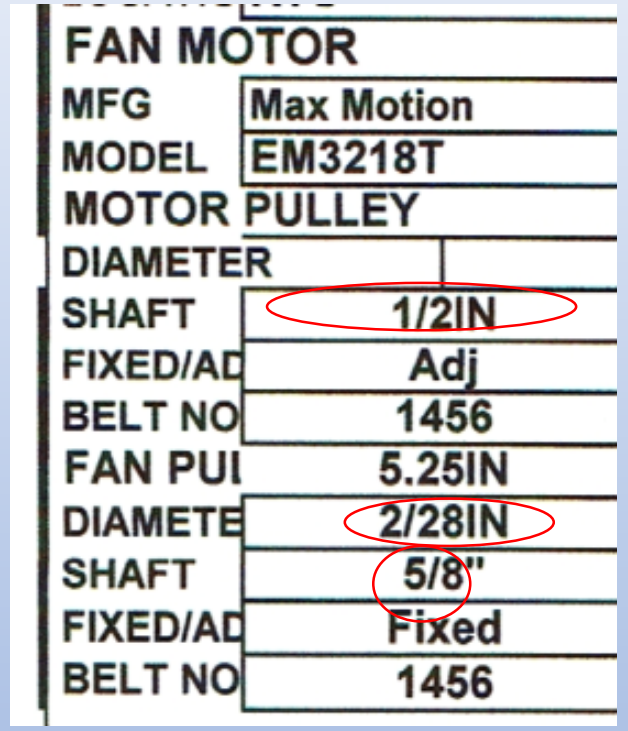
NEMA QUICK REFERENCE CHART

NEMA FRAME	D	E	2F	H	N	O	P	U	V	AA	AB	AH	AJ	AK	BA	BB	BD	XO	TAP
42	2-5/8	1-3/4	1-11/16	9/32 SLOT	1-1/2	5	4-11/16	3/8	1-1/8	3/8	4-1/32	1-5/16	3-3/4	3	2-1/16	1/8	4-5/8	1-9/16	1/4-20
48	3	2-1/8	2-3/4	11/32 SLOT	1-7/8	5-7/8	5-11/16	1/2	1-1/2	1/2	4-3/8	1-11/16	3-3/4	3	2-1/2	1/8	5-5/8	2-1/4	1/4-20
56 56H	3-1/2	2-7/16	3 5	11/32 SLOT	2-7/16 2-1/8	6-7/8	6-5/8	5/8	1-7/8	1/2	5	2-1/16	5-7/8	4-1/2	2-3/4	1/8	6-1/2	2-1/4	3/8-16
143T 145T	3-1/2	2-3/4	4 5	11/32	2-1/2	6-7/8	6-5/8	7/8	2-1/4	3/4	5-1/4	2-1/8	5-7/8	4-1/2	2-1/4	1/8	6-1/2	2-1/4	3/8-16
182 184 182T 184T	4-1/2	3-3/4	4-1/2 5-1/2 4-1/2 5-1/2	13/32	2-11/16 2-11/16 3-9/16 3-9/16	8-11/16	7 7-7/8	/8 7/8 1-1/8 1-1/8	2-1/4 2-1/4 2-3/4 2-3/4	3/4	5-7/8	2-1/8 2-1/8 2-5/8 2-5/8	5-7/8 5-7/8 7-1/4 7-1/4	4-1/2 4-1/2 8-1/2 8-1/2	2-3/4	1/8 1/8 1/4 1/4	6-1/2 6-1/2 9 9	2-3/8	3/8-16 3/8-16 1/2-13 1/2-13
213 215 213T 215T	5-1/4	4-1/4	5-1/2 7 5-1/2 7	13/32	3-1/2 3-1/2 3-7/8 3-7/8	10-1/4	9-9/16	1-1/8 1-1/8 1-3/8 1-3/8	3 3 3-3/8 3-3/8	3/4	2 7-3/8	-3/4 2-3/4 3-1/8 3-1/8	7-1/4	8-1/2	3-1/2	1/4	9	2-3/4	1/2-13
254U 256U 254T 256T	6-1/4	5	8-1/4 10 8-1/4 10	17/32	4-1/16 4-1/16 4-5/16 4-5/16	12-7/8	12-15/16	1-3/8 1-3/8 1-5/8 1-5/8	3-3/4 3-3/4 4 4	1	9-5/8 3 3	3-1/2 3-1/2 -3/4 -3/4	7-1/4	8-1/2	4-1/4	1/4	10	—	1/2-13
284U 286U 284T 286T 284TS 286TS	7	5-1/2	9-1/2 11 9-1/2 11 9-1/2 11	17/32	5-1/8 5-1/8 4-7/8 4-7/8 3-3/8 3-3/8	14-5/8	14-5/8	1-5/8 1-5/8 1-7/8 1-7/8 1-5/8 1-5/8	4-7/8 4-7/8 4-5/8 4-5/8 3-1/4 3-1/4	1-1/2	13-1/8	4-5/8 4-5/8 4-3/8 4-3/8 3 3	9	10-1/2	4-3/4	1/4	11-1/4	—	1/2-13
324U 326U 324T 326T 324TS 326TS	8	6-1/4	10-1/2 12 10-1/2 12 10-1/2 12	21/32	5-7/8 5-7/8 5-1/2 5-1/2 3-15/16 3-15/16	16-1/2	16-1/2	1-7/8 1-7/8 2-1/8 2-1/8 1-7/8 1-7/8	5-5/8 5-5/8 5-1/4 5-1/4 3-3/4 3-3/4	2	14-1/8	5-3/8 5-3/8 5 5 3-1/2 3-1/2	11	12-1/2	5-1/4	1/4	13-3/8	—	5/8-11
364U 365U 364T 365T 364TS 365TS	9	7	11-1/4 12-1/4 11-1/4 12-1/4 11-1/4 12-1/4	21/32	6-3/4 6-3/4 6-1/4 6-1/4 4 4	18-1/2	18-1/4	2-1/8 2-1/8 2-3/8 2-3/8 1-7/8 1-7/8	6-3/8 6-3/8 5-7/8 5-7/8 3-3/4 3-3/4	2-1/2	15-1/16	6-1/8 6-1/8 5-5/8 5-5/8 3-1/2 3-1/2	11	12-1/2	5-7/8	1/4	13-3/8	—	5/8-11
404U 405U 404T 405T 404TS 405TS	10	8	12-1/4 13-3/4 12-1/4 13-3/4 12-1/4 13-3/4	13/16	7-3/16 7-3/16 7-5/16 7-5/16 4-1/2 4-1/2	20-5/16	20-1/8	2-3/8 2-3/8 2-7/8 2-7/8 2-1/8 2-1/8	7-1/8 7-1/8 7-1/4 7-1/4 4-1/4 4-1/4	3	18	6-7/8 6-7/8 7 7 4 4	11	12-1/2	6-5/8	1/4	13-7/8	—	5/8-11
444U 445U 444T 445T 447T 449T 444TS 445TS 447TS 449TS	11	9	14-1/2 16-1/2 14-1/2 16-1/2 20 25 14-1/2 16-1/2 20 25	13/16	8-5/8 8-5/8 8-1/2 8-1/2 8-15/16 8-15/16 5-3/16 5-3/16 4-15/16 4-15/16	22-7/8 22-7/8 22-7/8 22-7/8 22-15/16 22-15/16 22-7/8 22-7/8 22-15/16 22-15/16	22-3/8 22-3/8 22-3/8 22-3/8 23-3/4 23-3/4 22-3/8 22-3/8 23-3/4 23-3/4	2-7/8 2-7/8 3-3/8 3-3/8 3-3/8 3-3/8 2-3/8 2-3/8 2-3/8 2-3/8	8-5/8 8-5/8 8-1/2 8-1/2 8-1/2 8-1/2 4-3/4 4-3/4 4-3/4 4-3/4	3 4NPT 4NPT	19-9/16 19-9/16 19-9/16 19-9/16 21-11/16 21-11/16 19-9/16 19-9/16 21-11/16 21-11/16	8-3/8 8-3/8 8-1/4 8-1/4 8-1/4 8-1/4 4-1/2 4-1/2 4-1/2 4-1/2	14	16	7-1/2	1/4	16-3/4	—	5/8-11

NEMA Chart

NEMA FRAME	D	E	2F	H	N	O	P	U	V	AA	AB	AH	AJ	AK	BA	BB	BD	XO	TAP
42	2-5/8	1-3/4	1-11/16	9/32 SLOT	1-1/2	5	4-11/16	3/8	1-1/8	3/8	4-1/32	1-5/16	3-3/4	3	2-1/16	1/8	4-5/8	1-9/16	1/4-20
48	3	2-1/8	2-3/4	11/32 SLOT	1-7/8	5-7/8	5-11/16	1/2	1-1/2	1/2	4-3/8	1-11/16	3-3/4	3	2-1/2	1/8	5-5/8	2-1/4	1/4-20
56 56H	3-1/2	2-7/16	3 5	11/32 SLOT	2-7/16 2-1/8	6-7/8	6-5/8	5/8	1-7/8	1/2	5	2-1/16	5-7/8	4-1/2	2-3/4	1/8	6-1/2	2-1/4	3/8-16
143T 145T	3-1/2	2-3/4	4 5	11/32	2-1/2	6-7/8	6-5/8	7/8	2-1/4	3/4	5-1/4	2-1/8	5-7/8	4-1/2	2-1/4	1/8	6-1/2	2-1/4	3/8-16
182 184 182T 184T	4-1/2	3-3/4	4-1/2 5-1/2 4-1/2 5-1/2	13/32	2-11/16 2-11/16 3-9/16 3-9/16	8-11/16	7 7-7/8	/8 7/8 1-1/8 1-1/8	2-1/4 2-1/4 2-3/4 2-3/4	3/4	5-7/8	2-1/8 2-1/8 2-5/8 2-5/8	5-7/8 5-7/8 7-1/4 7-1/4	4-1/2 4-1/2 8-1/2 8-1/2	2-3/4	1/8 1/8 1/4 1/4	6-1/2 6-1/2 9 9	2-3/8	3/8-16 3/8-16 1/2-13 1/2-13
213			5-1/2		3-1/2			1-1/8	3		2	-3/4							

The motor model listed in the TAB report only came in a 184T Frame, so it will ALWAYS have a 1 1/8ths motor bore.



FAN MOTOR	
MFG	Max Motion
MODEL	EM3218T
MOTOR PULLEY	
DIAMETER	
SHAFT	1/2IN
FIXED/AD	Adj
BELT NO	1456
FAN PUI	5.25IN
DIAMETE	2/28IN
SHAFT	5/8"
FIXED/AD	Fixed
BELT NO	1456

The motor model listed in the TAB report only came in a 184T Frame, so it will ALWAYS have a 1 1/8ths motor bore.

Motor bores typically come in ½ or 1/8" measurements.

Fan bores typically come in whole numbers, 1/16th inch and quarter inch measurements.

I have NO IDEA what 2/28" is. It's not on any tape measure that I'm aware of, but it sure is in this report!

Duct Traverse

Importance of Quality of Readings

If 75% of the readings are between the highest reading, and 10% of the highest reading, the data is acceptable." - ASHRAE 111

Example

1200	1145	1100	105
1150	1025	950	400
1075	975	825	-295
1020	950	115	650

In this traverse, at least 75% of the readings are between 1200 fpm (the highest reading), and 120 fpm (10% of the highest reading).

13 of the 16 readings fall between 120 fpm and 1200 fpm.

13 ÷ 16 = 81%

Duct Traverse

Which of the following traverses are acceptable under the ASHRAE rule?

Why?

1550	1145	800	0
1235	825	770	0
1158	500	730	-455
345	275	310	-250

A

155	180	981	1910
115	245	1025	2015
175	165	1250	1750
135	155	970	1670

B

Duct Traverse

Which of the following traverses are acceptable under the ASHRAE rule?

Why?

1550	1145	800	0
1235	825	770	0
1158	500	730	-455
345	275	310	-250

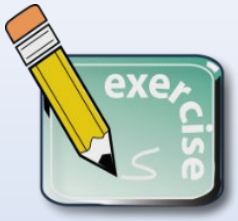
A

In this traverse, at least 75% of the readings must be between 1550 fpm (the highest reading), and 155 fpm (10% of the highest reading).

12 of the 16 readings fall between 155 fpm and 1550 fpm.

12 ÷ 16 = 75%

Duct Traverse



Which of the following traverses are acceptable under the ASHRAE rule?

Why?

(155)	(180)	981	1910
(115)	245	1025	2015
(175)	(165)	1250	1750
(135)	(155)	970	1670

B

In this traverse, at least 75% of the readings must be between 2015 fpm (the highest reading), and 202 fpm (10% of the highest reading).

9 of the 16 readings fall between 202 fpm and 2015 fpm.

9 ÷ 16 = 56%

Duct Traverse

Log / Tchebycheff Duct Traverse Method

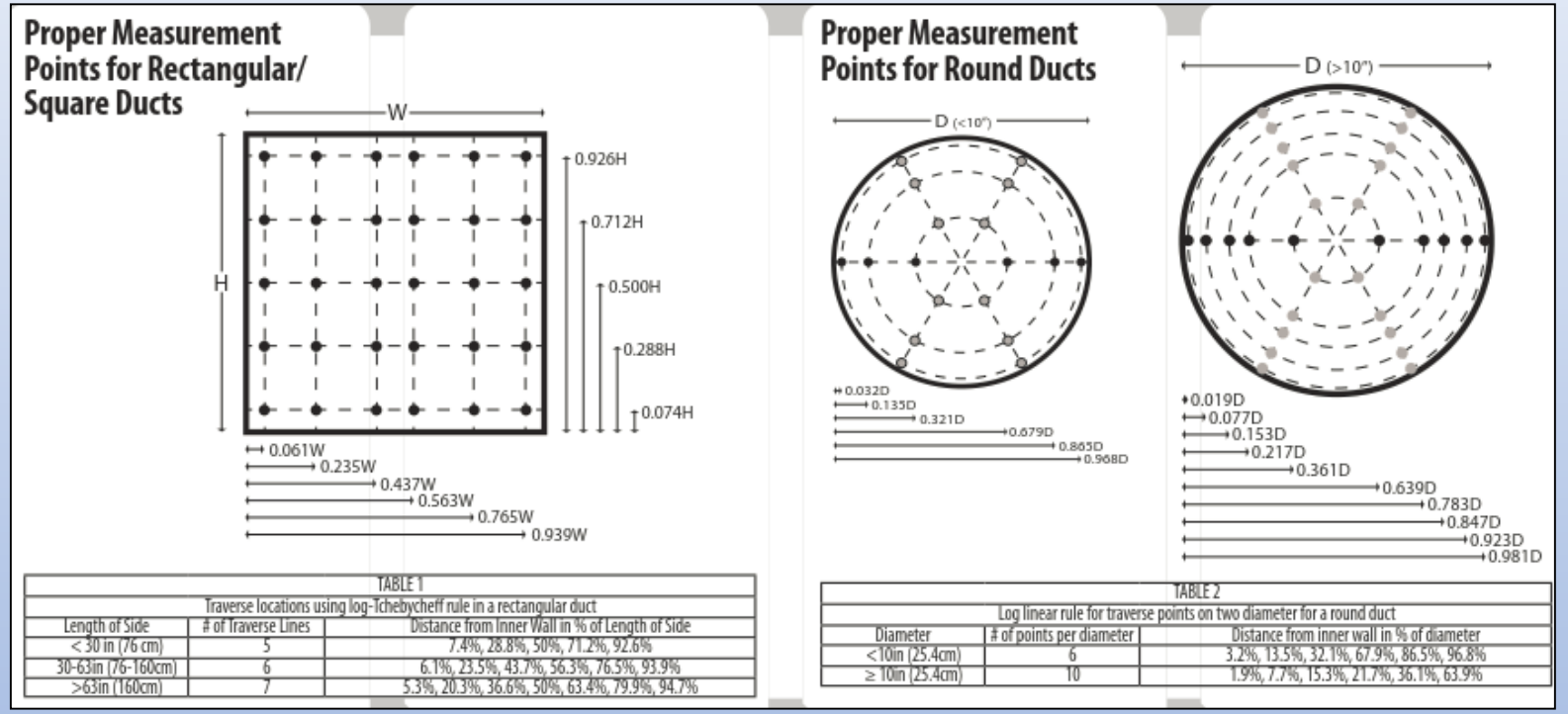


TABLE 1
Traverse locations using log-Tchebycheff rule in a rectangular duct

Length of Side	# of Traverse Lines	Distance from Inner Wall in % of Length of Side
< 30 in (76 cm)	5	7.4%, 28.8%, 50%, 71.2%, 92.6%
30-63in (76-160cm)	6	6.1%, 23.5%, 43.7%, 56.3%, 76.5%, 93.9%
>63in (160cm)	7	5.3%, 20.3%, 36.6%, 50%, 63.4%, 79.9%, 94.7%

TABLE 2
Log linear rule for traverse points on two diameter for a round duct

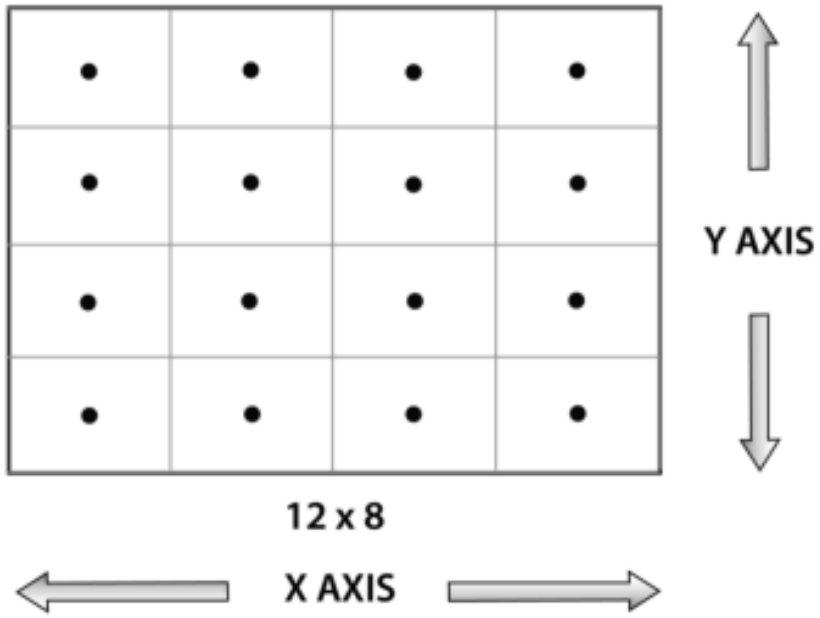
Diameter	# of points per diameter	Distance from inner wall in % of diameter
<10in (25.4cm)	6	3.2%, 13.5%, 32.1%, 67.9%, 86.5%, 96.8%
≥ 10in (25.4cm)	10	1.9%, 7.7%, 15.3%, 21.7%, 36.1%, 63.9%

Rectangular traverse will have minimum of 25 readings, maximum of 49.
Round traverse will have a minimum of 12 readings, maximum of 20.

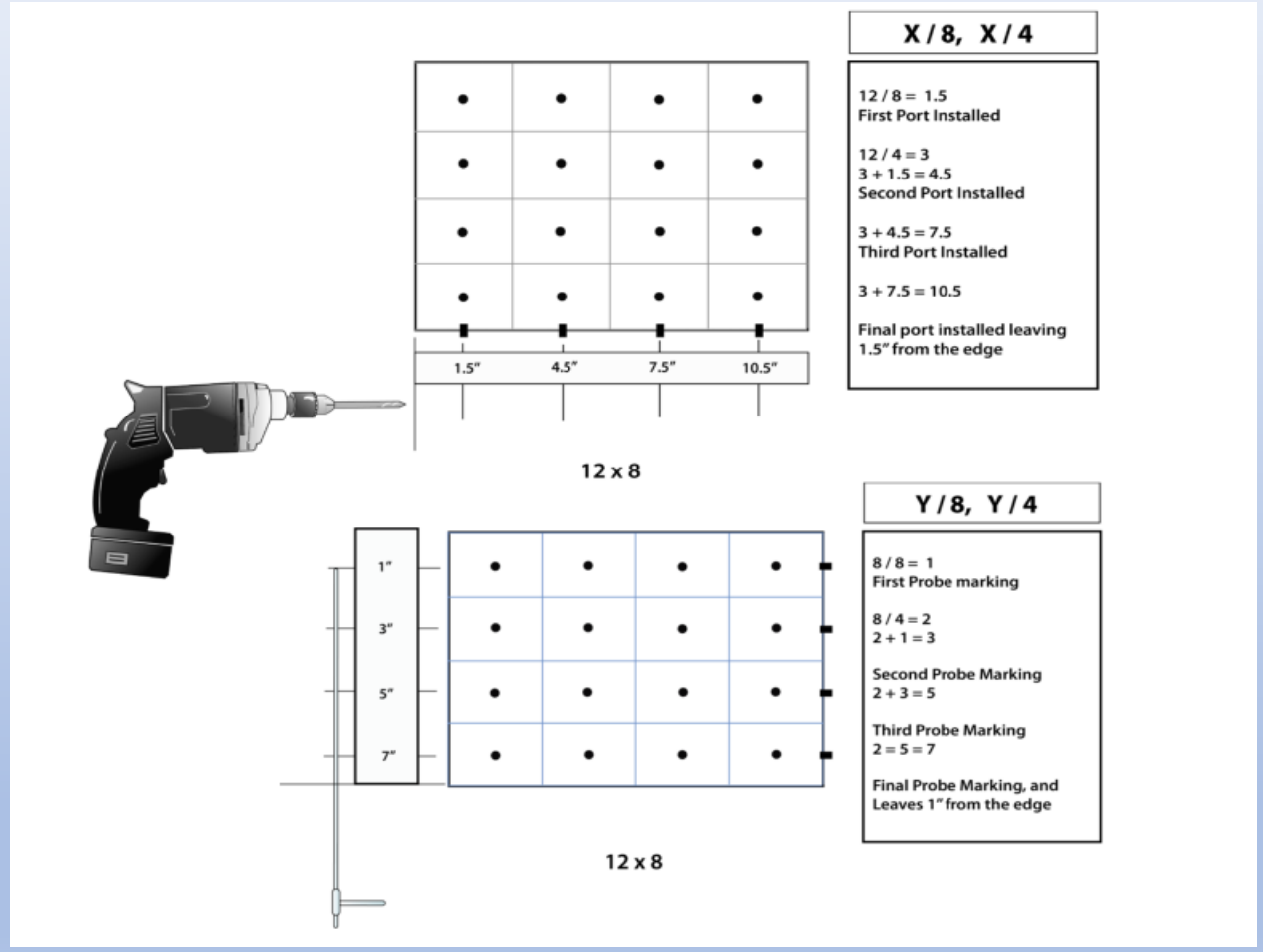
Duct Traverse

Equal Area Duct Traverse

1. Ports / markings at edges are half the distance of the rest.
2. 16 to 64 readings.
3. Ports / markings are to be no more than 6" apart.
4. Ducts larger than 48" will exceed the 6" distance to maintain 64 readings.

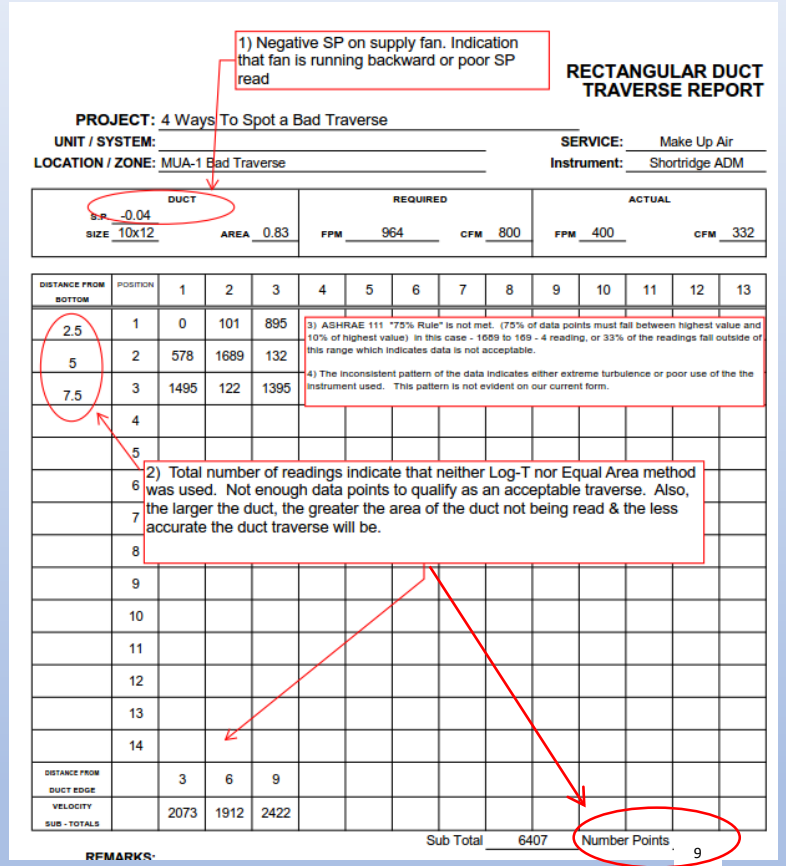


Duct Traverse – Equal Area



Duct Traverse

HOW TO SPOT A BAD DUCT TRAVERSE IN A TAB REPORT.



1) Negative SP on supply fan. Indication that fan is running backward or poor SP read

RECTANGULAR DUCT TRAVERSE REPORT

PROJECT: 4 Ways To Spot a Bad Traverse
UNIT / SYSTEM:
LOCATION / ZONE: MUA-1 Bad Traverse
SERVICE: Make Up Air
Instrument: Shortridge ADM

DUCT		REQUIRED		ACTUAL	
S.P. -0.04		FPM 964	CFM 800	FPM 400	CFM 332
SIZE 10x12	AREA 0.83				

DISTANCE FROM BOTTOM	POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13
2.5	1	0	101	895										
5	2	578	1689	132										
7.5	3	1495	122	1395										
	4													
	5													
	6													
	7													
	8													
	9													
	10													
	11													
	12													
	13													
	14													
DISTANCE FROM DUCT EDGE		3	6	9										
VELOCITY SUB - TOTALS		2073	1912	2422										

3) ASHRAE 111 "75% Rule" is not met. (75% of data points must fall between highest value and 10% of highest value) In this case - 1689 to 169 - 4 reading, or 33% of the readings fall outside of this range which indicates data is not acceptable.

4) The inconsistent pattern of the data indicates either extreme turbulence or poor use of the the instrument used. This pattern is not evident on our current form.

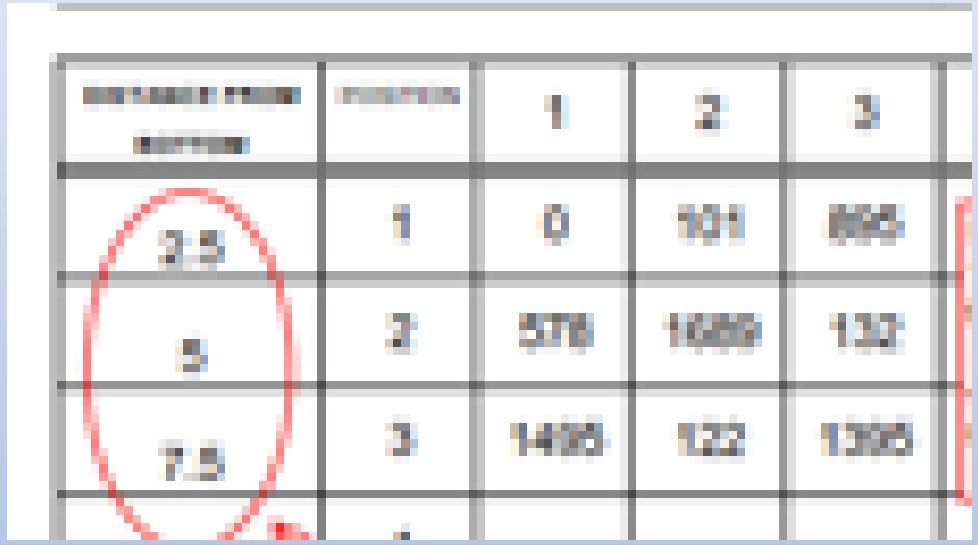
2) Total number of readings indicate that neither Log-T nor Equal Area method was used. Not enough data points to qualify as an acceptable traverse. Also, the larger the duct, the greater the area of the duct not being read & the less accurate the duct traverse will be.

Sub Total 6407 Number Points 9

REMARKS:

Duct Traverse

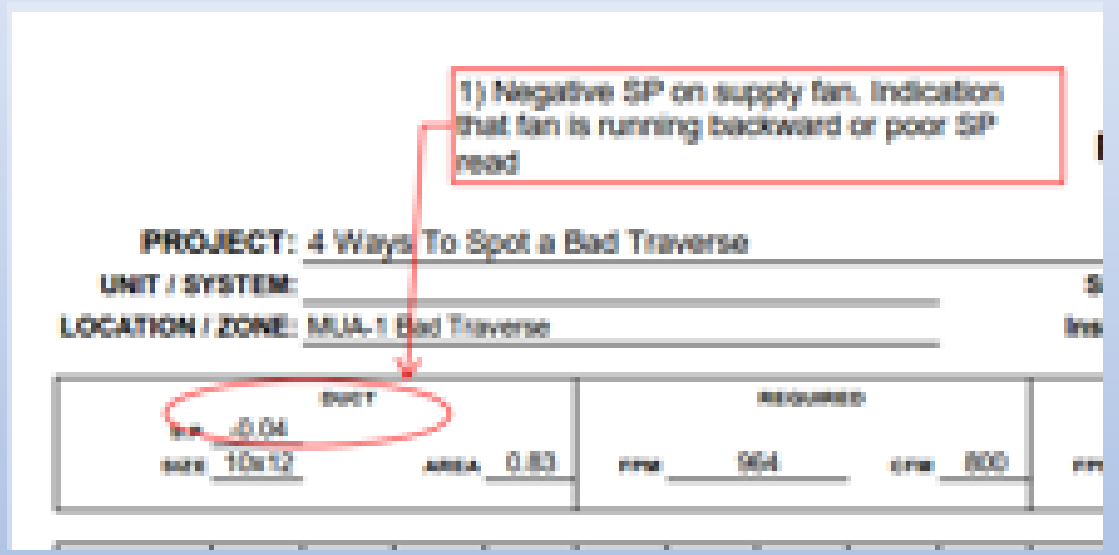
Acceptable Method
Was not used.



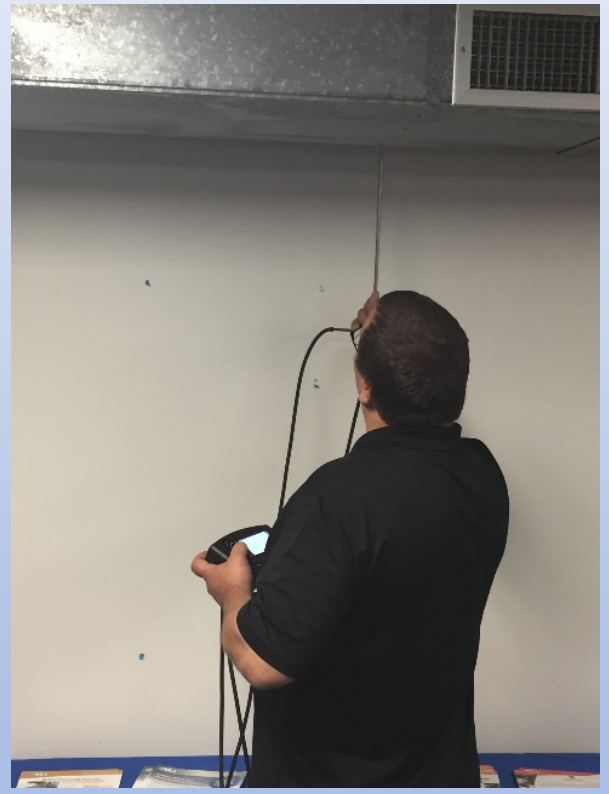
		1	2	3
2.5	1	0	101	866
5	2	576	1686	132
7.5	3	1486	122	1366

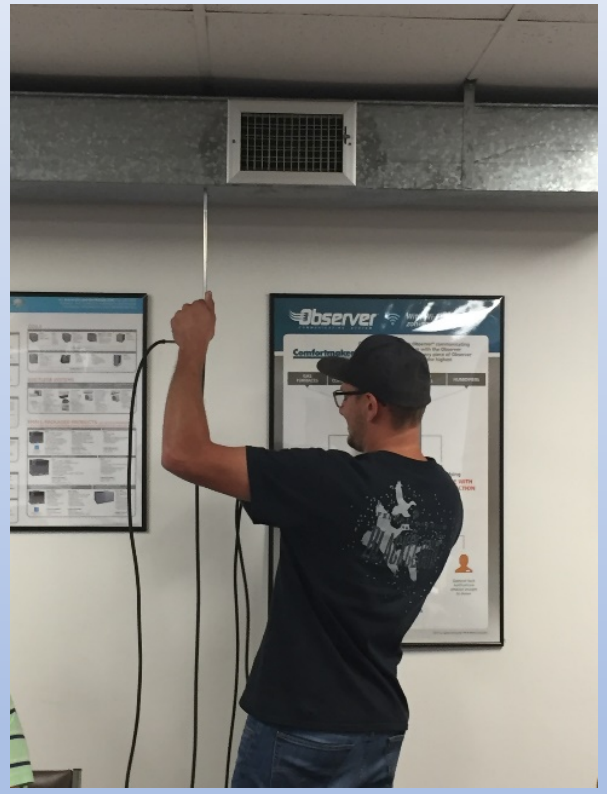
Duct Traverse

Negative Discharge Static Pressure on a Make Up Air Fan



Duct Traverse





Applying Fan Laws to Report Review

Situation

Off Brand Kitchen Hood with Non-Standard Grease Extractor Filters.

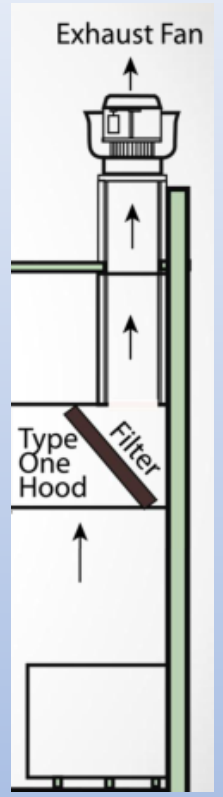
Unable to find manufacture's best practices, so TAB Professional used best method available.

4" opening, used a 4" Rotating Vane.

Detailed the procedure and submitted the following data.

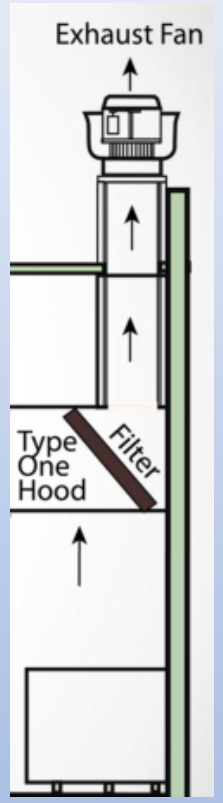
Initial TAB Readings

4.1 Amps
1025 Fan RPM
1.28 TESP



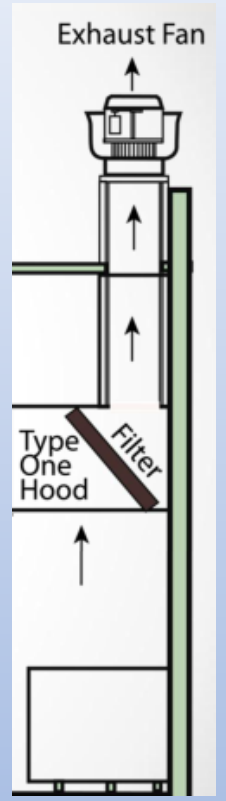
3050 CFM

4.3 Amps
1069 Fan RPM
1.35 TESP



3125 CFM

3.7 Amps
1001 Fan RPM
1.23 TESP



2980 CFM

MEP Response

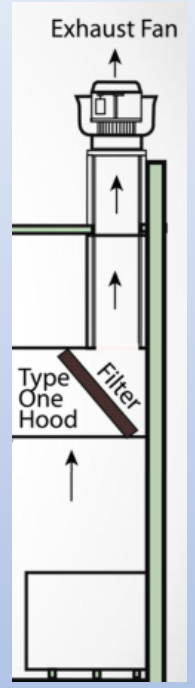
The design team reviewed the data but didn't like the methodology used.

The design team called to have the "Manufacturer's Rep" go verify the readings. (Remember, the new owner / distributor of the product line had already informed the TAB Professional that they weren't making it, just selling existing inventory and had no product experts on staff.)

The "Manufacturer's Rep" provided the data on the following page.

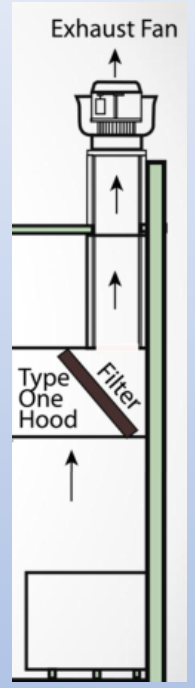
“Manufacturer’s” Readings

4.2 Amps
1030 Fan RPM
1.28 TESP



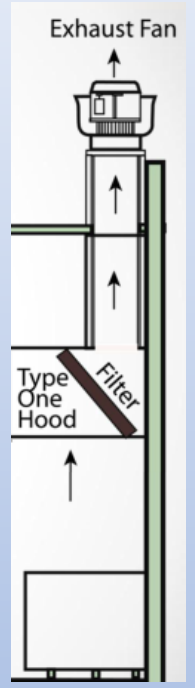
3890 CFM

4.4 Amps
1079 Fan RPM
1.31 TESP



2450 CFM

3.8 Amps
1011 Fan RPM
1.26 TESP

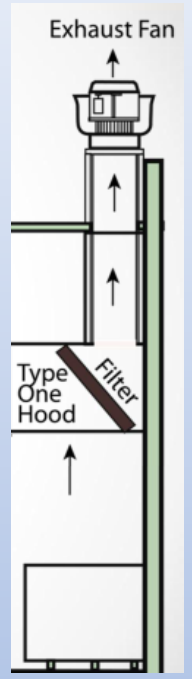


3425 CFM

Combined Readings

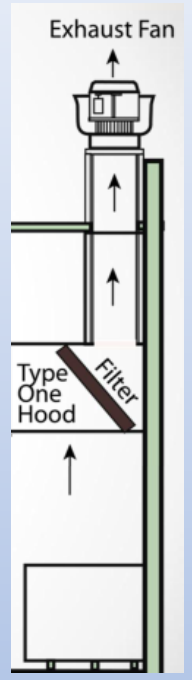
TAB Data

“Manufacturer” Data



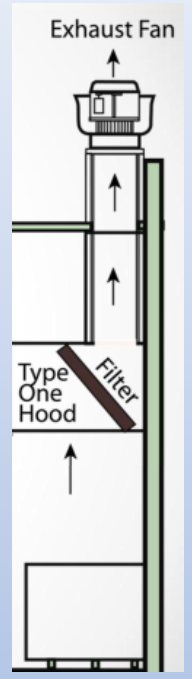
4.1 Amps
1025 Fan RPM
1.28 TESP

4.2 Amps
1030 Fan RPM
1.28 TESP



4.3Amps
1069 Fan RPM
1.35 TESP

4.2Amps
1079 Fan RPM
1.31 TESP



3.7 Amps
1001 Fan RPM
1.23 TESP

3.8 Amps
1011 Fan RPM
1.26 TESP

TAB Data

“Manufacturer” Data

3050 CFM

3890 CFM

3125 CFM

2450 CFM

2980 CFM

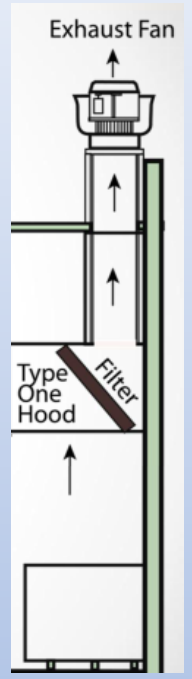
3125 CFM

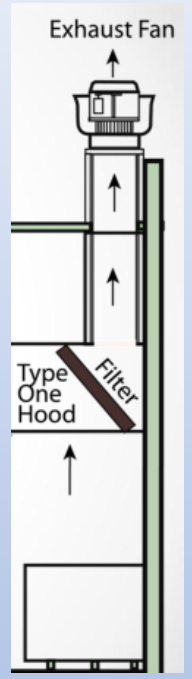
Combined Readings

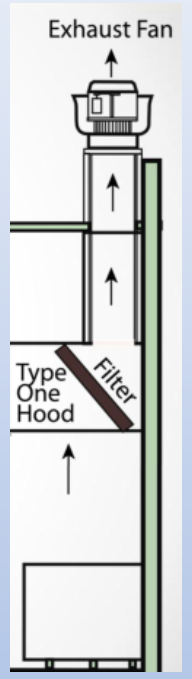
What Do our Fan Laws Tell Us
About this situation?

Combined Readings

TAB Data	4.1 Amps 1025 Fan RPM 1.28 TESP	4.3Amps 1069 Fan RPM 1.35 TESP	3.7 Amps 1001 Fan RPM 1.23 TESP
"Manufacturer" Data	4.2 Amps 1030 Fan RPM 1.28 TESP	4.2Amps 1079 Fan RPM 1.31 TESP	3.8 Amps 1011 Fan RPM 1.26 TESP





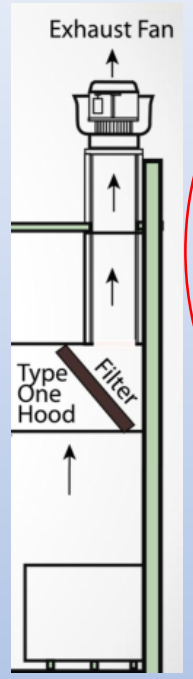


TAB Data	3050 CFM	3125 CFM	2980 CFM
"Manufacturer" Data	3890 CFM	2450 CFM	3125 CFM

Combined Readings

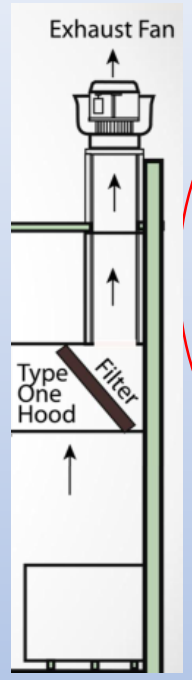
TAB Data

“Manufacturer” Data



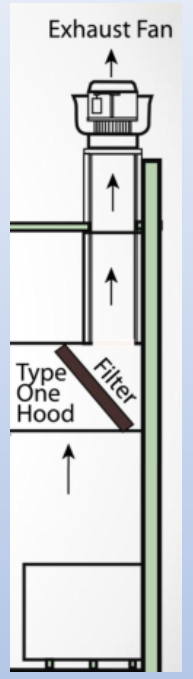
4.1 Amps
1025 Fan RPM
1.28 TESP

4.2 Amps
1030 Fan RPM
1.28 TESP



4.3Amps
1069 Fan RPM
1.35 TESP

4.2Amps
1079 Fan RPM
1.31 TESP



3.7 Amps
1001 Fan RPM
1.23 TESP

3.8 Amps
1011 Fan RPM
1.26 TESP

TAB Data

“Manufacturer” Data

3050 CFM

3890 CFM

3125 CFM

2450 CFM

2980 CFM

3125 CFM

Combined Readings

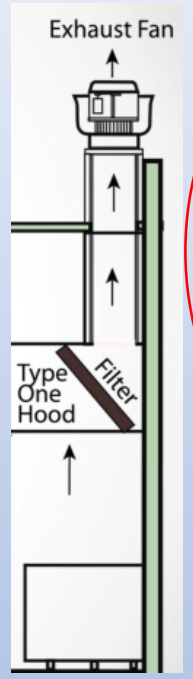
Our FAN LAWS tell us that the airflow is the same. This is fire-rated, 16 gauge duct that was already proven to have zero leakage. Two different technicians produced almost IDENTICAL amps, fan rpms and TESP.

Even if the TAB professional's readings are INNCORRECT, the "Manufacture's Readings" are **impossible**, as our FAN LAWS dictate that the air flow readings should be consistent. What do you think the "Manufacturer's Rep" may have done wrong?

Combined Readings

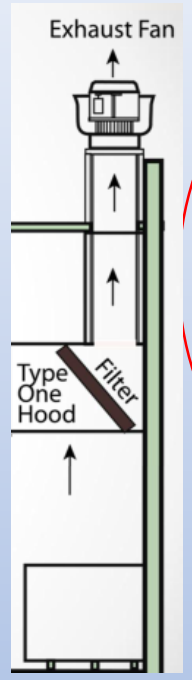
TAB Data

“Manufacturer” Data



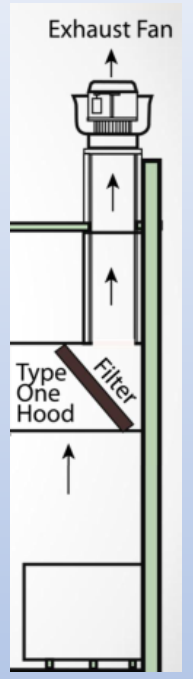
4.1 Amps
1025 Fan RPM
1.28 TESP

4.2 Amps
1030 Fan RPM
1.28 TESP



4.3Amps
1069 Fan RPM
1.35 TESP

4.2Amps
1079 Fan RPM
1.31 TESP



3.7 Amps
1001 Fan RPM
1.23 TESP

3.8 Amps
1011 Fan RPM
1.26 TESP

TAB Data

“Manufacturer” Data

3050 CFM

3890 CFM

3125 CFM

2450 CFM

2980 CFM

3125 CFM

Combined Readings

What Else Our Fan Laws Tell Us About this Situation

1. Whoever took the readings was not malicious. They were capable at reading AMPS, RPMs, and TESP. The fact they knew how to do this and matched the certified professional tells me they have done this before.

2. Whatever instrument they used, wasn't being used correctly. They were either twisting it or holding it a varying distances. It could also mean they used a cheap, uncalibrated instrument or a combination of both.

3. The Rep did not understand airflow or their fan laws. If they had, they would have recognized the fact that their airflow readings were not physically possible.

Engineer Meeting On Job Site To Confirm Data

We live and work in a +/- 10% world. You will NEVER obtain the exact same readings twice. We balance fluids. They shift and move.

However, if we do things properly, we should ALWAYS be able to repeat our recorded values within +/- 5%, 10%. If it exceeds that ratio, you or your technician didn't do it correctly, or you are not maintaining your instruments.

The examples below are within 2% for very specific reasons: The EXACT same technician, used the EXACT same instrument, in the exact same manner, 3 to 4 weeks after his initial readings. Had he sent a technician six months later, with the same model, but different instrument, and that technician repeated the exact process, he should still be within +/- 5 to 10%.

Regardless, the Engineer was satisfied with the readings and methodology.

TAB DATA: TAB Report	3050 CFM	3125 CFM	2980 CFM
TAB DATA: Field Verified	2995 CFM	3088 CFM	3025 CFM
Variance	1.8%	2%	1.5%

How to Read & Interpret a TAB Report

If you see a TAB report where all of the actual numbers are the same as the design numbers, physics and the laws of odds and probability tell us that these numbers are false!

The industry standard for TAB is +/- 10%, some specifications are +/- 5%.

TAB professionals would make HORRIBLE finish carpenters, because they deal in exact measurements.

Picture a bad Geico commercial where none of the trim on house lines up because a TAB professional used the +/- ten percent standard.

Flip side of the coin, professionals used to dealing with solids, wood, metal, etc. make horrible balancers, and that's how you know that another contractor generated that report.

In Closing

I would like to reiterate that all mistakes and questionable data in TAB reports does not mean the TAB contractor was simply making up numbers.

Human error is involved in every step, of every process.

If data is questionable, or simple wrong, please provide the contracted TAB Professional the opportunity to explain the data, correct the data, or support the data by meeting them in the field.

In the meantime, I encourage all professionals involved in this process, from the field technician, to the TAB Supervisor, to mechanical contractor to the design team to review the data more carefully, and work together to interrupt and understand the data.