| ES-24.77 | HUDSON PRODUCTS CORPORATION<br>*Fan Engineering Standards*<br><br>**Field Service: Procedure for In-Field Balancing of Tuf-Lite, Tuf-Lite II, and Tuf-Lite III Fan Assemblies**<br><br>***For General Release*** | **Page 1 of 6** |
|---|---|---|

The following procedure is intended for use by Customer fan service personnel in field balancing of Hudson fan assemblies and is based on Hudson's standard Field Service procedure WI-003.

1. PURPOSE

1.1 To provide standard directions and instructions to balance Hudson Tuf- Lite, Tuf-Lite II, and Tuf-Lite III Fan assemblies in the field.

2. ASSIGNMENT OF RESPONSIBILITY

2.1 Field Service Representative

3. REFERENCE DOCUMENTS

3.1 API 661

4. REQUIRED SKILLS/TRAINING:

4.1 Experience in plant and equipment operating procedures
4.2 Product knowledge
4.3 Safety awareness training
4.4 Vibration and Machinery Balance training

5. PROCEDURE DESCRIPTION

5.1 After arrival at plant contact assigned plant personnel to your job and sign in at unit control room.
5.2 Lock -out Tag-out
5.2.1 Complete no operation tag
5.2.2 Disconnect all energy sources to fan
5.2.3 Install lock and tag at each energy source.
5.2.4 Operate local start/stop switch to be sure all power is off.

| REVISION | 0 | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | 12-22-04 | | | | | | |
| INITIALS | LRS | | | | | | |

5.3 Access to Fans

5.3.1 Lower section of fan guard to gain access to fan area
5.3.2 Use step ladder to climb from walkway into fan plenum
5.3.3 If working off ladder above 6 ft., use safety harness

5.4 Attachment of ANALYZER to fan.

5.4.1 Attach magnetic transducer and cable to gear box or machinery mount.
5.4.2 Attach reflective tape to fan shaft in line with a fan blade.
5.4.3 Attach Photo-cell and cable with magnetic base to pick-up shaft RPM of reflective tape.
5.4.4 Extend cables to outside of fan area.
5.4.5 Attach cables to ANALYZER Vibration analyzer.

5.5 Fan Balance

5.5.1 Remove locks and tags.
5.5.2 Energize fan motor and start fan.
5.5.3 Using ANALYZER proceed to fan balance program.
5.5.4 Take initial reading of vibration amplitude, phase angle and speed and FFTof before balance amplitude.
5.5.5 Stop fan, de-energize motor and attach lock and tag.
5.5.6 Attach trial weight to one of the fan blades approximately 6" from tip of blade on trailing edge (see Figure I) with Allen wrench.
5.5.7 Enter into ANALYZER how much weight and location in degrees of trial weight.
5.5.8 Remove lock and tag.
5.5.9 Energize fan motor and start fan.
5.5.10 Take new readings of vibration amplitude, phase angle and speed .
5.5.11 Stop fan and de-energize motor.
5.5.12 Attach lock and tag.

5.5.13 ANALYZER analyzer will now read where to add permanent weights and at what location in degrees.

5.5.14 If a fan blade is at the degree location then drill a 1/8" hole into center of fan blade (see Figure I) approximately 6" from tip of blade and attach measured lead weight to blade using a monel rivet and hydraulic pop riveter.

5.5.15 If a fan blade is not at the degree location then it will be necessary to select split weights on ANALYZER program and enter number of blades, amount of weight and degree which the ANALYZER will then read two new locations of weights and amounts at degrees where blades are located. Attach to blades as in above paragraph.

5.5.16 Remove trial weight.

5.5.17 Remove lock and tag.

5.5.18 Energize motor and start fan.

5.5.19 Take new readings of vibration amplitude, phase angle and fan speed. If vibration amplitude at fan speed is below 6 mils ( API 661) then balancing is complete. Take FFT of after balance vibration amplitude.

5.5.20 If vibration amplitude is higher than 6 mils it will be necessary to select trim balance on the ANALYZER, which will then read new readings of weight to be added and degree of location .

5.5.21 Repeat steps 5.5.11 through 5.5.15

5.5.22 Take new readings of amplitude ,phase and speed.

5.5.23 Balancing complete.

5.5.24 Stop fan, attach lock and tag and remove equipment and cables from fan area.

5.5.25 Remove lock and tag.

5.5.26 Report job completion to contact.

5.5.27 Sign out of unit control room.

6 INSTRUMENTATION and TOOLS

6.1 Analyzer, transducer, photo cell, and cables.

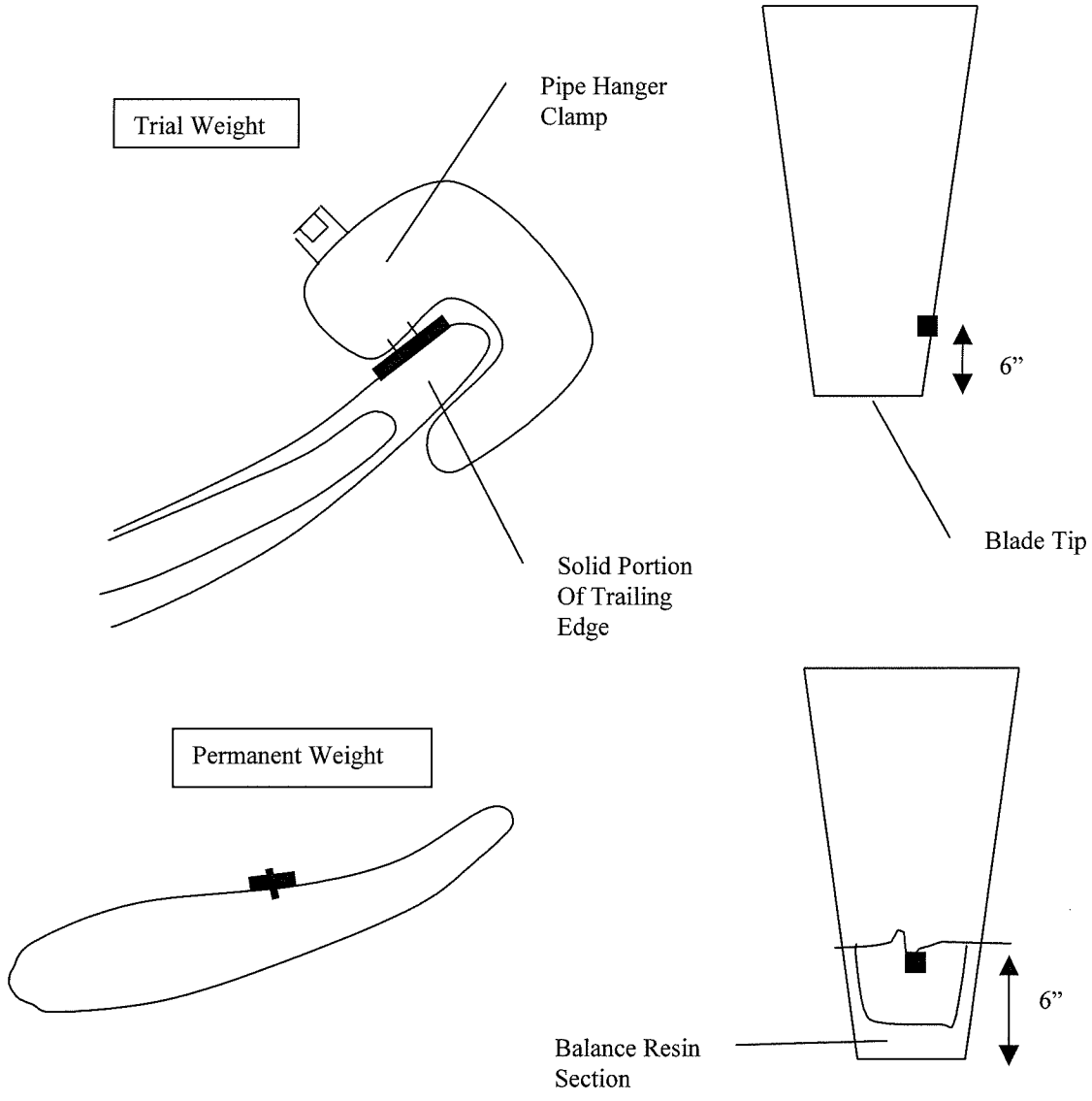
6.2 Allen wrenches

6.3 Hydraulic pop riveter

6.4 Monel pop rivets

6.5 Drill and drill bits
6.6 Lead weights
6.7 Weight scale

## Figure I - Balance Weight Locations



| REV. | DESCRIPTION OF REVISION | DATE | APPROVED |
|---|---|---|---|
| 0 | Initial release | 12/22/04 | LRS |
| | | | |
| | | | |
| | | | |
| | | | |