HEATING COOLING AIR CONDITION RESEARCH and EDUCATION FOUNDATION

TESTING, ADJUSTING AND BALANCING (TAB) SPECIFICATIONS

Rev. 23.11.2022

1. PURPOSE	**1.1.** The purpose of this document is to define administrative terms and scope of Testing, Adjsting and Balancing (TAB) works.
2. WORK DESCRIPTION	**2.1.** The work includes Testing, Adjusting and Balancing (TAB) of HVAC and plumbing systems as provided in the attached Billing of Quantities (BoQ) per design conditions and technical requirements. Specified TAB work will be performed under the scope of the prime contractor or consultant firm by a independent third party agency. It is recommended to hire a Commissioning (Cx) service to ensure proper TAB works.
3. QUALIFICATION OF TAB FIRM	**3.1 TAB Works Qualifications** The TAB firm shall perform the work of testing, adjusting and balancing of air and hydronic systems in accordance with the procedures of ISKAV or internationally recognized institutions and the company shall be an experienced firm and shall have test instruments. It must be clearly determined and signed that the works are managed and directed by experts certified by ISKAV or internationally recognized institutions, and the responsibility is taken by these professionals. It is essential that TAB works are carried out by 3rd party companies with ISKAV or equivalent international certificates.
4. DOCUMENTS PREPARED BY TAB FIRM	**4.1 TAB Submittals ;** TAB submittal document shall include the below items. **4.1.1 TAB Work Schedule** Work schedule which is prepared by TAB firm to submit client and/or prime contractor. **4.1.2 TAB Procedures** The list of procedures, norms, and standards to be used during TAB executions **4.1.3 Instrument Calibration Certifications :** The calibration certificates of instruments shall be provided by TAB firm. Calibration Certificates shall conform to ISKAV or internationally recognized institutions requirements for accuracy and the ranges.

	4.1.4. Design Review Report: Design review report shall be provided to show if design is appropriate for proper TAB works. If there are any design deficiencies which will preclude TAB works, deficiencies shall be clearly stated in the report. **4.2 TAB Reports :** Final TAB reports shall be submitted per ISKAV or internationally recognized institutions standards for testing, adjusting and balancing**.**
5. DESIGNER'S RESPONSIBILITIES	**5.1.** It is designer's responsibility to provide the list of equipments and the systems to be tested, adjusted and balanced, the parameters and the measuring ranges (tolerances) per ISKAV or international standards in the construction documents prepared by designer (BoQ and specifications). **5.2** Designer enables to TAB firm to start the work at the early stage of the construction phase by construction documents (specifications, etc.) prepared by the designer. **5.3** Designer shall specify in the contruction documents (specifications) that building management system (BMS) or building automation system (BAS) shall be enabled before TAB work starts. **5.4** For a proper TAB work, all pressure and temperature test points and all other balancing equipments be provided in the design documents (drawings, specifications and/or BoQs)

6. CLIENT AND/OR PRIME CONTRACTOR'S RESPONSIBILITIES	**6.1.** Construction shall be completed in terms of TAB works. Client and/or prime contractor shall confirm that walls are sealed, doors, windows, ceilings, elevators, shafts, roofs, raised floors, etc. are completed and undesired infiltration/exfiltration is eliminated. Any uncompleted of those or other constructional works will cause inproper TAB works. **6.2.** Client and/or prime contractor shall confirm that building mechanical systems (HVAC and/or plumbing for TAB works) are completed. That confirmation includes but not limited to perform duct air leakage test and hydrostatic tests. All related mechanical and plumbing systems flushing are completed, all related system strainers are clean, the system is vented (so, the system is free of air), pre-controls (normally closed and normally open valves are in correct positions, etc.) are completed. It should be verified that air handling units, fans and all other equipments are clean, complete and operational. For additional requirements, check ISKAV or international recognized institutions check lists. **6.3.**Client or Prime Contractor shall verify that HVAC and plumbing electrical systems have proper power supply and are in operational. Client or prime contractor shall also confirm health and safety rules are met. **6.4.**Client or prime contractor shall confirm that all related HVAC and plumbing equipments or systems start-up operations are performed by authorized services. Completed start-up documents shall be submitted to TAB firm. **6.5.** Client or prime contractor shall verify that building automation system is completed and operational. Building automation systems should be checked before TAB works. **6.6.** Client or prime contractor shall coordinate building automations system sub-contractor to assist TAB firm. **6.7.** Client or prime contractor shall coordinate mechanical and electrical sub-contractors to provide sufficient numbers of staff to support TAB works. **6.8** Client or prime contractor should arrange a meeting to introduce TAB firm and TAB works for construction staff. All permissions should be taken and provide required documentation for TAB works. **6.9.** Client or prime contractor shall provide IFC (issued for construction) and as-built drawings, latest specifications to TAB firm. All those

	documents shall include any revisions or change orders. **6.10.** Client or prime contractor shall provide the drawings which show h holes, covers, probs, etc. for TAB purposes. **6.11.** Client or prime contractor shall provide approved material (or equipment) submittals associated with TAB works. **6.12.** Client or prime contractor shall provide delivery record that shows marking and tagging is completed. **6.13.** Client or prime contractor shall provide equipment schedules, control diagrams, sequence of operations and all control set points of building automation system. **6.14** Before TAB works client or prime contractor shall check and verify the following : • Belt tension • Proper lubrication for rotating or sliding parts of equipments • Coils are clean • Dampers, control and balancing valves are operational
7. RESPONSIBILITIES OF 3 RD PARTY TAB FIRM	**7.1** The TAB firm must be certified by ISKAV or international institutes, and the firm must be an independent third party. **7.2** A certified supervisor will be assigned to the related project by the TAB firm. **7.3** TAB work shall be performed in accordance with most recent and applicable procedures published by ISKAV or international institutions. **7.4** The TAB design review report shall be submitted before the TAB works starts. **7.5** TAB works shall be performed as per specifications and the TAB works scope. **7.6** The submitted final TAB report shall include the final air and water flow rates. **7.7** The TAB work is part of the Commissioning (Cx) process.
8. MESUREMENT AND VERIFICATION WORKS FOR HEATING, VENTILATION AND	**8.1** Methods to be followed for determining and reporting the compliance of air conditioning ventilation systems and components with design conditions and technical definitions in accordance with ISKAV, ISO, EN,

AIR CONDITIONING SYSTEMS	ASHRAE norms, directives and annexes is provided as below : **8.1.1.** Determination and recording of the mechanical systems used in the building. **8.1.2.** Fresh air, supply, return and exhaust air flow rate measurements. **8.1.3.** Reporting performance of fans, pumps, filters, dampers and air handling units, ventilation reclaim units, heat exchangers thermal, mechanical and/or electrical performance **8.1.4.** Measurements of flow, temperature and humidity shall be made in accordance with guidelines **8.1.5.** Verification and reporting of inlet and outlet areas, velocity and airflow rates of natural ventilation systems
TAB Report includes record of client information, design conditions, results of measurements and deficiencies.	
9. TAD YAPIM YÖNTEMİ **TAB METHODOLOGY**	**9.1 VERIFICATION** **9.1.1** Verifying balancing valves sizes, test ports, measuring devices, flow-control devices and determining that the volume dampers are provided as required for TAB works. Verifying balancing devices are in the given quantity and in the correct zones and determining that they are accessible and in a good condition to balance effectively. **9.1.2** Reviewing approved mechanical design drawings and TAB-related equipment submittals. **9.1.3** Inspection of mechanical systems and equipment installations and verification of installation of flow-regulation devices (such as test ports, gauge inlets, flow-control devices, balancing valves, volume dampers). In addition, determining that the installed devices are accessible and suitable for adjustment and balancing of systems and equipments. **9.1.4.** Determining the places where adjustment and balancing can not be done in the system. **9.1.5.** Reporting the deficiencies found in the system before and during the TAB process. Reporting the difference of measured values from reference values. **9.2 GENERAL PROCEDURES FOR TESTING AND**

BALANCING

9.2.1. Implementations of all balance and test procedures separetaly in each system according to TAB procedures of ISKAV or internationally recognized institutions, measurements and tests according to relevant norms.

9.2.2. Marking the settings of equipments and balancing devices (including damper-control positions, valve position indicators, fan speed controls and similar controls and devices) with a colored pencil or a suitable pen to show their final settings in case of later intervention

9.3 PROCEDURES FOR TESTING AND BALANCING OF EXISTING SYSTEMS

9.3.1. Application of TAD to existing systems and testing, adjustment, and balancing procedure standards for mechanical installation systems of ISKAV or internationally recognized institutions in contract documents, to the extent permitted.

9.4 ACCEPTANCE CRITERIA

The balancing of the system according to the applicable standards is foreseen according to the following conditions :

9.4.1. In case there is no other factor that will change the measurement conditions; the measured air and hydronic flow values are within ± 10% of the design values (this limit can be changed at the contract stage by agreement with the client/. Deficiencies and deviations will be noted in the TAB report.

9.4.2. At least one path shall be provided with the dampers fully open between the fan and the return/extract air or supply air terminals (diffusers, grille, etc.). In addition, if a system has branch volume dampers; each adjusted branch shall have at least one fully open path downstream of the damper.

9.4.3. At least one line with a fully open balancing valve from the pump to the system shall be provided. Also, if a system includes branch balancing valves, at least one open path downstream of each regulated branch balancing valve shall be provided.

	9.5 REPORTING Deficiencies and obstacles shall be reported daily, weekly and monthly to Client or Prime contractor. These deficiencies and obstacles shall be eliminated by Client or Prime Contractor before final TAD adjustments are made. **9.6 FINAL REPORT** The final report shall be in accordance with the applicable standard procedures of ISKAV or internationally recognized institutions.