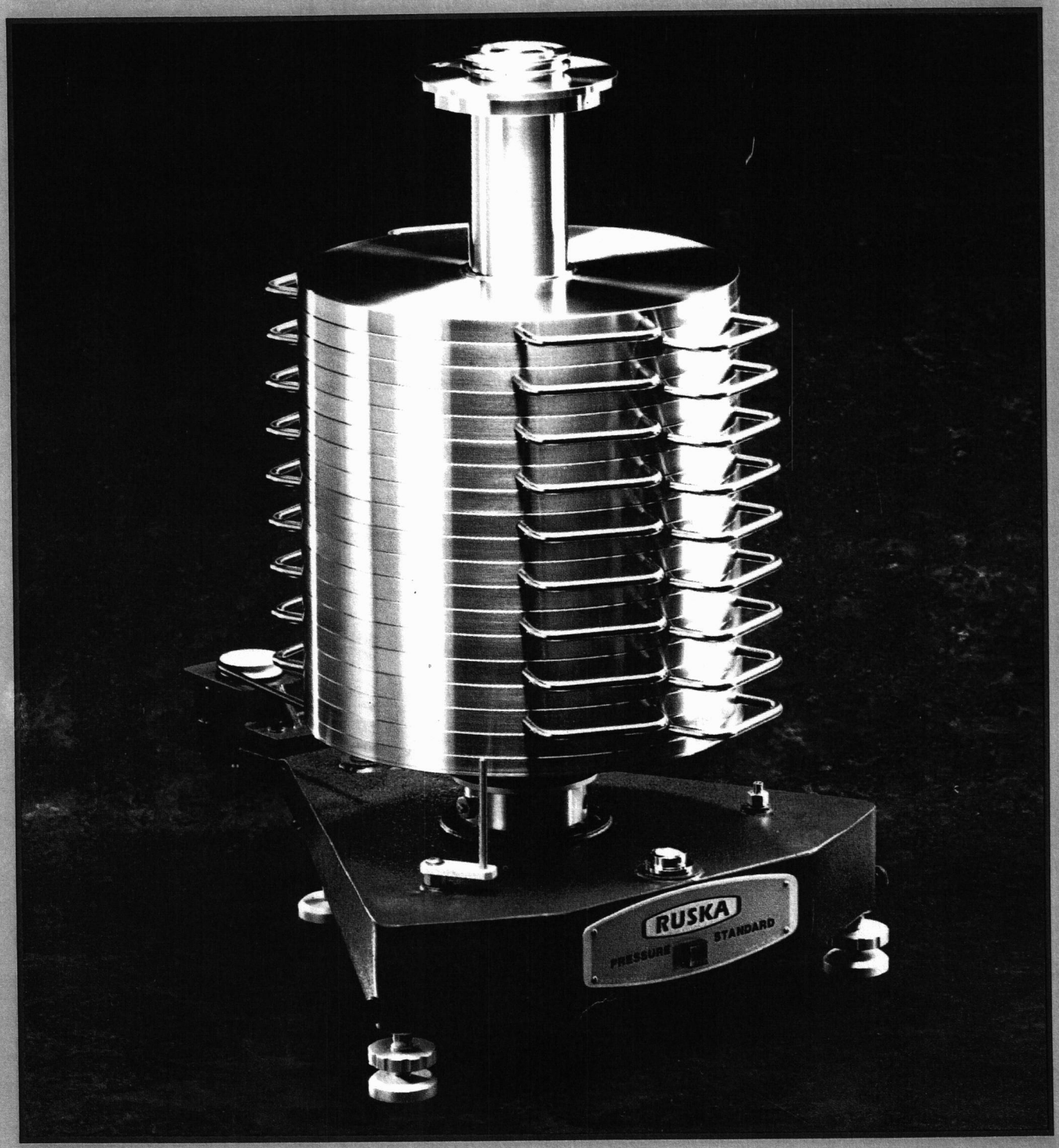
RUSKA

PRECISION PRESSURE STANDARDS

Series 2480



DATA SHEET 2480-84

HISTORY

Since 1944 when the first Ruska Model 2400 hydraulic dead weight gage was manufactured for the petroleum industry, a steady evolution and expansion of the Ruska line has ensued.

As the needs of the scientific community surfaced, Ruska responded, whether it meant extending the range as in the case of Model 2450, or increasing the precision as with the 2455.

The years of the early 1960's saw the model 2400 become the standard of United States Air Force metrology laboratories.

Shortly thereafter Ruska introduced the tilting piston gage for pneumatic pressures to 600 psi, and then in the seventies the Model 2470 to extend pneumatic measurements to 2500 psi without the use of oil to gas separators. The early eighties brought the pneumatic differential pressure system.

Now, the Series 2480 and 2481 have been developed to reinforce Ruska's commitment to progress with the customer in mind.

USING THE PAST TO BUILD FOR THE FUTURE

In forty years of producing the highest quality dead weight gages, Ruska has learned the means and significance of combining precision, durability, and facility into its instruments.

Each series was designed with a specific goal in mind. Each feature answered a need.

With today's emphasis on versatility, economy, and reliability, none at the expense of others, it follows that the lessons of the past should be combined into a concept for the future which will give the user the best of both worlds.

Ruska has studied the features of Models 2400, 2450, 2455, and 5000, taking the best from all of them and presenting them in a new design as Series 2480 and 2481.

The consolidation into the new series means the elimination of excessive inventories of parts. It means the stocking of fewer different parts. Consequently, cost savings and shorter delivery times are now available to the end user. Yet, there is no sacrifice in the traditional precision, quality, or durability of the product.

THE BUILDING BLOCK CONCEPT

Series 2480 and 2481 are designed to permit the user to choose components to fulfill his present needs, and to add, at a later date modifications which will expand his capabilities with little or no sacrifice of his initial investment.

Model 2480 in its simplest form uses one of three piston-cylinder assemblies and one weight set to achieve any of three ranges, 1000 psi FS, 5000 psi FS, or 10,000 psi FS, depending on which range P/C is chosen. By ordering one or two additional P/C assemblies, the other two ranges are achieved using the same weight set.

Now, by simply adding more platters to the weight set, the full span of any of the ranges is increased by as much as 50%!

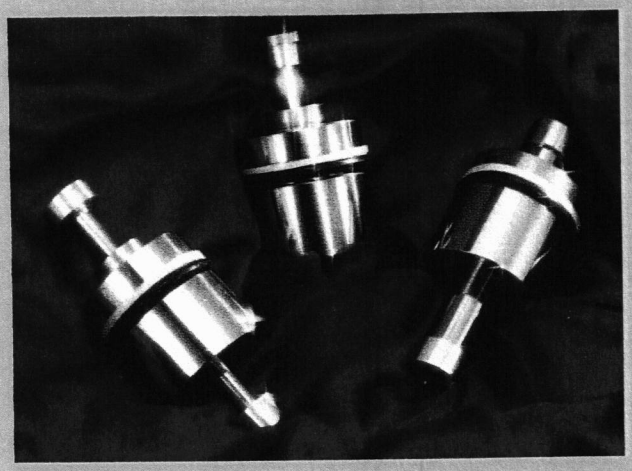
And that's not all!

In the past, the user was limited to the capacity of his system such that going to higher pressures usually meant a complete new system.

Today, that is no longer the case.

By adding a longer column assembly and new sleeve weight, the gage can now accept additional weights to provide the capability of many more full scale combinations, the highest being 40,000 psi. In order to maintain proper sensitiveness and sink rate, it may be necessary for Ruska to qualify your existing piston assembly for the higher pressure ranges.

PISTON-CYLINDER ASSEMBLIES



Series 2480/2481 dead weight pressure gages are offered with 3 basic sizes of pistons. Pistons and cylinders are of cemented tungsten carbide — an important material to the achievement of having maximum sensitiveness with minimum leakage.

SPECIFICATIONS:

PRECISION: 2 standard deviations, 14 ppm of measured pressure

MAX. SINK RATE: 0.04 inches per minute (1 mm per minute)*

THERMAL COEFFICIENT: 9.1×10^{-6} in²/in²/°C

	HI RANGE 1000 to 40000 psi (7 to 280 MPa)	MID RANGE 500 to 20000 psi (3.5 to 140 MPa)	LOW RANGE 100 to 4000 psi (0.7 to 28 MPa)
MAX. TARE PRESSURE:	60 psi (0.45 MPa)	31 psi (0.24 MPa)	8 psi (0.06 MPa)
NOMINAL AREA:	0.013 in.² (8.4×10^{-6} M²)	0.026 in² (1.68×10^{-5} M²)	0.13 in² (3.4×10^{-5} M²)
MAXIMUM ERROR BELOW MINIMUM OF PRESSURE RANGE:	0.1 psi (0.7 Kpa)	0.05 psi (0.35 Kpa)	0.01 psi (0.07 Kpa)

*While using highly-refined spindle oil of (SI) grade 22 viscosity.

WEIGHTS

All weights are completely machined from non-magnetic stainless steel. Each is marked with the serial number of the set and/or identified with a unique sub-number.

In addition to the proper number of large 12 kilogram platter weights, each set contains the following smaller weights.

NUMBER	QUANTITY	NOMINAL MASS
20	1	6 kg
21 & 22	2	2.4 kg
23	1	1.2 kg
24	1	0.6 kg
25 & 26	2	0.24 kg
27	1	0.12 kg

Each set is supplemented with a laboratory weight set (0.005 to 100 gms) to permit establishing any pressure within the sensitiveness and range of the instrument.

The values of mass are tabulated in the test report according to the system "Apparent Mass vs. Brass Standards". Values of weight are obtained by correcting the reported mass for the effects of local gravity and air buoyancy.

Platter weights are outfitted with convenient lifting handles which permit safe loading of the weights onto the platform without endangering the operator's hands or fingernails. Return to the fitted weight boxes is also facilitated by this design.

INSTRUMENT PLATFORM

Utility and ruggedness characterize this base assembly made up of a broad, stable casting, fully machined stainless steel column and drive sleeve assembly, leveling screws and vial, precision thermometer, and float position index.

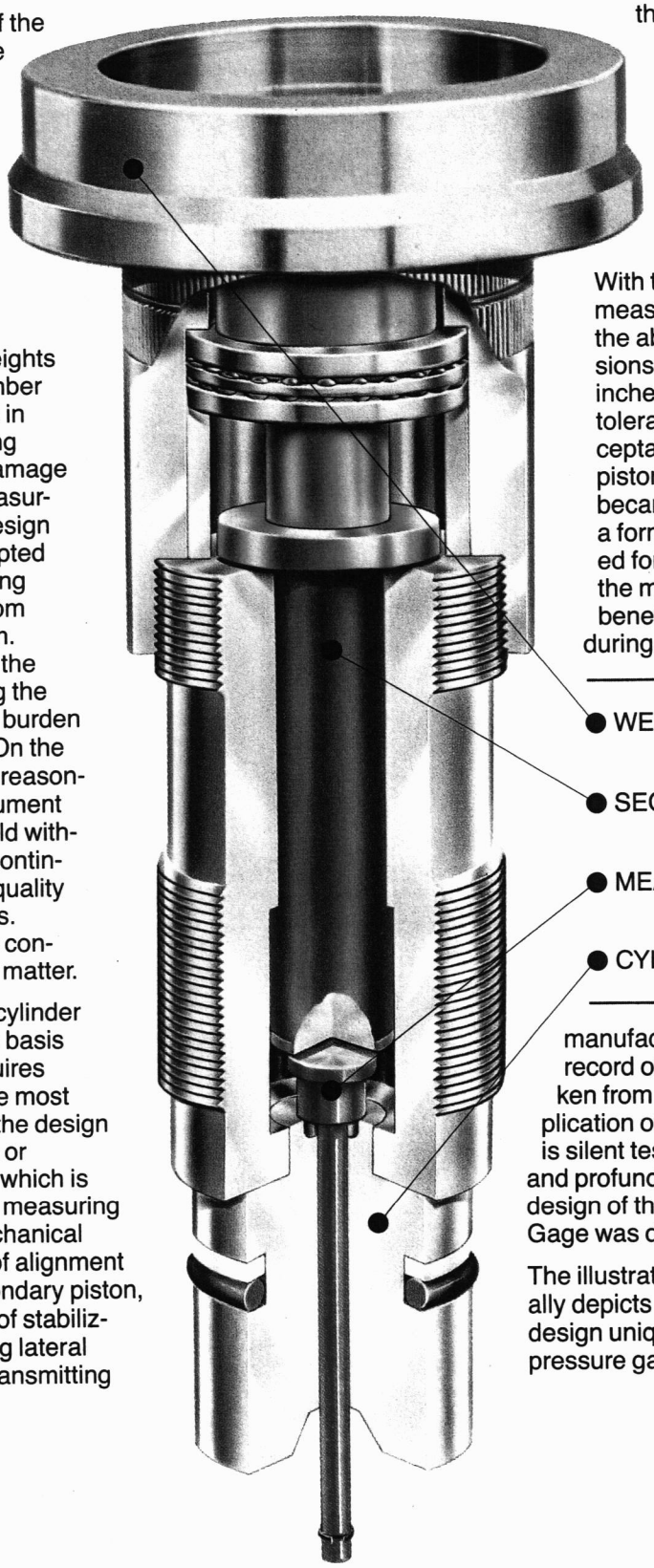
No magnets are employed which could contribute undesirable effects on the measurement process.

Easy conversion from Model 2480 to 2481 is achieved by replacing the shorter column and drive sleeve assemblies with the longer comparable parts.

PROTECTING THE HEART OF THE DEAD WEIGHT TESTER

Though the original design of the Ruska Piston Pressure Gage was directed toward a laboratory/production instrument of high quality, the possibility of accidental misuse by less-than-professional operators, performing routine tests, was recognized as a demand for a robust, shock-resistant mechanism. The continuous application of weights to the load-transmitting member would, sooner or later, result in an impact collision, producing stresses that could surely damage or break an unprotected measuring piston. A fundamental design criterion was therefore accepted as one in which the measuring piston was fully detached from the load-bearing mechanism. The piston would then have the single purpose of measuring the pressure without having the burden of also stabilizing the load. On the surface, this idea appeared reasonable and attractive; an instrument could be produced that would withstand the normal abuse of continous use without sacrificing quality in the measurement process. Successful execution of the concept, however, was another matter.

The manufacture of piston-cylinder assemblies on a production basis is no small endeavor; it requires the skills and patience of the most experienced mechanics. If the design calls for a secondary piston or spindle of adequate rigidity which is located coaxially above the measuring piston, the problems of mechanical excellence and perfection of alignment are compounded. The secondary piston, of course, has the function of stabilizing the weights and resisting lateral mechanical shocks while transmitting the load to the measuring piston. By absorbing the disturbances of the inevitable imperfect manipulations, it allows the workman to perform his duties in a convenient and speedy manner.



With the development of shop measuring equipment having the ability to indicate dimensions to within a few microinches, control of the very small tolerances necessary for acceptable performance of the piston and support mechanisms became a reality. The task was a formidable one and accounted for a substantial portion of the manufacturing costs. The benefits, however are legion; during 40 years of continuous manufacture there is not a single record of a piston having been broken from carelessness in the application of the weights. This record is silent testimony of the forethought and profundity under which the design of the Ruska Piston Pressure Gage was developed.

The illustration on this page graphically depicts the protected piston design unique to Ruska dead weight pressure gages.

ACCURACY

Ruska's Series 2480/2481 retains the traditional accuracy capability of attaining 0.01% of reading.

Verification of this claim is confirmed by intercomparisons with Ruska Laboratory Standards which retain traceability to the U.S. National Bureau of Standards through periodic calibrations at the Bureau.

The instrument constants are reported with the uncertainty of each, based on a simple error analysis of the calibration experiment, and representing the sum of the systematic errors and of two standard deviations of the random variability of the comparison to the standards.

The reported values of mass are traceable to the National Bureau of Standards. Errors of calibration do not exceed 10 ppm or 2×10^{-6} pounds (1.0×10^{-6} kg) whichever is greater.

To achieve the ultimate accuracy of the instrument it is necessary that it is operated in strict accordance with the operating procedure, applying correction factors properly, with knowledge of local gravity acting on the weights to within ± 0.001 cm/sec^2.

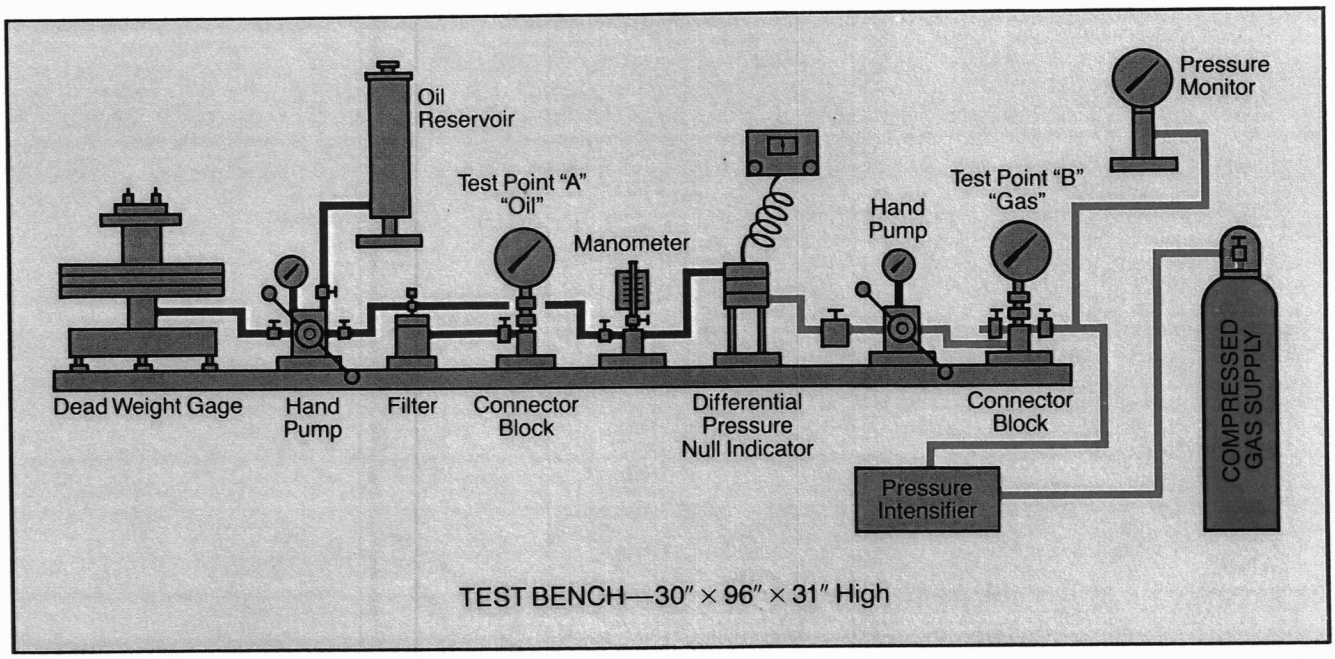
Because of the use of tungsten carbide pistons and cylinders, the average annual change in the piston area is usually less than 3 parts per million, making recertification no more frequent than 3½ or 4 year intervals.

SYSTEMS

Ruska continues to offer the industry the widest variety of pressure calibration systems based on Ruska dead weight testers throughout the total range of 40,000 psi.

Complete tables equipped with all necessary accessories provide convenience oriented work centers for oil, oil-to-gas, oil-to-water, or other mediums appropriate to the job at hand.

Consult Ruska for further information on these systems or others using Ruska primary type or secondary transfer standards in accordance with your specific needs.



SERIES 2480/2481		MODEL NUMBERS		
PRESSURE RANGE	**MAXIMUM TARE PRESSURE**	**PLATFORM 115V–50/60Hz**	**PISTON CYL. ASSY.**	**WEIGHT SET**
100 To 1000 psi 0.7 To 7 MPa	8 psi 0.06 MPa	**2480-700**	**2480-704**	**2480-710**
100 To 1500 psi 0.7 To 10 MPa	8 psi 0.06 MPa	**2480-700**	**2480-704**	**2480-720**
100 To 3000 psi 0.7 To 20 MPa	8 psi 0.06 MPa	**2481-700**	**2481-704**	**2481-710**
100 To 4000 psi 0.7 To 28 MPa	8 psi 0.06 MPa	**2481-700**	**2481-704**	**2481-720**
500 To 5000 psi 3.5 To 35 MPa	31 psi 0.24 MPa	**2480-700**	**2480-702**	**2480-710**
500 To 7500 psi 3.5 To 50 MPa	31 psi 0.24 MPa	**2480-700**	**2480-702**	**2480-720**
1000 To 10,000 psi 7 To 70 MPa	60 psi 0.45 MPa	**2480-700**	**2480-701**	**2480-710**
500 To 15,000 psi 3.5 To 100 MPa	31 psi 0.24 MPa	**2481-700**	**2481-702**	**2481-710**
1000 To 15,000 psi 7 To 100 MPa	60 psi 0.45 MPa	**2480-700**	**2480-701**	**2480-720**
500 To 20,000 psi 3.5 To 140 MPa	31 psi 0.24 MPa	**2481-700**	**2481-702**	**2481-720**
1000 To 30,000 psi 7 To 200 MPa	60 psi 0.45 MPa	**2481-700**	**2481-701**	**2481-710**
1000 To 40,000 psi 7 To 280 MPa	60 psi 0.24 MPa	**2481-700**	**2481-701**	**2481-720**

Additional Weight Platters, 12 Kg Ea.	**2481-710**–(Wt. number)
Extended Range Pressure Housing Assy.	**2481-100**
Extended Range Sleeve Weight	**2481-720-1**
Class "S" Milligram Weight Set	**93-201**

RUSKA

RUSKA INSTRUMENT CORPORATION

P.O. Box 742688, Houston, Texas 77274

Phone: 713-975-0547 TELEX 76-2404 CABLE RUSKACORP