

Abstract Submitted  
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**Mean velocity measurements in a commercial steel pipe in the smooth to fully rough regime**<sup>1</sup> LEIF LANGELANDSVIK<sup>2</sup>, GARY KUNKEL<sup>3</sup>, ALEXANDER SMITS, Princeton University — Mean velocity profiles and friction factors were obtained in fully-developed flow in a commercial, extruded steel pipe. The surface roughness was as delivered by the supplier, with  $k_{rms} = 5\mu\text{m}$ . These are believed to be the first results ever obtained in commercial steel pipe under laboratory conditions. It was found that commercial steel pipe has a friction factor behavior that lies between the Colebrook type roughness, and sand-grain type roughness, in that the departure from the smooth pipe is rather sudden, with little or no evidence for the inflectional behavior characteristic of sand-grain roughness (and honed surface roughness). In addition, the equivalent sand-grain roughness of commercial steel pipe is closer to  $2.0k_{rms}$ , rather than the commonly accepted value of  $3.0k_{rms}$ . The velocity profiles in the rough regime show the expected departure below the logarithmic law, and they also follow Townsend's outer-layer similarity.

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