THE EFFECT OF DEGREE OF FUEL VAPORIZATION UPON EMISSIONS FOR A PREMIXED - PREVAPORIZED COMBUSTION SYSTEM

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The report presents test results from a study which was conducted to assess the impact of the degree of fuel vaporization upon emissions from a flametube combustor burning premixed, "partially" vaporized fuel-air mixtures. Tests were conducted at an inlet air pressure of 3×10^5 pascals, inlet air temperatures of 600K and 700K, a reference velocity of 35 meters per second and equivalence ratios of .6 and .72 using Jet A fuel.

The tests reported herein were conducted in a closed duct test facility as shown in figure 1. Incoming air to the test section was preheated to temperatures from 600K to 700K by a non-vitiating preheater. Jet A fuel was injected into this airstream through two different fuel injectors (figure 2-3) manifolded together and mounted in series upstream of a watercooled perforated plate flameholder (figure 4). The fuel-air mixture burned in a watercooled combustor section. Samples of the fuel-air mixture upstream of the flameholder were obtained for analysis to determine the local degree of fuel vaporization and the fuel-air ratio. Samples of the combustion products were analyzed to determine gaseous emissions.

Results of effects of vaporization on NO_x emissions are presented in figure 5. The data displays an effect of vaporization on NO_x which differs with equivalence ratio. For an equivalence ratio of .6, decreasing the fuel vaporization leads to a nearly linear increase in NO_x. However, for equivalence ratios of .72, changes in vaporization had very little impact on NO_x emissions. Both slight increases and decreases were found.

Results on the effect of vaporization on CO emissions are shown in figure 6a and 6b for two different sample measurement distances from the flameholder. In figure 6a (48 cm. probe location) the data displays uniform decreases in the CO level with increasing vaporization. Data for 79 cm. probe position is shown in figure 6b and shows the combustion of CO to be essentially complete and the degree of vaporization having little effect upon the CO emissions.

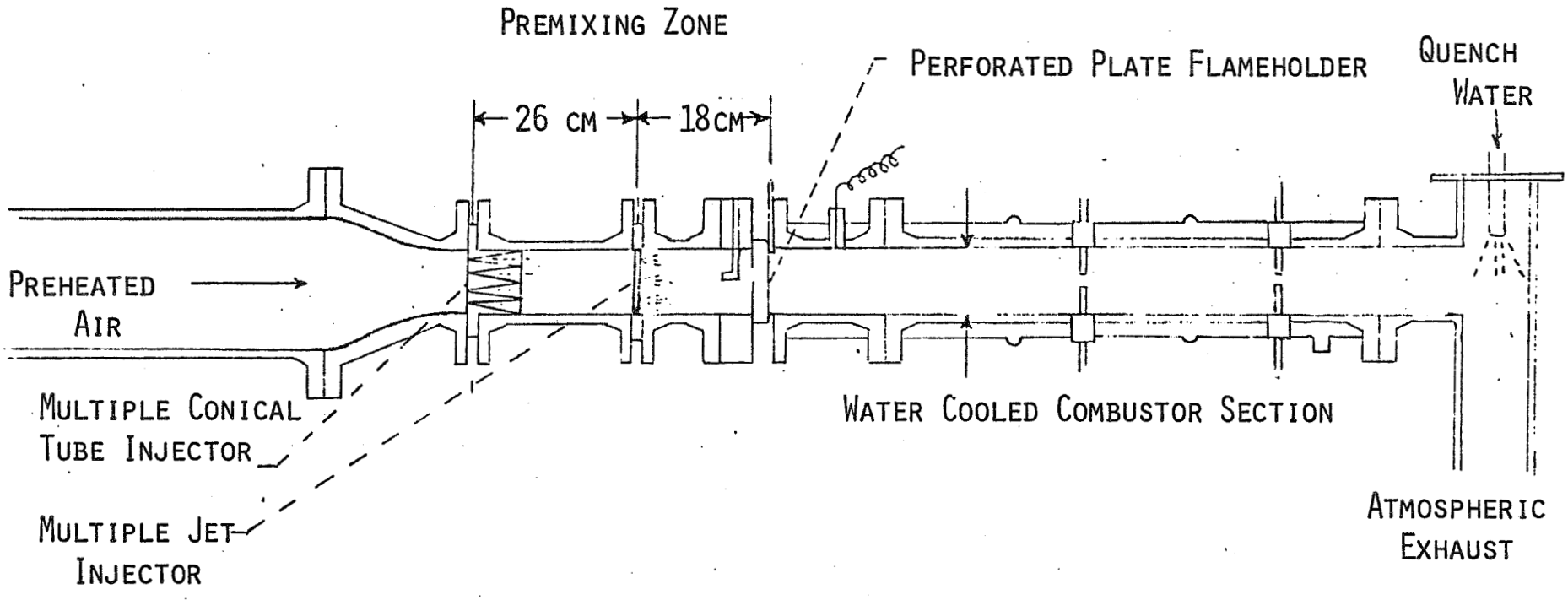

FIGURE 1. RIG SCHEMATIC (DIMENSIONS IN CM.)

MULTIPLE JET INJECTOR

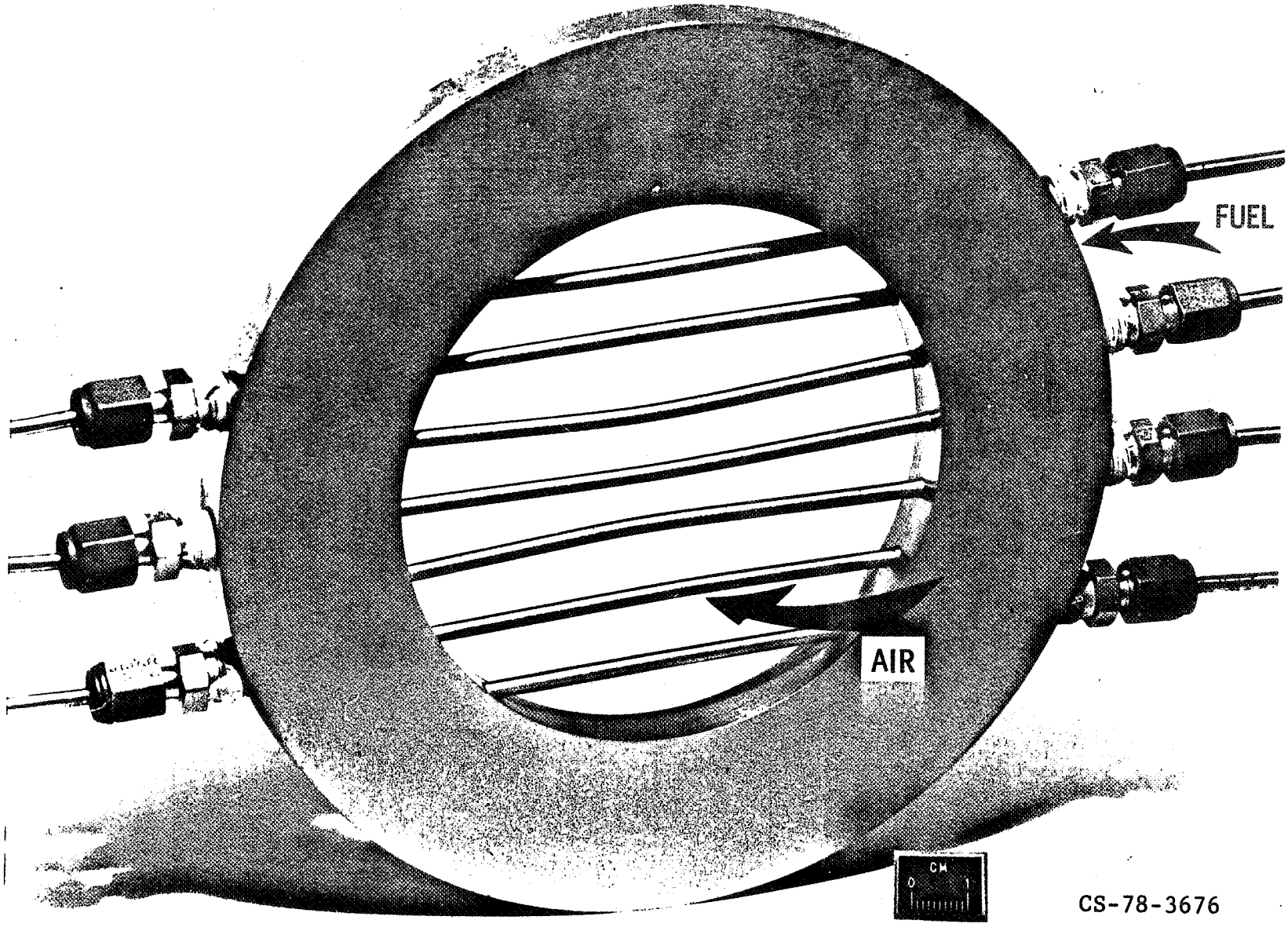

FIGURE 2 - MULTIPLE JET INJECTOR

MULTIPLE CONICAL TUBE INJECTOR

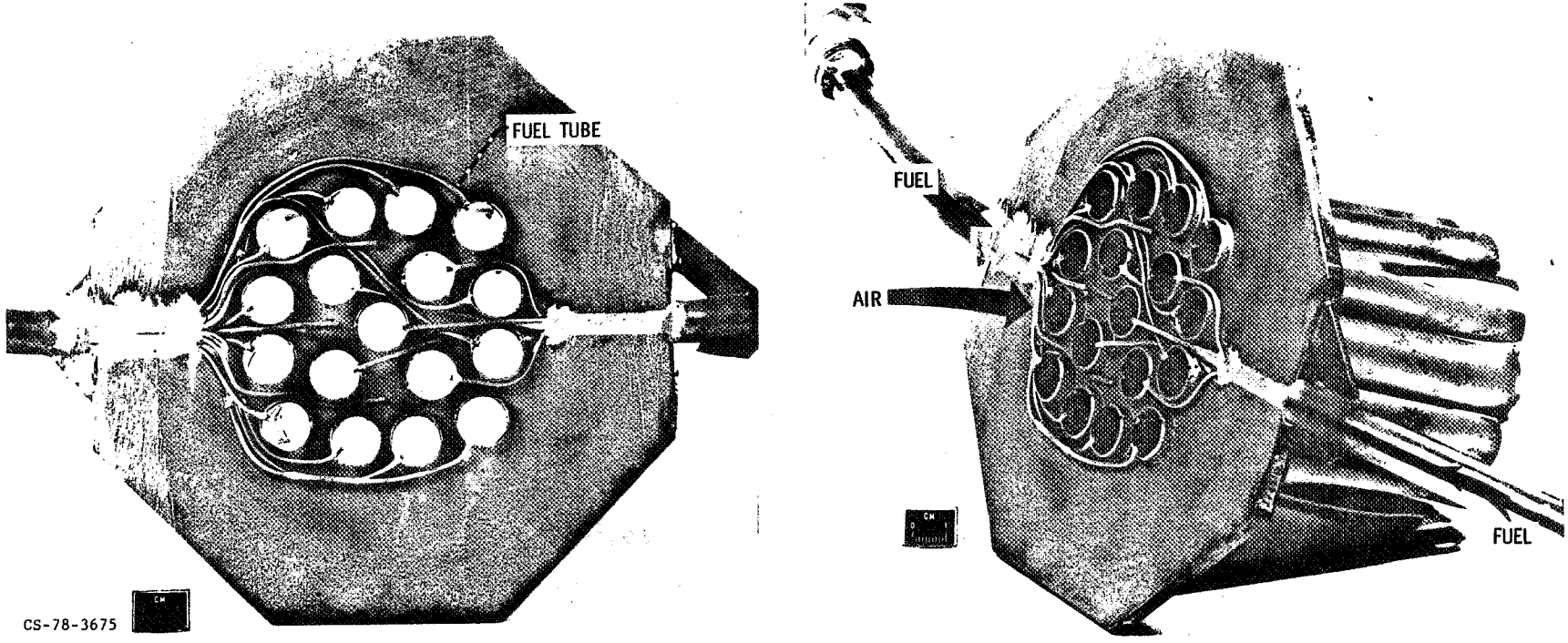

FIGURE 3 - MULTIPLE CONICAL TUBE INJECTOR