Exercise for Module - 2

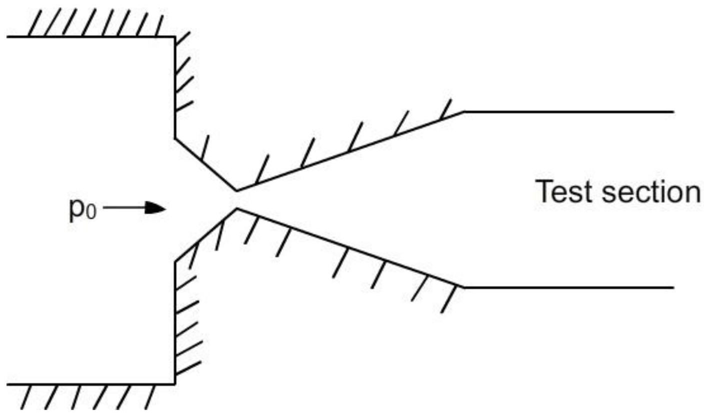
Answer the following

1. Compare and contrast pressure storage and indraft wind tunnels
2. Why are air storage vessels of supersonic wind tunnels stacked with empty metallic cans?
3. How justified are the stagnation pressure measurements being done in the settling chamber of the supersonic wind tunnels?
4. What decides the exit Mach number of a c-d nozzle?
5. What is understood by the term 'choking' in c-d nozzles?
6. How to decide the exit Mach number of a c-d nozzle before it is choked?
7. Is there any change in the flow through the c-d nozzle if the stagnation pressure is increased after the nozzle is choked?
8. Define the three critical pressure ratios of the c-d nozzle.
9. Explain the flow in the c-d nozzle of the supersonic wind tunnel between the 1^{st} and 2^{nd} critical pressure ratios.
10. Justify the provision of a diffuser for a blow down wind tunnel.
11. Why the diffuser of a supersonic wind tunnel converging-diverging?
12. How to arrive at the dimensions of the second throat diffuser vis-a vis the nozzle dimensions.
13. Derive the expression for the power required for the operation of a supersonic wind tunnel in terms of the operating pressure ratio.
14. Differentiate between the 'starting' and 'operating' pressure ratios of the supersonic wind tunnel provided with a second throat diffuser.
15. What factors decide the condensation in supersonic wind tunnels?
16. How can condensation be avoided/reduced in supersonic wind tunnels?
17. What is meant by liquefaction in supersonic wind tunnels?

Work out the following numerical problems

Problem 1
Part I

In a supersonic wind tunnel of the following configuration, it is desired to simulate a flow



of Mach number ,M = 3.0, p = 0.680bar in a cross section of 30cm^2 by taking compressor supply from 1bar and 30^{0}C.Determine the resultant test section temperature and the power required to operate the wind tunnel.

Part 2

For the wind tunnel given in Part I, in order to convert it to a continuous flow facility, a diffuser is provided so proportional that it will barely swallow the starting shock. For identical flow conditions as in Part I, find the size of the nozzle and diffuser throats and the power required to (i) start and (ii) operate the wind tunnel.

Problem 2

A two dimensional double wedge airfoil of semi wedge angle 8.0^0 is placed at zero angle of attack in a Mach 3.0 supersonic wind tunnel. What should be the minimum height of the wind tunnel test section in terms of the chord so that the reflections of the oblique shock formed at the leading edge of the model does not disturb the model.

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