

HVAC SYSTEMS TESTING, ADJUSTING & BALANCING



**SHEET METAL AND AIR CONDITIONING CONTRACTORS'
NATIONAL ASSOCIATION, INC.**

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THIRD EDITION — AUGUST, 2002



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NATIONAL ASSOCIATION, INC.**
4201 Lafayette Center Drive
Chantilly, VA 20151-1209

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**SHEET METAL AND AIR CONDITIONING CONTRACTORS'
NATIONAL ASSOCIATION, INC.**

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FOREWORD

This handbook has been extensively updated for 2002 from the original 1983 publication and includes all of the many changes that have taken place in the industry since the 1990's. We have added many new sections covering variable frequency drives (VFD), direct digital control (DDC) systems, lab hood exhaust balancing, and the latest changes in the balancing equipment and procedures.

All of the system testing, adjusting, and balancing fundamentals that make up the original text has been updated, and all helpful reference tables and charts in the Appendix have been extensively updated.

This handbook will provide any SMACNA contractor already familiar with mechanical system operation basics, with the information necessary to balance most heating, ventilation, and air conditioning (HVAC) systems. Chapters on both air and water side HVAC system adjusting and balancing are included, and the chapters on system controls have been totally rewritten to reflect the trend away from pneumatic controls and towards programmable micro-processor controls.

Most of today's HVAC systems are being designed with many more individually controlled temperature zones to improve occupant comfort, and variable speed fans and pumps are now commonplace to provide the exact amount of heating and cooling system capacity necessary to minimize energy usage. New occupant air ventilation codes are much more restrictive, at the same time building envelopes are becoming much tighter. The combination of constantly changing HVAC flows and increased demand for fresh and filtered ventilation air for all occupants is placing much more emphasis on proper HVAC system operation and balancing.

Any SMACNA contractor wanting to become part of this rapidly growing field is strongly encouraged to read other related SMACNA publications available, and take part in the many training courses offered to become a certified TAB Contractor. The International Training Institute provides a Certified Technician program for journeyman sheet metal workers who already have a basic understanding of system testing and balancing, and many of these courses are available in versions for home study.

The building construction industry is experiencing a major growth in demand for trained and experienced contractors who can balance today's much more complex HVAC systems.

SHEET METAL AND AIR CONDITIONING CONTRACTORS'
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CHAPTER 1

INTRODUCTION

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1.1 INTRODUCTION TO TAB WORK

1.1.1 New Buildings

Testing, adjusting and balancing (TAB) of all HVAC systems in a new building is needed to complete the installation and to make the systems perform as the designer intended.

Assuming that the system design and installation meets the comfort needs of the building occupants, good testing, adjusting and balancing of the HVAC system provides occupant comfort with minimum energy input. This is extremely important in this era of rising energy costs.

It is also important to make sure all factory equipment startup service has been completed before beginning any TAB work. Most specifications on new building construction usually require a factory representative to be present during the initial startup and adjustment of central boilers, chillers, large variable speed motor drives, and cooling towers. This initial equipment checkout is also usually required to activate the factory warranties and are not be part of the TAB contractor's responsibility. After this initial startup service has been completed, the TAB contractor should be informed that the systems are operating properly, that all safety interlocks and protective devices are functioning, and the systems are ready to be balanced.

The Testing, Adjusting, and Balancing or TAB phase of any building construction or renovation is intended to verify that all HVAC water and air flows and pressures meet the design intent and equipment manufacturer's operating requirements. It is rare to find an HVAC system of any size that will perform completely satisfactorily without the benefit of TAB work. This is why it is necessary for the designer to specify that TAB work be part of the HVAC system installation. A sample TAB specification can be found in the Appendix.

Commissioning services for any new building construction or renovation are intended to verify all HVAC, lighting, plumbing, electrical, and security systems operate properly and meet performance criteria.

Commissioning also includes the testing of all building controls for each mode of operation to verify all systems are being sequenced correctly with each other, and that all interlocks are functioning. The commissioning agent must document the results of each equipment test performed as it is completed.

It should be made clear that the Testing, Adjusting, and Balancing (TAB) services may be the only HVAC system testing services contracted on most projects, but TAB work is not intended to be "commissioning." Most commissioning services are completed by firms having technicians experienced with each of the individual building systems mentioned above.

These firms will usually subcontract the services of an independent TAB contractor to verify HVAC system balancing as part of their more inclusive commissioning contract.

1.1.2 Existing Buildings

There are few buildings in existence that have not experienced changes in internal loads and wall relocations since they were designed and built. These buildings should have their HVAC systems rebalanced to achieve maximum operating efficiency and comfort. Many buildings require rebalancing twice each year with the seasonal change from heating to cooling or the reverse.

Firms with a good TAB team have had a natural lead-in to service contracts and retrofit work because the TAB work identifies system operating deficiencies.

1.2 THE TAB TECHNICIAN/TEAM

1.2.1 The Technician

Throughout this publication, TAB technician will be used to designate the person in charge of the TAB work being done on the HVAC system discussed.

It will be apparent after reading this publication and observing TAB procedures on a complicated HVAC system that the TAB technician must be a highly skilled and knowledgeable individual. This person must know the fundamentals of airflow, hydronic flow, refrigeration and electricity and be familiar with all types of HVAC temperature control and refrigeration systems. They must also know how to take pressure, temperature and flow measurements; and be able to perform effective trouble-shooting. The days of balancing using a wet finger and cigarette smoke are long gone!

1.2.2 The Team

There are TAB jobs that can be done by one person. However, many HVAC systems need a TAB team to complete the TAB work in a reasonable time period. It is equally important that the other members of the TAB team be trained and become knowledgeable in

