BANDO NAC6.22852 Allegato 1 II Verbale

CONORSO BANDO N. NA/C6/22852 PROVA N.1

1) Ricerca delle perdite per camere in ultra vuoto
2) Sistemi per la lavorazione meccanica di metalli.
3) Caratteristiche di recipienti per liquidi criogenici.

-Testo in lingua inglese-

No single multitask measurement apparatus exists that is adequate for many different types of measurements over a wide temperature range. Once, I tried to design one—it turned into a "camel" (a camel has been defined as a "horse put together by a committee"). Measurement cryostats can range anywhere from a simple stainless-steel tube (or even a wooden stick) for dipping a sample in liquid helium, to complex systems with multiple vacuum jackets, internal variable temperature control, and radiation windows. In general, the simpler the cryostat for any given job, the better; however, always keep in mind that sometimes a little extra complexity makes a cryostat more flexible for a wider range of measurements.

BANDO NA.C6.22852 Allegato 2 Verbale II

CONORSO BANDO N. NA/C6/22852 PROVA N.2

1) Differenze tra perdite reali e virtuali in sistemi da ultra vuoto.
2) Saldatura e brasatura di materiali e leghe metalliche.
3) Perdite termiche a bassa temperature.

-Testo in lingua inglese-

The word cryogenics is defined as the study of low-temperature phenomena. However, the temperature level at which refrigeration in the conventional sense ends and cryogenics begins is somewhat arbitrary. The temperature separating cryogenics from conventional refrigeration that is suggested by the workers at the National Institute for Standards and Technology in Boulder, Colorado, is −150°C (123 K) or −238°F (222°R) (Scott 1958, p. 1). This selection is logical because the normal boiling points (NBPs) of fluids that are important in the cryogenic industry, including helium, hydrogen, nitrogen, oxygen, and air, all lie below −150°C. The fluids commonly used in domestic refrigerators, air conditioners, and freezers all boil at temperature above −150°C at atmospheric pressure. Because cryogenic systems operate at temperature levels that are far below ambient temperature, heat transfer is always an important concern. In some cases, such as cryogenic fluid storage vessels (i.e., Dewars), the engineer is concerned with reducing the heat transfer rate to a low value.

BANDO NAC6 22852 Allegato 3 II Verbale

CONORSO BANDO N. NA/C6/22852 PROVA N.3

1) Tecniche e strumenti per la produzione del vuoto pneumatico.
2) Strumentazione, misura e rilievo di precisione per parti meccaniche.
3) Misura della temperatura in ambienti criogenici.

-Testo in lingua inglese-

In some cryostats, the primary mode of heat transfer to the low-temperature region is thermal radiation. For example, the primary mode of heat transfer from space-based cryogenic systems is generally radiant heat transfer. In this chapter, the phenomena of thermal radiation heat transfer and some of the physical phenomena associated with radiant energy transfer that are encountered primarily at low temperatures will be examined. Radiation heat transfer is defined as the transfer of energy from one surface to another surface through electromagnetic energy emission from one surface, transmission of that energy through the intervening space, and absorption of the energy by another surface. The energy transport by radiation is associated with electromagnetic waves that travel (in a vacuum) at the speed of light, $c_0 = 2.99792 \times 108$ m/s (9.8357×108 ft/s). In a material other than a vacuum, the speed of electromagnetic waves is related to the index of refraction, n_r, as follows:

Bando NA.C6. 22852 Allegato 4 II Verbale

CONORSO BANDO N. NA/C6/22852 PROVA N.4

1) Analisi dei gas residui in sistemi da vuoto.
2) Rifinitura superficiale per componenti da vuoto.
3) Principi di funzionamento di un liquefattore per liquidi criogenici.

-Testo in lingua inglese-

Joule heating [the heat generated in a resistance R (ohms) carrying current I (amperes): Q (watts)=I^2R] seems trivial enough, but it is one of the most vexing problems for transport measurements. Joule heating can occur anywhere along the electrical current path—in the cryostat current leads, in the test-sample contacts, and in the sample itself. Unfortunately, unwanted Joule heating sources are often not recognized until after the apparatus has been built and tested. Joule heating in the sample and its contacts can be reduced by designing the cryostat to provide good sample cooling (described in Secs 7.3.1 and 7.4.1) and by making low-resistance sample contacts (described in Chapter 8). When this is not possible, a less satisfactory approach is to use pulsed-current techniques (Sec. 9.2.1), where heating in the sample and contacts is kept low by using a pulsed sample current with a low duty cycle

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Scrolo NA.C6.22852 Allegato 5 II Verbale

CONORSO BANDO N. NA/C6/22852 PROVA N.5

1) Misura del grado di vuoto in una camera in depressione.
2) Sistemi e tecniche per la progettazione meccanica.
3) Sistemi di tenuta e sicurezze per linee criogeniche.

-Testo in lingua inglese-

Often an apparatus must support vacuum pressure, or tolerate the magnetic forces associated with large-scale superconductor critical-current testing, or withstand the high loads of a mechanical measurement. In such cases, we need to calculate the size of parts on the basis of mechanical considerations. Four general guidelines are recommended *when sizing* parts for mechanical strength.

1. *Dimension* critical parts so the maximum expected stress *is kept to less* than about half the material's yield strength (Sec. 3.5.1).
2. Keep support-tube walls thick enough to avoid buckling if the tubes are subjected to compression (Euler buckling criterion, Sec. 3.5.2).
3. Limit flexure to an acceptable level (deflection formulas for beams and circular plates, Sec. 3.5.3).
4. Size the thickness of cryostat walls so they can withstand the maximum loading they will experience from pressurization or evacuation (Sec. 3.5.4).

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