David Klein Fold
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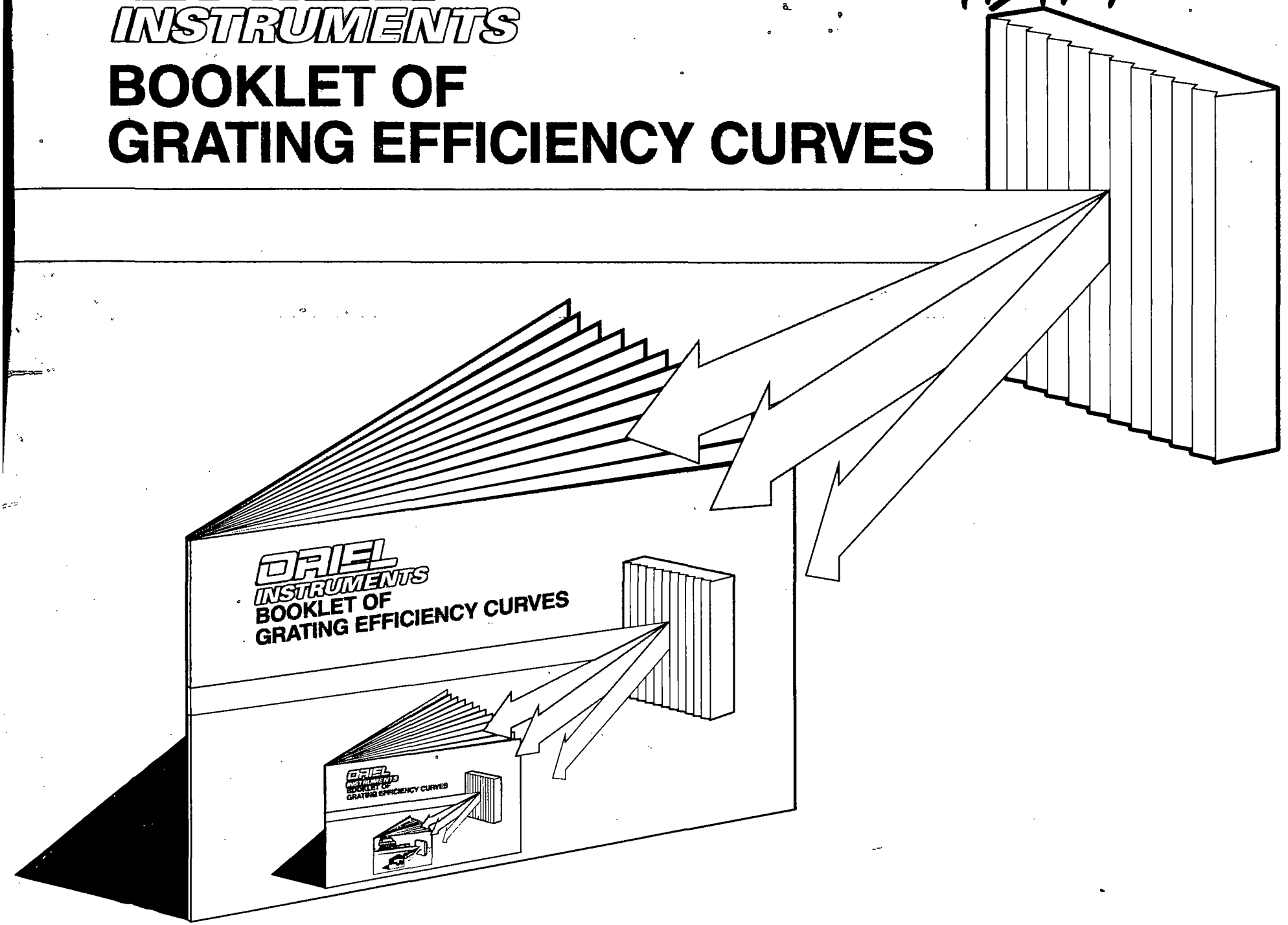
ORIEL
INSTRUMENTS

BOOKLET OF GRATING EFFICIENCY CURVES



CHOOSING YOUR GRATING

The choice of grating for any spectroscopic system depends on the application and must be made as one step in an iterative process of system design. The radiation source, radiation detector, polarization of radiation, spectral range of interest and desired resolution all play a role in grating selection. Our monochromators and spectrographs are designed to allow easy grating interchange and we supply a wide range of gratings. Sometimes the solution is to select more than one grating.

This booklet discusses some properties of Oriel diffraction gratings, and shows typical efficiency curves. We hope it helps you select the best grating for your application.

GROOVE DENSITY

Oriel gratings are available in various **groove densities** (i.e. lines/mm) and blaze wavelengths. The **blaze wavelength** is the wavelength where the grating efficiency is enhanced by shaping the grating grooves. (We refer to our holographic gratings as blazed for convenience. This is not strictly true though recent production techniques allow modification of the simple symmetrical sinusoidal groove shape to enhance efficiency over a limited spectral region.) Gratings for the UV and visible are available with groove densities from 200 to 2400 l/mm, though not for all instruments. Gratings for the near infrared are 600 l/mm and then infrared gratings have lower groove densities.

Groove density, bandpass and resolution

Higher groove densities give higher reciprocal dispersion and therefore higher resolution. The monochromator **bandpass** with a 2400 l/mm grating (and slits with widths above 50 µm) is half that of the same arrangement with a 1200 l/mm grating. The **resolution** with the 2400 l/mm grating is **twice** that with the 1200 l/mm grating. This simple relationship is not accurate for slitwidths below 25 to 50 µm (depends on monochromator and grating) as the optical aberrations begin to play a role in the bandpass and resolution. Actual bandpasses are tabulated in the Volume II catalog.

Groove density and stepper motor wavelength drives

Because we use a **sine drive** in our 77250 and 77200 Monochromators, each step of the stepper motor changes the wavelength by a constant amount; 0.1 nm for a 1200 l/mm grating in the 77250 or 77200. The wavelength increment per step depends on the grating; with a coarser grating (i.e. one with a lower groove density) the wavelength increment per step is larger. The wavelength increment per step is given by

$$0.1 \times 1200/g_{den} \text{ nm}$$

Where:

g_{den} = Groove density of the grating in use

E.g., with a 2400 l/mm grating, you get a 0.05 nm increment.

Dispersion

As usual the first law of physics "You don't get something for nothing" applies. You may gain resolution by going to a higher groove density grating, but you lose spectral range. This is easy to see for our 77400 1/8 m Spectrograph where the 77411 1200 l/mm grating has a reciprocal dispersion of around 6.3 nm/mm, and spreads 6.3 x 12.5 = 79 nm over a 12.5 mm long diode array or 6.3 x 25 = 158 nm over a 25 mm long diode array. For our 1/4 m Monochromator/Spectrograph, the same 1200 l/mm grating has a reciprocal dispersion of around 3.2 nm/mm, and spreads 80 nm.

The dispersion of a grating changes inversely with the groove density. If the groove density is halved, the dispersion is doubled. For example, a 600 l/mm grating spreads approximately 320 nm over a 25 mm long diode array, and a 300 l/mm grating spreads approximately 640 nm.

Because linear dispersion varies with incident angle, the dispersion of a 600 l/mm grating over a diode array is not exactly double that of a 1200 l/mm grating over the same diode array.

Groove density and spectral range for a monochromator

A monochromator mechanism can only tilt the grating through a limited angle, from ~0° to 45° in the 77200. The angle and groove density determine the transmitted wavelength, you can then use the grating equation and the maximum angle determined by the mechanism, to find the longest possible wavelength.

Since the grating can be tilted down to 0°, the lowest possible wavelength, ca. 180 nm, is set by the transmittance of the air (ca. 150 nm for a nitrogen flushed monochromator).

Table 2 Longest Wavelength in First Order Determined by the Mechanism of the Monochromator

	Longest Wavelength in nm			
Grating Groove Density (l/mm)	77250 1/8 m Monochromator	77200 1/4 m Monochromator	77400 1/8 m Spectrograph	77700 Series Monochromator/ Spectrograph
2400	500	600	625	700
1200	1000	1200	1250	1400
600	2000	2400	2500	2800
400	3000	3600	3750	4200
300	4000	4800	5000	5600
200	N/A	7200	N/A	8400
150	8000	9600	N/A	11200
75	16000	19200	N/A	23000
50	24000	N/A	N/A	33600

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GRATING EFFICIENCY

It would be wonderful to have efficient gratings to cover 185 to 3000 nm in first order. Unfortunately due to diffraction physics, gratings only have high efficiency over a limited spectral range. Groove shaping techniques ("blazing") allow selection of the high efficiency range. We have 1200 l/mm gratings where groove shaping has been used to give high efficiency at 250 nm. Other 1200 l/mm gratings are optimized for 500 nm.

The efficiency curves starting on page 12 show how the measured efficiency falls from the maximum at the blaze wavelength. As you can see from the curves, some gratings are very efficient over a limited wavelength range; this means for radiation at any wavelength in this range most of the incident beam is diffracted into the first order, and through the monochromator (set for that wavelength).

Please use the curves as a guide and not as absolute data. The measurements which led to all the data used a particular monochromator geometry; performance in each of our instruments will differ slightly from this data as the geometries are not exactly the same. This is of particular importance with spectrographs.

If light of 500 nm is measured with a diode array detector when the center wavelength on the detector is 400 nm, the signal will differ from that measured when the center wavelength is displaced, for example, to 600 nm. For this reason sections of emission spectra taken at different center wavelengths cannot be simply spliced together to make up a wider spectral range.

We list the **usable** and **primary efficiency ranges** for each grating. The usable range is the range in first order for which the grating has an efficiency of more than 10% (for unpolarized radiation), and the primary is the range in which the grating has an efficiency of more than 20% (for unpolarized radiation).

In summary then, there are three spectral ranges.

- Wavelengths increasing to the theoretical maximum (see page 9 for a brief description of "theoretical maximum")
- Maximum range determined by the mechanical rotation limit of the monochromator. The shaded area of our curves are beyond the mechanical limit of the instrument.
- The efficiency limited spectral range somewhat arbitrarily divided into primary (≳20%) and usable (≳10%) ranges.

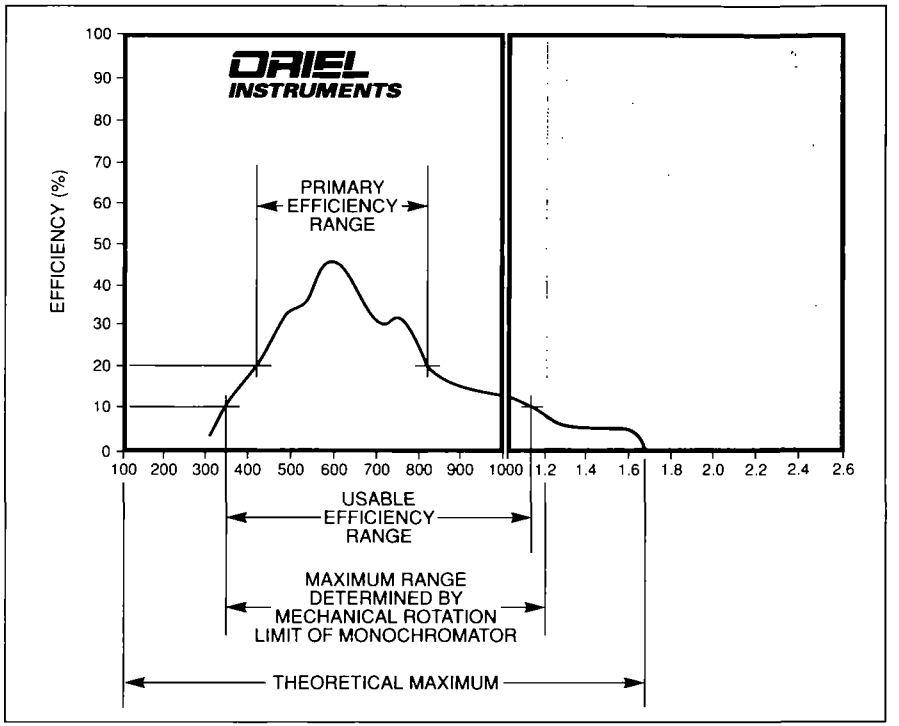

Fig. 1 Typical grating efficiency curve showing the various spectral ranges. The wavelength scale is changed at 1000 nm (1 µm).

When you set a monochromator at 600 nm, any radiation present at 200 nm or 300 nm will pass through the monochromator. Similarly, if the grating is set for 1000 nm, then 500 nm, 333 nm, 250 nm and 200 nm radiation also pass through the monochromator. In general when the monochromator is set for wavelength λ, radiation at λ/1, λ/2, λ/3, etc. can pass through. The denominator 1, 2, 3, etc. is called the order of diffraction. Radiation at λ is called first order radiation and is usually what we want (as we have set the monochromator at λ!). Radiation at λ/2 is called second order radiation, λ/3 third order, etc. All radiation at λ/2, λ/3, λ/4, etc. can be collectively referred to as **higher order radiation.**

EFFICIENCY OF HIGHER ORDER DIFFRACTION

The efficiency curves in this booklet are for first order radiation.

Fig. 2 shows typical efficiency curves for first, second and third orders. The curves for the higher orders have lower peaks and show less structure than the first order curve. The second order curve peaks at $\lambda_B/2$, the third order peaks at $\lambda_B/3$, etc. (λ_B = Blaze wavelength). When the monochromator is operating efficiently in first order it is also efficient for 2nd, 3rd, etc. orders. You can make use of this behavior to extend the useful range of a grating to shorter wavelengths.

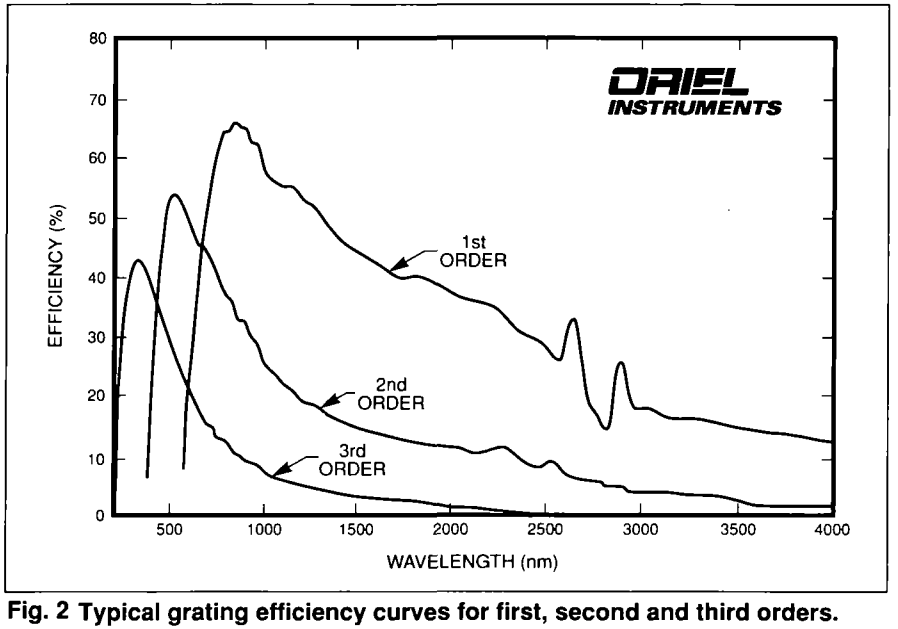

Fig. 2 Typical grating efficiency curves for first, second and third orders.

HIGHER ORDER DIFFRACTION CAN BE USEFUL

Higher order diffraction can be used for more efficient operation at low wavelengths. For example, if you have a grating blazed for 500 nm in first order, then the curve shows very low first order efficiency at 250 nm, so by cranking the monochromator down to 250 nm you will get very little throughput. The reason that the grating has low first order efficiency at 250 nm is that, because of the blazed groove shape, 250 nm radiation is being efficiently diffracted into the second order! You can get much better efficiency at 250 nm by operating this grating in second order with the monochromator set at 500 nm. (This will only be useful if you have no problem with 500 nm radiation or can filter it out from the desired 250 nm radiation.)

In general, when the monochromator is set for $\lambda_B/2$, the first order efficiency is so low, very little radiation passes through. For more efficiency at wavelength $\lambda_B/2$, you can set the monochromator at λ_B, and use second order diffraction. There the $\lambda_B/2$ efficiency is much greater.

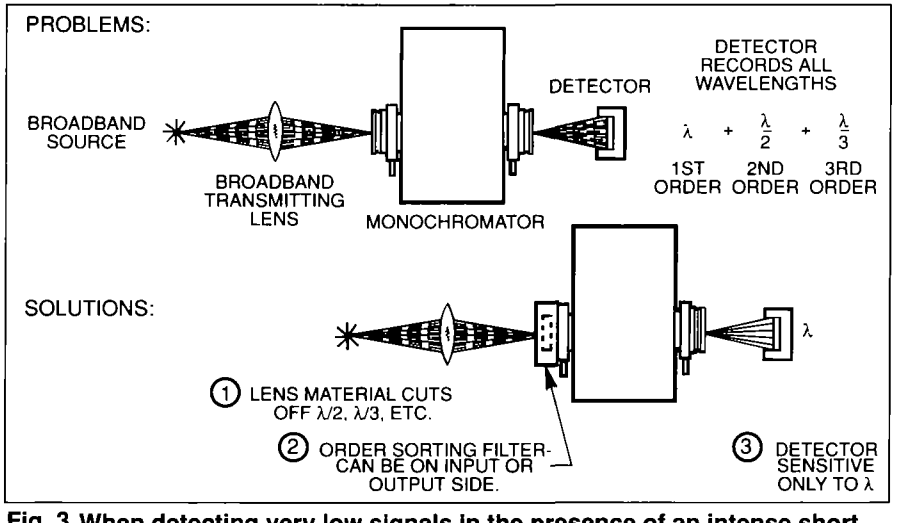

Fig. 3 When detecting very low signals in the presence of an intense short wavelength background, use the filter on the input side. If the filter is on the output side, close to the detector, then the higher order radiation coming through the monochromator can cause the filter to fluoresce and this fluorescence will be detected. Of course the fluorescence will be due only to the narrow band of higher order radiation that passes through the monochromator, but if the filter is close to the detector, the detector can collect a lot of the isotropically emitted fluorescence. If the filter is on the input side it will also fluoresce, but the monochromator collection angle and narrow bandpass will reduce the fluorescence reaching the detector. When using the monochromator as a filter for an intense source, the filter may be better on the output side as this reduces the power on the filter.

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HIGHER ORDER RADIATION CAN BE A NUISANCE

For meaningful spectral measurements you should be careful to remove unwanted orders, particularly if the input radiation is intense or the detector more sensitive at the higher order.

Many radiometric and spectrophotometric measurements are erroneous because what was thought to be a measurement with a single wavelength was actually a measurement using radiation at that wavelength contaminated with higher order radiation. This happens frequently with an arc or tungsten halogen source and photomultiplier operating in the 750 to 900 nm region. The sensitivity of most photomultipliers falls off rapidly as you go beyond 800 nm, but the sensitivity to second order radiation (385 to 450 nm) is deceptively high as you scan from 750 to 900 nm. In this case you might want to use our 51294 Filter which cuts on at 505 nm, blocking the unwanted 385 to 450 nm band. See page 2-79 of Volume II for a selection of Order Sorting Filters.

HIGHER ORDER CONSIDERATIONS

If you calibrate our 1/4 m Spectrograph/InstaSpec™ IV CCD combination with a calibrated source then the counts at any wavelength λ are (ignoring stray light):

$$C_\lambda = k_1 R_\lambda E_\lambda T_\lambda + k_2 R_{\lambda/2} E_{\lambda/2} T_{\lambda/2} + \text{etc.}$$

Where:

- R_λ = Reponsivity of the array (in counts/joule) at wavelength λ
- T_λ = Transmission of the spectrograph at wavelength λ
- E_λ = Incident energy per unit bandwidth through the spectrograph entrance slit during the array "exposure time". For continuous sources, $E_\lambda = I_\lambda t$, where t is the exposure time of the array and I_λ is the source irradiance in watts $cm^{-2}nm^{-1}$ on the slit.
- k_1 = Normalizing constant which relates the energy through the slit to that falling on one pixel of the array. It includes the dispersion of the grating at λ, the entrance slit width, the pixel (and total capture) dimensions and the imaging geometry of the spectrograph.

Values for $\lambda/2$ are those for the second order radiation, and the "etc." takes care of any higher orders.

We can simplify the expression to:

$$C_\lambda = c_\lambda E_\lambda + c_{\lambda/2} E_{\lambda/2} + \text{etc.}$$

Where:

c_λ includes all the factors in the previous equation

The whole purpose of radiometry is to measure an unknown source by first measuring a known source. The whole irradiance program is based on being able to say that at any wavelength λ (corresponding to say pixel #123) the irradiance from the unknown, I_{uk}, is given by:

$$I_{uk} = I_k \times C_{uk}/C_k$$

I.e. if the unknown source produced three times as many counts at pixel #123 as the known source for the same exposure time ($C_{uk} = 3C_k$), then you know that the irradiance of the unknown is three times that of the known at that wavelength λ.

But, if you let the higher orders be mixed in, then you don't know what the counts at pixel #123 are due to, either for the known source or for the unknown. In a simple example, if the known (calibration source) has no second or higher order radiation, then C_k, the number of counts for pixel #123, can be expressed as:

$$C_k = c_\lambda E_\lambda$$

Now suppose we have an unknown that may or may not have second or higher order radiation and we measure C_{uk} counts at pixel #123, we don't know anything except that pixel #123 recorded some mixture of radiation at λ, $\lambda/2$, $\lambda/3$, etc.

Unfortunately, for any quantitative measurements we must know that the known and unknown sources have the same spectral distribution (in which case why bother with an expensive spectral radiometer), we must know that there is no higher order radiation at the wavelengths of interest, or we must use order sorting filters and record a piece of the spectrum at a time.

STRAY LIGHT

In practice, a second type of stray light is a big problem with broadband sources and detectors. It is due to the dispersed radiation inside the monochromator/spectrograph, and its level depends on the design of the baffles and spectrograph, and the finish (absorbing black paint) inside the instrument. Even if the grating is perfect, this stray light will be there and could be troublesome. Spectral filters should be used to remove as much of it as possible. Or, you can use a double monochromator. You can look on one monochromator of a double monochromator as a tunable narrow spectral filter.

POLARIZATION

The diffraction efficiency from a grating usually depends on the polarization of the radiation incident on the grating. There can be significant differences between the efficiency for radiation with the electric field vector parallel to the grating grooves and radiation with the electric vector perpendicular to the grooves.

Radiation with the electric vector restricted to a specific direction is linearly polarized. Linearly polarized radiation with the electric vector parallel to the grooves is **p polarized** and radiation polarized perpendicular to the grooves is **s polarized**. For our monochromators and spectrographs, p polarized radiation has the polarization axis parallel to the entrance slit. In most laboratory applications with the instrument sitting on its feet on a horizontal bench, **p polarized radiation is vertically polarized.**

(Note that this historical definition of s and p polarization for diffraction gratings does not follow the general rules for s and p polarization for optics where the plane of incidence rather than the grooves are used to define parallel and perpendicular.)

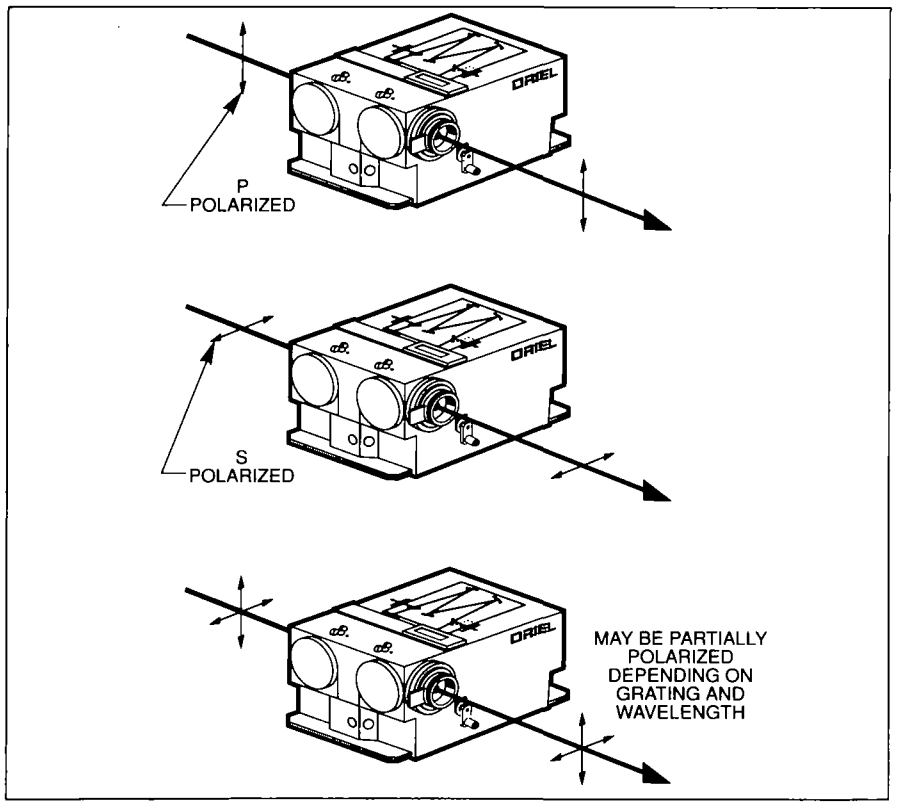

Fig. 4 The direction of p, s and unpolarized radiation entering and exiting the 77200 Monochromator.

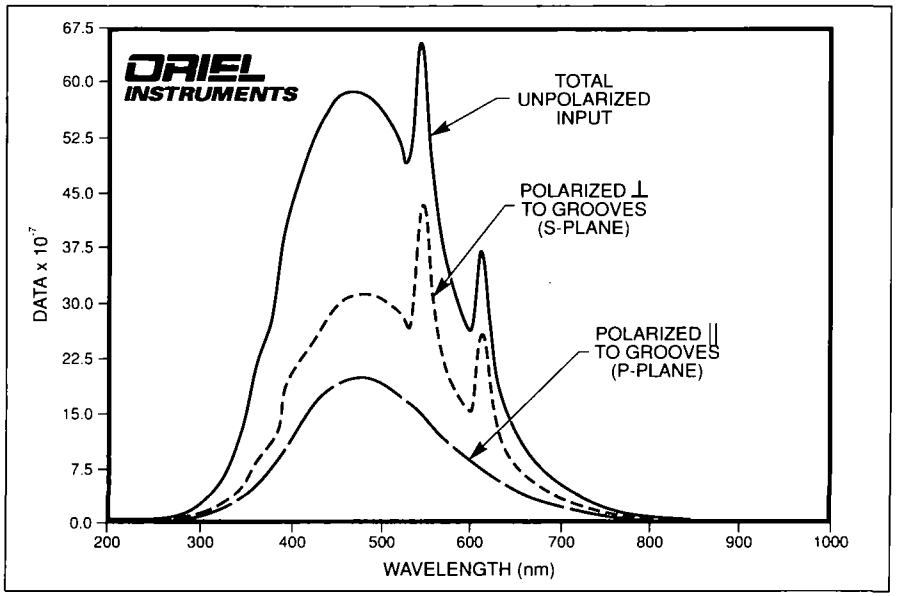

Fig. 5 This shows the three polarization curves for the scan from Fig. 6 on the next page.

Polarization and Efficiency

Most of our graphs for any grating have two separate efficiency curves, one for radiation polarized parallel to the grooves and one for radiation polarized perpendicular to the grooves.

We will discuss three aspects of this polarization dependence

1. Efficiency considerations for polarized input radiation.
2. The efficiency curves for one polarization are "smoother".
3. When you use unpolarized light, the output from the monochromator may be partially polarized.

1. Efficiency considerations

   If your source is linearly polarized and efficiency is important, then you should make sure that you have the most efficient orientation for polarization to grating. You can ensure this by rotating the source, rotating the polarization, or rotating the spectrometer. Rotating the polarization of a large laser system using a half wave plate (Volume III page 3- 28) or achromatic retarder (Volume III page 3- 30), is often simpler than rotating either the laser or spectrometer.

2. Curve smoothness

   Typically the efficiency curve for p polarized light peaks slightly lower than nominal blaze wavelength and smoothly declines to 0 at about three times the blaze. The curves for p polarized light are generally smooth, without dramatic changes in direction or sharp features. The curves for s polarized light peak slightly above nominal blaze and

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decline but can recover dramatically and show good efficiency right out to the theoretical maximum diffraction wavelength. The s polarization curves can show sharp features, **anomalies**, which complicate data deconvolution from spectral scans. If you are measuring a spectral feature close to an anomaly, then the real feature may be dramatically distorted. If possible, you should select a grating (or polarization) which has no significant anomaly in the spectral region of interest. Most radiometric or spectrophotometric measurements are relative. A reference scan of a calibrated light source (or scan without sample) is used to evaluate the unknown. Because of the polarization related efficiency differences, it is important that the reference and "unknown" radiation have exactly the same polarization properties. We recommend the use of a diffuser at the input to the monochromator, preferably an integrating sphere, for the most accurate measurements.

3. Polarization of the output radiation
   When you pass unpolarized light through a monochromator, the output monochromatic beam may be polarized. The performance of many optical elements depends on polarization. This is particularly true of dielectric reflectors used at non normal incidence. You should be cognizant of the polarization effects when selecting components for the path of the radiation from the monochromator. You should also distinguish between the use of s and p polarization for gratings and monochromators and the general use of the terms in optics.
   The sensitivity of most detectors does not depend on the polarization of the detected radiation. Side-on photomultipliers do show some polarization dependence.

An Example: Diode Laser Measurements

The 77234 600 l/mm grating blazed at 1 µm is a popular grating for measurement of diode laser spectral characteristics. Diode lasers typically have a polarized output (with greater than 50:1 ratio). For the visible laser diodes this grating is more than 2 times as efficient for p polarized radiation than for s polarization. At 850 nm the difference in efficiency is inconsequential while at 1.3 and 1.5 µm radiation, the s polarization is diffracted more efficiently.

The radiating area of many diodes is rectangular, and the polarization direction is parallel to the long dimension of the diode. For direct coupling of the diode output to the slit of a spectrograph, it is more efficient to couple the long dimension of the emitting area to the long dimension of the slit. With the 1.3 and 1.5 µm infrared diode lasers, this means that for highest total efficiency, coupling and grating, you must align the diode to the slit and rotate the polarization of the infrared radiation.

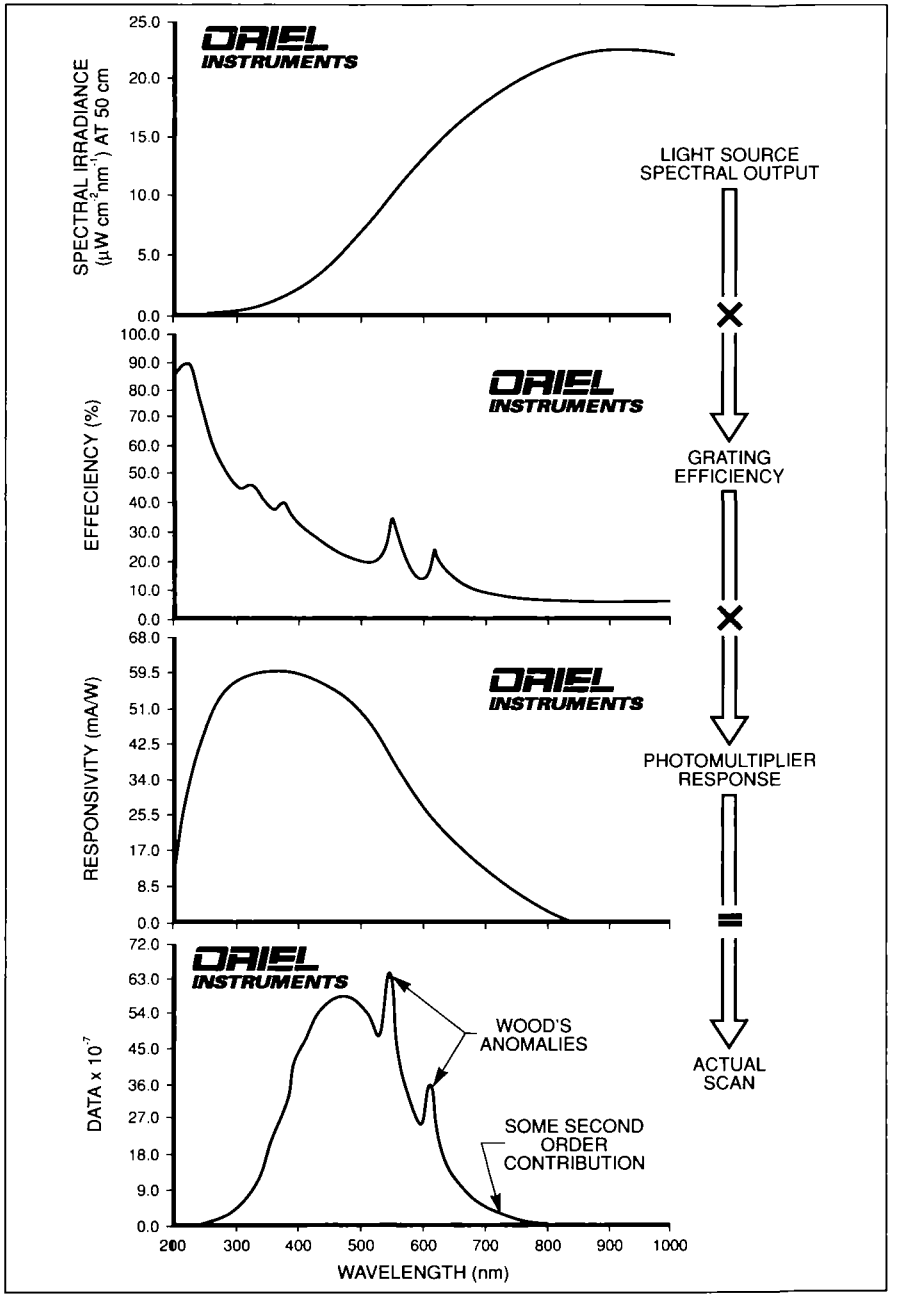

Fig. 6 The bottom graph shows an actual scan of a calibrated lamp output when used with the 77296 Grating and a PMT.

GHOSTS AND ANOMALIES

Anomalies are sudden increases or decreases in the efficiency vs. wavelength curve. They are a result of the interaction of the electric fields of incident and diffracted beams with each other and with the metal coated grooves of the grating. They are not a defect of the grating but an inescapable consequence of the diffraction physics of blazed gratings. They were first documented by Wood and so are sometimes called Wood's Anomalies. Fig. 7 shows a typical grating efficiency curve with anomalies. Fig. 6 shows the effect these anomalies have on the recorded spectrum of a typical tungsten halogen source.

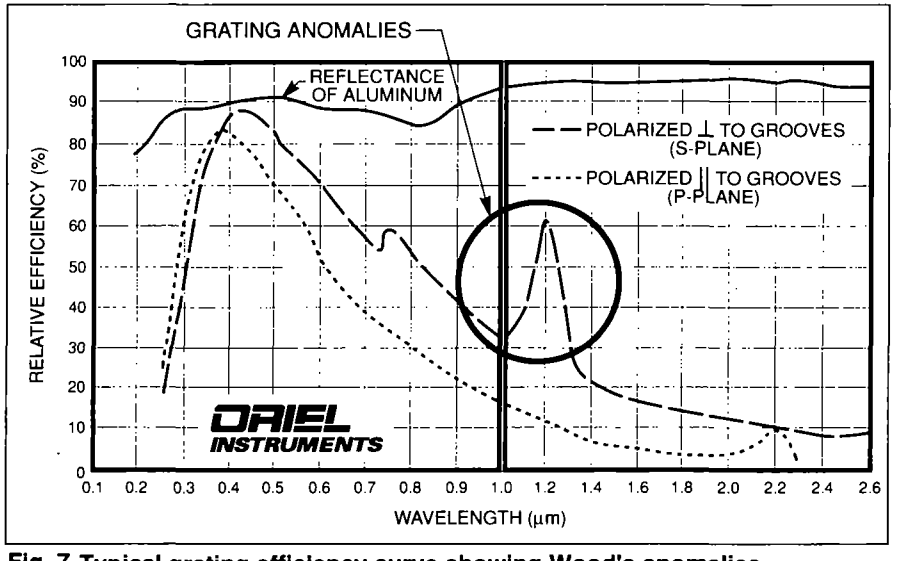

Fig. 7 Typical grating efficiency curve showing Wood's anomalies.

Some gratings exhibit prominent anomalies; others with different blaze design, have no significant anomalies. Anomalies are much more troublesome for s- polarized radiation (though p polarized radiation can exhibit anomalous behavior also.

The best ruled gratings can also exhibit **ghosts**. You see these most clearly when using a high power monochromatic input, such as a laser used for Raman studies. In addition to the strong main line in the output spectra the grating may produce faint satellite lines equally spaced on each side of the main line. **Rowland** ghosts are close to the expected line and **Lyman** ghosts are well separated from the line. Both are due to periodic errors in the grating grooves caused by minor defects in the ruling machine. The intensity of the brightest ghost should be less than 0.0003 times the line intensity. Knowing that all ruled gratings suffer from ghosts allows you to avoid interpreting these faint signals as weak but real spectral signatures. Ghosts appear equally spaced on both sides of the main line. Holographic gratings do not suffer from ghosts.

RULED OR HOLOGRAPHIC?

Grating masters are either ruled using a ruling engine with an extremely fine cutting tool, or produced by recording interference fringes in photoresist. The different techniques cause some differences in the performance of **ruled** and (**interference** or) **holographic** gratings. Additionally, because there are few combinations of photoresist and high power lasers suitable for grating production, holographic gratings are only available with higher groove densities. (The groove density depends on the fringe spacing which depends on the laser wavelength).

We recommend holographic gratings for work in the UV and through the visible to ca. 600 nm. They scatter less stray light into the signal direction, so, even if the efficiency is lower than that of the competing ruled grating, the holographic grating may give better signal to noise performance. (The actual signal to noise will depend on the spectral content of the incident light and the detector.)

Holographic gratings have an additional advantage; they do not suffer from ghosts, so interpretation of line spectra is simplified.

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CARE AND CLEANING OF GRATINGS

Grating cleanliness is important for efficiency but even more important for stray light rejection. A dirty grating will still diffract, but there will be a high stray light background as the radiation scatters or reflects off the dirt.

We have not found a satisfactory method of cleaning gratings that doesn't cost more than the grating. Usually attempts at cleaning the surface result in worsening the problem. The grooved replicated surface is fragile and can peel off. The grooves trap all sorts of small particles. We do not recommend solvent baths, ultrasonic cleaning or strippable coatings.

If you have appropriate safety equipment and environmentally safe means of chemical disposal then you can clean fresh fingerprints from a grating using high purity xylene or toluene and extreme care. General purpose solvent will leave a residue. The solvent must only flow over the grating surface. Contact with the metal holder or adhesives can transfer contaminants from these to the grating face. When we attempt this cleaning we usually find that the learning curve costs us most of the gratings we wanted to clean!

So, take care of your gratings.

- Never touch the surface
- Don't wipe the grating - even gently
- Don't wrap gratings in tissue
- Never leave a grating face up on an open bench
- Store gratings in a dessicator

Grating Blemishes

The cosmetic appearance of a grating (as distinct from dirt and dust on the grating) does not correlate with performance. Rowland found that his best gratings were the ones with the worst visual appearance! Some of the most efficient gratings seem to have bands. These originate in the ruling of the master and may be due to the cutting tool picking up a tiny shard.

If the application is limited to a narrow spectral region, then the grating choice is simple; the most efficient grating in that region is the best choice.

WHY DON'T WE OFFER HIGH GROOVE DENSITY GRATINGS FOR THE INFRARED AND WHY DO OUR GRATINGS HAVE A MAXIMUM GROOVE DENSITY OF 2400 l/mm?

The practical difficulty in producing a grating with groove density above 2400 l/mm (i.e. line spacing of less than 0.42 μm) is just now being removed by new lithographic techniques or short wavelength holography, but grating physics place a limit on the use of higher groove density gratings.

The grating equation is:

$$a (\sin I + \sin D) = m \lambda^*$$

Where:

- m = the order
- a = the groove
- λ = the wavelength
- I = the angle of incidence
- D = the angle of diffraction

Since we are only considering first order, m = 1. For a 1200 l/mm grating, a = 833 nm. The maximum possible value of the sum of two sines is 2. Therefore the maximum possible value of λ to satisfy

$$833 (\sin I + \sin D) = \lambda$$

is obviously 1666 nm. So even if you could design a monochromator with D ~90° and I ~90°, the longest wavelength you could possibly get in first order from any 1200 l/mm grating is 1666 nm. Likewise with a 2400 l/mm grating the maximum is 833 nm. Practical considerations restrict the angles D and I so the longest usable wavelength is lower than this theoretically possible maximum. Our 1/4 m 77200 Monochromator allows use to 1200 nm with a 1200 l/mm grating and 600 nm with a 2400 l/mm grating, in both cases an impressive 72% of the theoretically possible maximum. A 4000 l/mm grating would only be useful to 360 nm. And of course the theoretical limit is why we offer only low groove density gratings for the infrared.

*** Different definitions of positive and negative angles (with respect to the grating normal) can lead to confusion in using this equation.**

Line Density (l/mm)	Blaze Wavelength (nm)	Wavelength Region		Type	Model No.	Efficiency Curve Page No.
		Primary	Usable			
Gratings for 77700 Series Monochromator/Spectrograph						
600	200	180-500 nm	175-700 nm	Ruled	**77743**	12
2400	250	200-700 nm	180-700 nm	Holographic	**77740**	13
1200	250	180-650 nm	175-1000 nm	Holographic	**77741**	14
1200	350	200-1400 nm	180-1400 nm	Ruled	**77742**	15
600	400	250-1300 nm	250-1600 nm	Ruled	**77744**	16
300	500	250-1150 nm	245-1500 nm	Ruled	**77747**	17
1800	500	300-1050 nm	250-1050 nm	Holographic	**77753**	18
1200	750	450-1400 nm	400-1400 nm	Ruled	**77752**	19
600	1000	600-2500 nm	550-2500 nm	Ruled	**77745**	20
200	1000	600-2200 nm	550-2400 nm	Ruled	**77749**	21
400	1200	700-2500 nm	650-3000 nm	Ruled	**77746**	22
300	2000	1.1-3.4 µm	1-4 µm	Ruled	**77748**	23
150	4000	2.5-9 µm	2.5-9.5 µm	Ruled	**77750**	24
75	7000	4.5-20 µm	4.5-21 µm	Ruled	**77751**	25
Gratings for 77250 Series 1/8 m Monochromator						
600	200	180-500 nm	175-700 nm	Ruled	**77304**	26
2400	250	200-500 nm	180-500 nm	Holographic	**77308**	27
1200	250	180-650 nm	175-1000 nm	Holographic	**77296**	28
1200	350	200-1000 nm	180-1000 nm	Ruled	**77298**	29
1800	500	300-750 nm	250-750 nm	Holographic	**77309**	30
1200	750	450-1000 nm	400-1000 nm	Ruled	**77306**	31
600	750	450-2000 nm	400-2000 nm	Ruled	**77305**	32
600	1000	600-2000 nm	550-2000 nm	Ruled	**77299**	33
200	1000	600-2200 nm	550-2400 nm	Ruled	**77307**	34
300	2000	1.1-3.4 µm	1-4 µm	Ruled	**77300**	35
150	4000	2.5-8 µm	2.5-8 µm	Ruled	**77301**	36
75	7000	4.5-16 µm	4.5-16 µm	Ruled	**77302**	37
50	11000	7-23 µm	6.5-24 µm	Ruled	**77303**	38
Gratings for 77200 Series 1/4 m Monochromator						
600	200	180-500 nm	175-700 nm	Ruled	**77239**	39
2400	250	200-600 nm	180-600 nm	Holographic	**77230**	40
1200	250	180-650 nm	175-1000 nm	Holographic	**77231**	41
1200	350	200-1200 nm	180-1200 nm	Ruled	**77233**	42
1800	500	300-900 nm	250-900 nm	Holographic	**77253**	43
400	500	300-1200 nm	270-1600 nm	Ruled	**77240**	44
1200	750	450-1200 nm	400-1200 nm	Ruled	**77229**	45
600	750	450-2400 nm	400-2400 nm	Ruled	**77243**	46
600	1000	600-2400 nm	550-2400 nm	Ruled	**77234**	47
200	1000	600-2200 nm	550-2400 nm	Ruled	**77244**	48
300	2000	1.1-3.4 µm	1-4 µm	Ruled	**77235**	49
150	4000	2.5-9 µm	2.5-9.5 µm	Ruled	**77236**	50
75	7000	4.5-19.2 µm	4.5-19.2 µm	Ruled	**77237**	51

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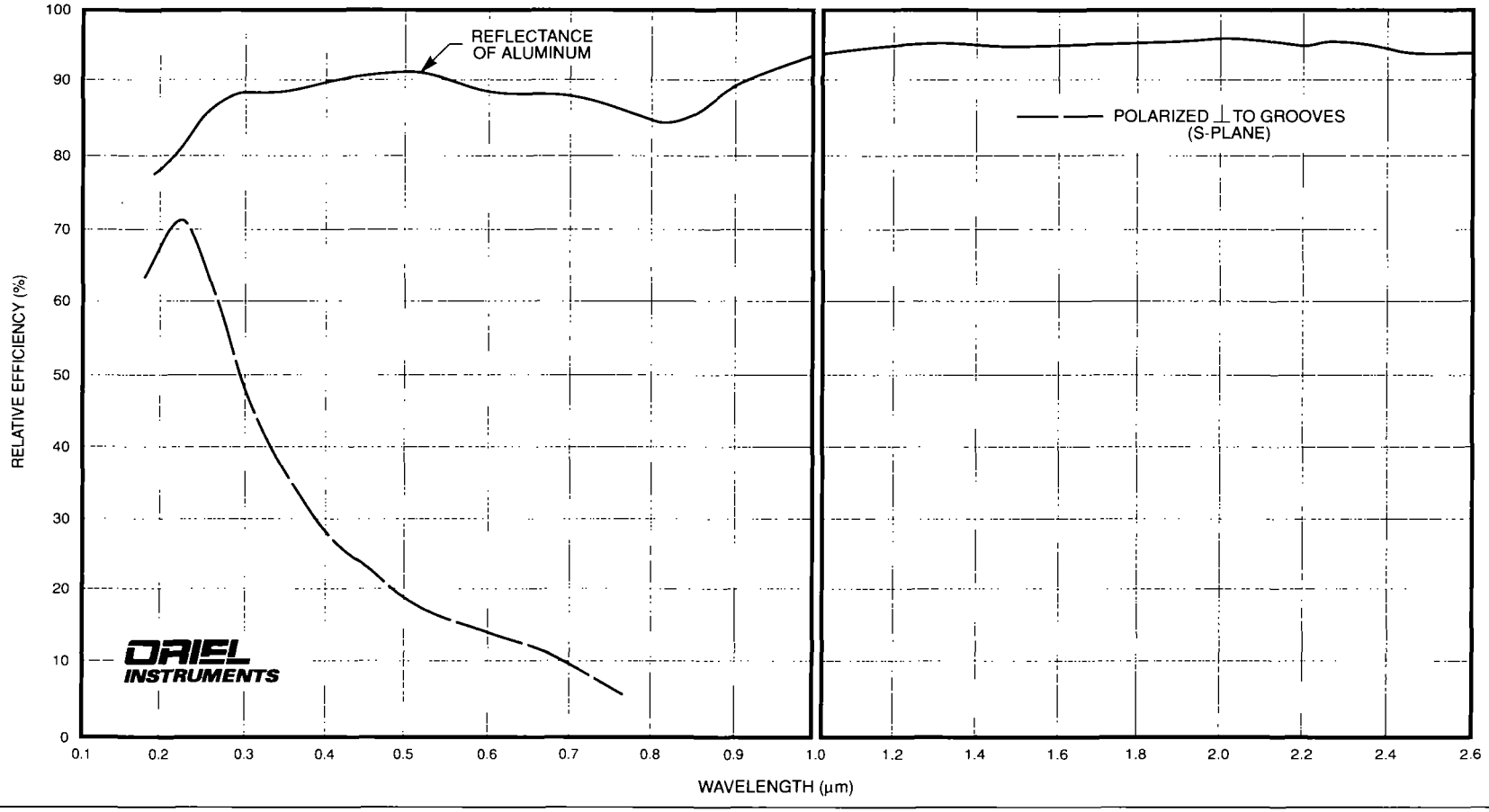
Line Density (l/mm)	Blaze Wavelength (nm)	Wavelength Region		Type	Model No.	Efficiency Curve Page No.
		Primary	Usable			
Gratings for 77400 1/8 m Spectrograph						
600	200	180-500 nm	175-700 nm	Ruled	**77413**	52
2400	250	200-625 nm	180-625 nm	Holographic	**77419**	53
1200	250	180-650 nm	175-1000 nm	Holographic	**77410**	54
300	300	200-750 nm	180-1000 nm	Ruled	**77422**	55
400	350	200-800 nm	180-1100 nm	Ruled	**77416**	56
1200	350	200-1250 nm	180-1250 nm	Ruled	**77411**	57
600	400	250-1300 nm	250-1600 nm	Ruled	**77414**	58
2400	400	230-625 nm	200-625 nm	Holographic	**77420**	59
1800	500	300-837 nm	250-837 nm	Holographic	**77421**	60
400	500	300-1200 nm	270-1600 nm	Ruled	**77417**	61
1200	750	450-1250 nm	400-1250 nm	Ruled	**77412**	62
600	750	450-2500 nm	400-2500 nm	Ruled	**77415**	63
Unmounted Gratings						
600	200	180-500 nm	175-700 nm	Ruled	**77917/918**	64
2400	250	200-750 nm	180-800 nm	Holographic	**77901/902**	65
1200	250	180-650 nm	175-1000 nm	Holographic	**77907/908**	66
600	300	250-850 nm	250-1400 nm	Ruled	**77919/920**	67
300	300	200-750 nm	180-1000 nm	Ruled	**77937/938**	68
1200	350	200-1600 nm	180-1600 nm	Ruled	**77909/910**	69
400	350	200-800 nm	180-1100 nm	Ruled	**77929/930**	70
2400	400	230-800 nm	200-850 nm	Holographic	**77903/904**	71
600	400	250-1300 nm	250-1600 nm	Ruled	**77921/922**	72
300	500	250-1150 nm	245-1500 nm	Ruled	**77939/940**	73
1800	500	300-1100 nm	250-1100 nm	Holographic	**77905/906**	74
1200	500	280-1600 nm	250-1600 nm	Ruled	**77911/912**	75
600	500	280-1200 nm	250-1600 nm	Ruled	**77923/924**	76
400	500	300-1200 nm	270-1600 nm	Ruled	**77931/932**	77
1200	750	450-1600 nm	400-1600 nm	Ruled	**77913/914**	78
600	750	450-2800 nm	400-3000 nm	Ruled	**77925/926**	79
400	850	550-2200 nm	500-2500 nm	Ruled	**77933/934**	80
1200	1000	550-1600 nm	300-1600 nm	Ruled	**77915/916**	81
600	1000	600-2500 nm	550-2500 nm	Ruled	**77927/928**	82
200	1000	600-2200 nm	550-2400 nm	Ruled	**77945/946**	83
400	1200	700-2500 nm	650-2500 nm	Ruled	**77935/936**	84
300	2000	1.1-3.4 µm	1-4 µm	Ruled	**77941/942**	85
150	4000	2.5-9 µm	2.5-9.5 µm	Ruled	**77947/948**	86
150	6000	4-10 µm	3.5-10.5 µm	Ruled	**77949/950**	87
75	7000	4.5-20 µm	4.5-21 µm	Ruled	**77951/952**	88
50	11000	7-23 µm	6.5-24 µm	Ruled	**77953/954**	89

GRATING ASSEMBLY: 77743 1/4 m Monochromator/Spectrograph Grating



SPECIFICATIONS

Line Density:	600 l/mm	Usable Wavelength Region[2]:	175-700 nm
Blaze Wavelength:	200 nm	77250 1/8 m Monochromator equivalent grating (page):	77304 (26)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77239 (39)
Reciprocal Dispersion at Blaze Wavelength:	6.4 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77413 (52)
Array Bandpass (For a 25 mm Spectrograph):	163 nm	Unmounted equivalent grating (page):	77917/77918 (64)
Primary Wavelength Region[1]:	180-500 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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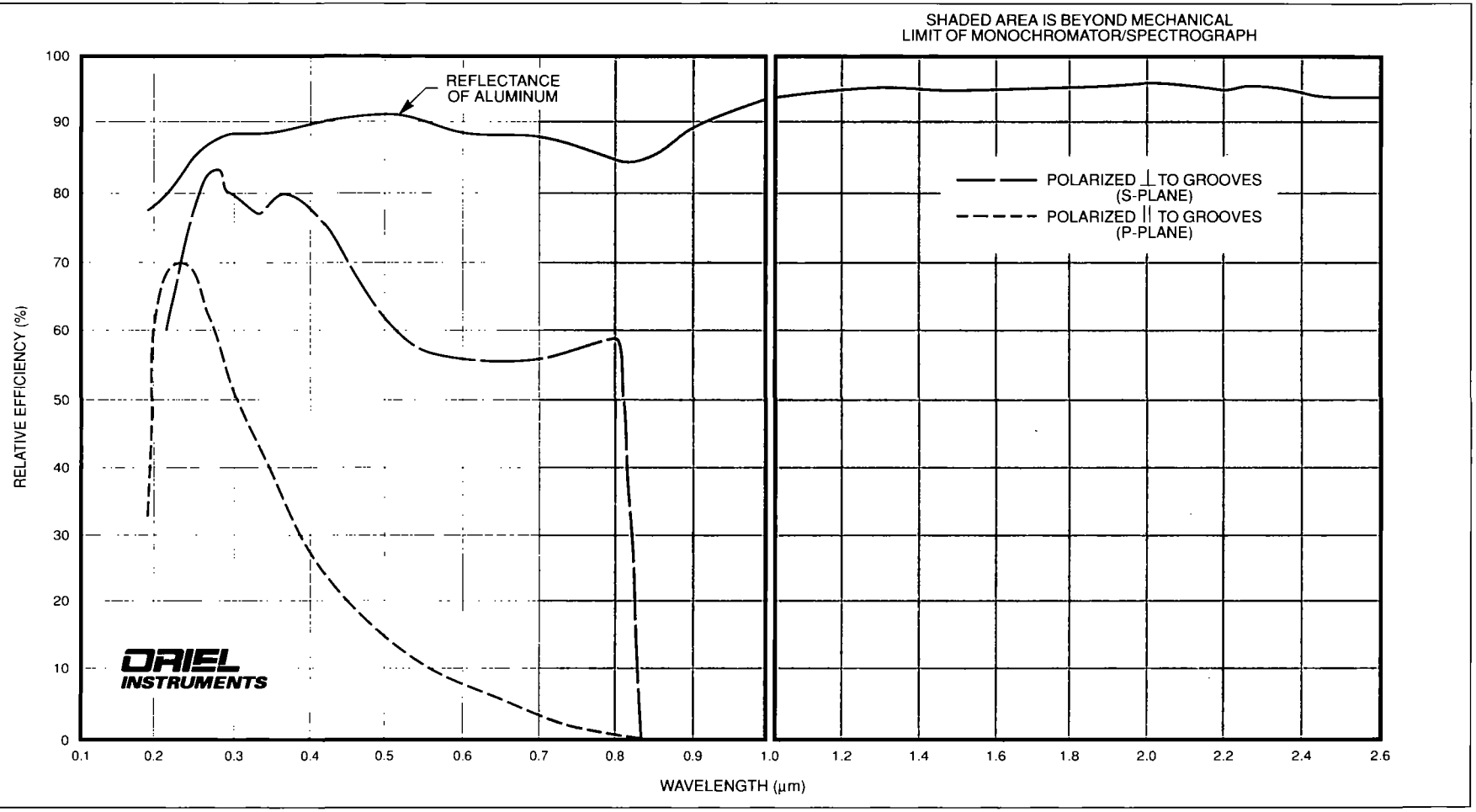
GRATING ASSEMBLY: 77740 1/4 m Monochromator/Spectrograph Grating

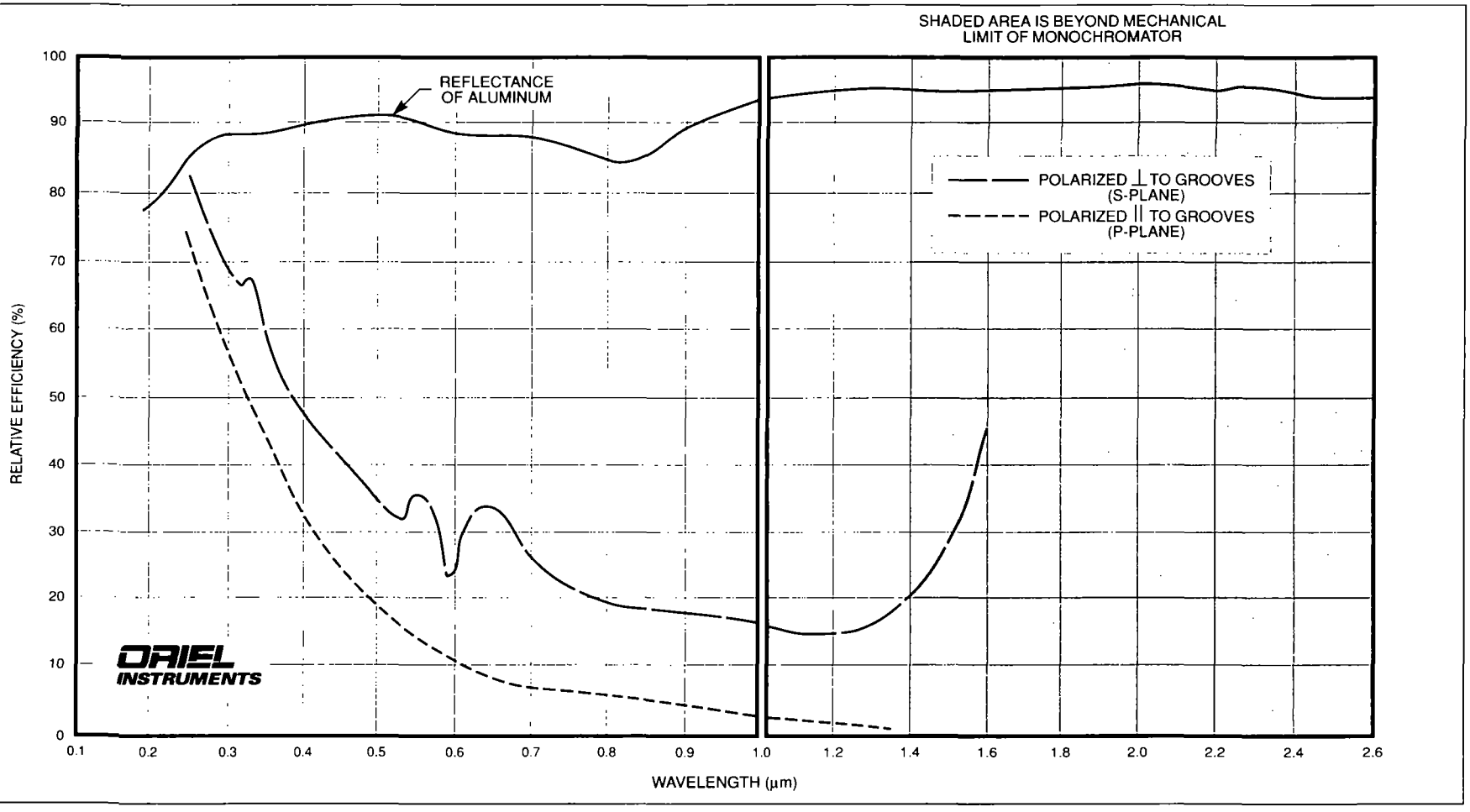


SPECIFICATIONS

Line Density:	2400 l/mm	Usable Wavelength Region[2]:	180-700 nm+
Blaze Wavelength:	250 nm	77250 1/8 m Monochromator equivalent grating (page):	77308 (27)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77230 (40)
Reciprocal Dispersion at Blaze Wavelength:	1.6 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77419 (53)
Array Bandpass (For a 25 mm Spectrograph):	40 nm	Unmounted equivalent grating (page):	77901/77902 (65)
Primary Wavelength Region[1]:	200-700 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77741 1/4 m Monochromator/Spectrograph Grating



SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	175-1000 nm
Blaze Wavelength:	250 nm	77250 1/8 m Monochromator equivalent grating (page):	77296 (28)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77231 (41)
Reciprocal Dispersion at Blaze Wavelength:	3.2 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77410 (54)
Array Bandpass (For a 25 mm Spectrograph):	82 nm	Unmounted equivalent grating (page):	77907/77908 (66)
Primary Wavelength Region[1]:	180-650 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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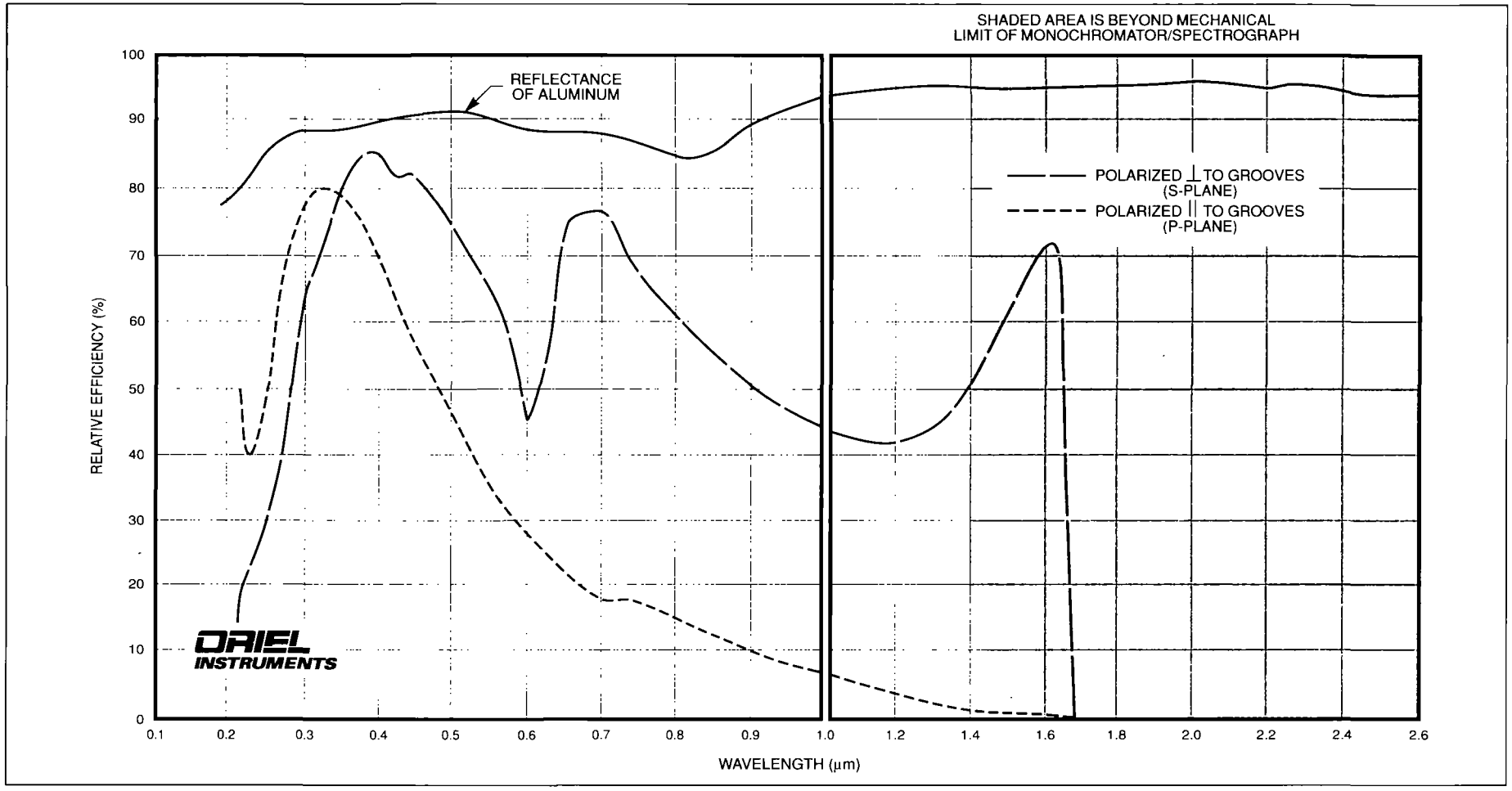
GRATING ASSEMBLY: 77742 1/4 m Monochromator/Spectrograph Grating

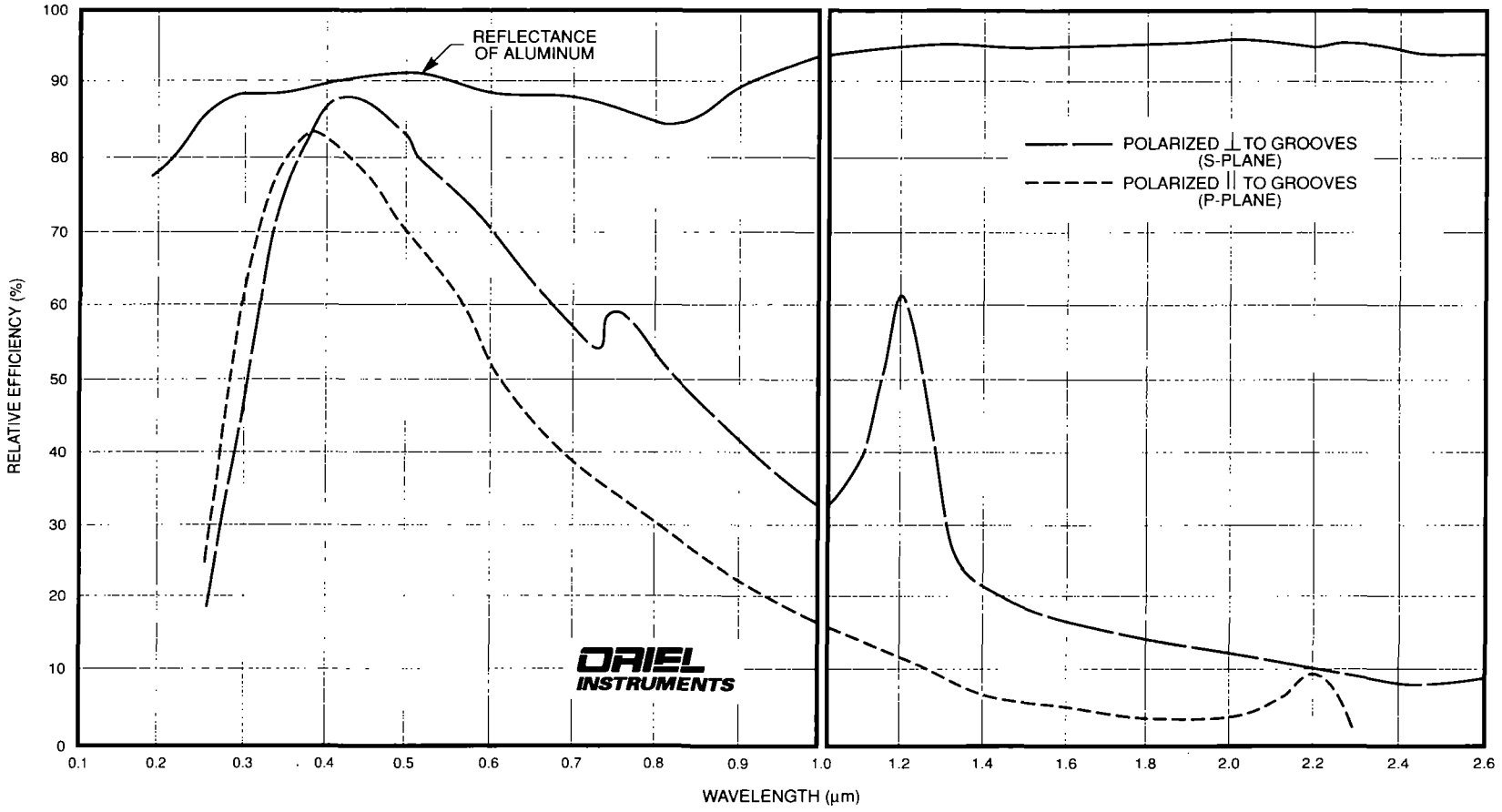


SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	180-1400 nm+
Blaze Wavelength:	350 nm	77250 1/8 m Monochromator equivalent grating (page):	77298 (29)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77233 (42)
Reciprocal Dispersion at Blaze Wavelength:	3.2 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77411 (57)
Array Bandpass (For a 25 mm Spectrograph):	82 nm	Unmounted equivalent grating (page):	77909/77910 (69)
Primary Wavelength Region[1]:	200-1400 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77744 1/4 m Monochromator/Spectrograph Grating



SPECIFICATIONS

Line Density:	600 l/mm	Usable Wavelength Region[2]:	250-1600 nm
Blaze Wavelength:	400 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	6.5 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77414 (58)
Array Bandpass (For a 25 mm Spectrograph):	163 nm	Unmounted equivalent grating (page):	77921/77922 (72)
Primary Wavelength Region[1]:	250-1300 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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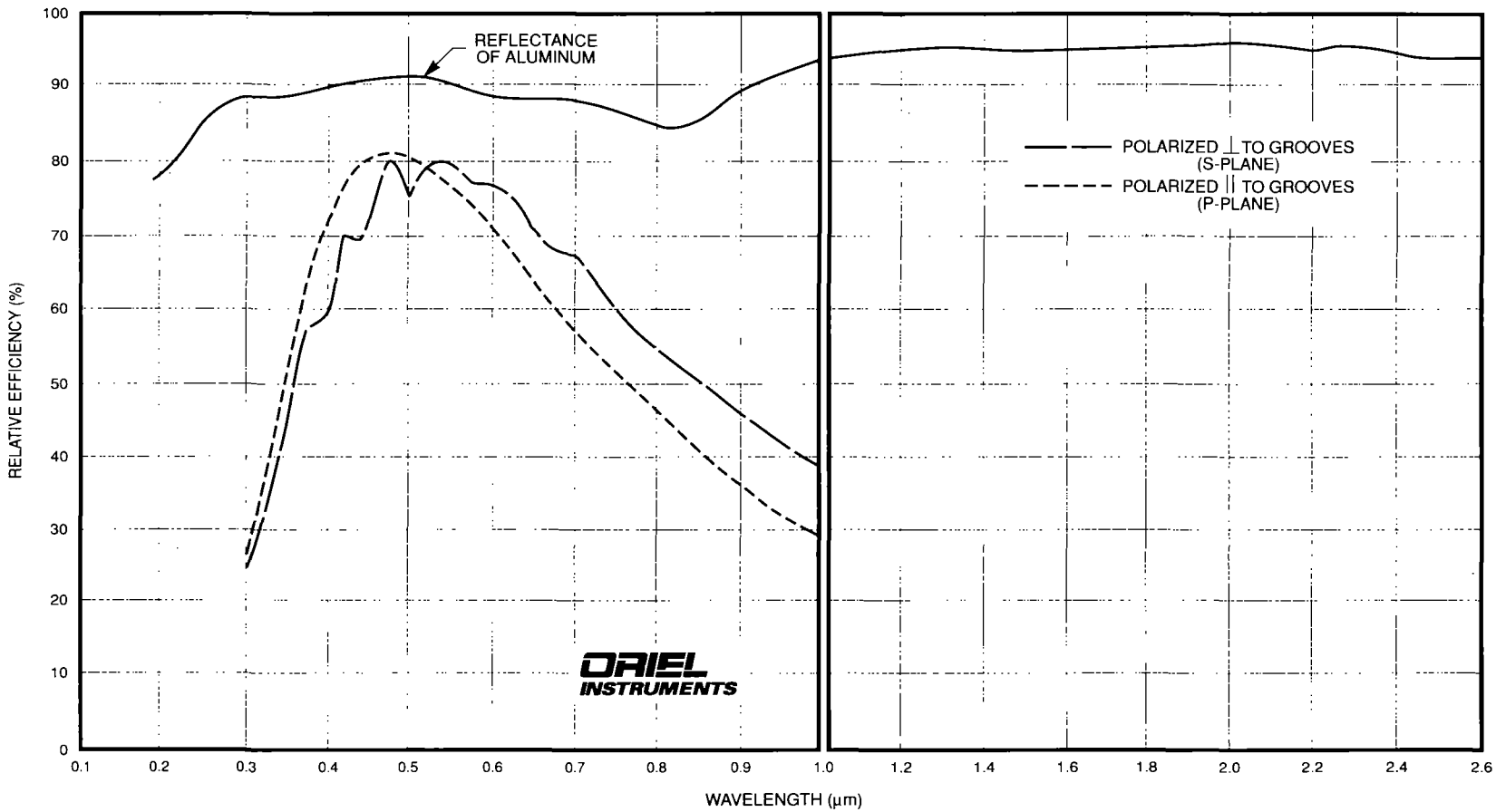
GRATING ASSEMBLY: 77747 1/4 m Monochromator/Spectrograph Grating

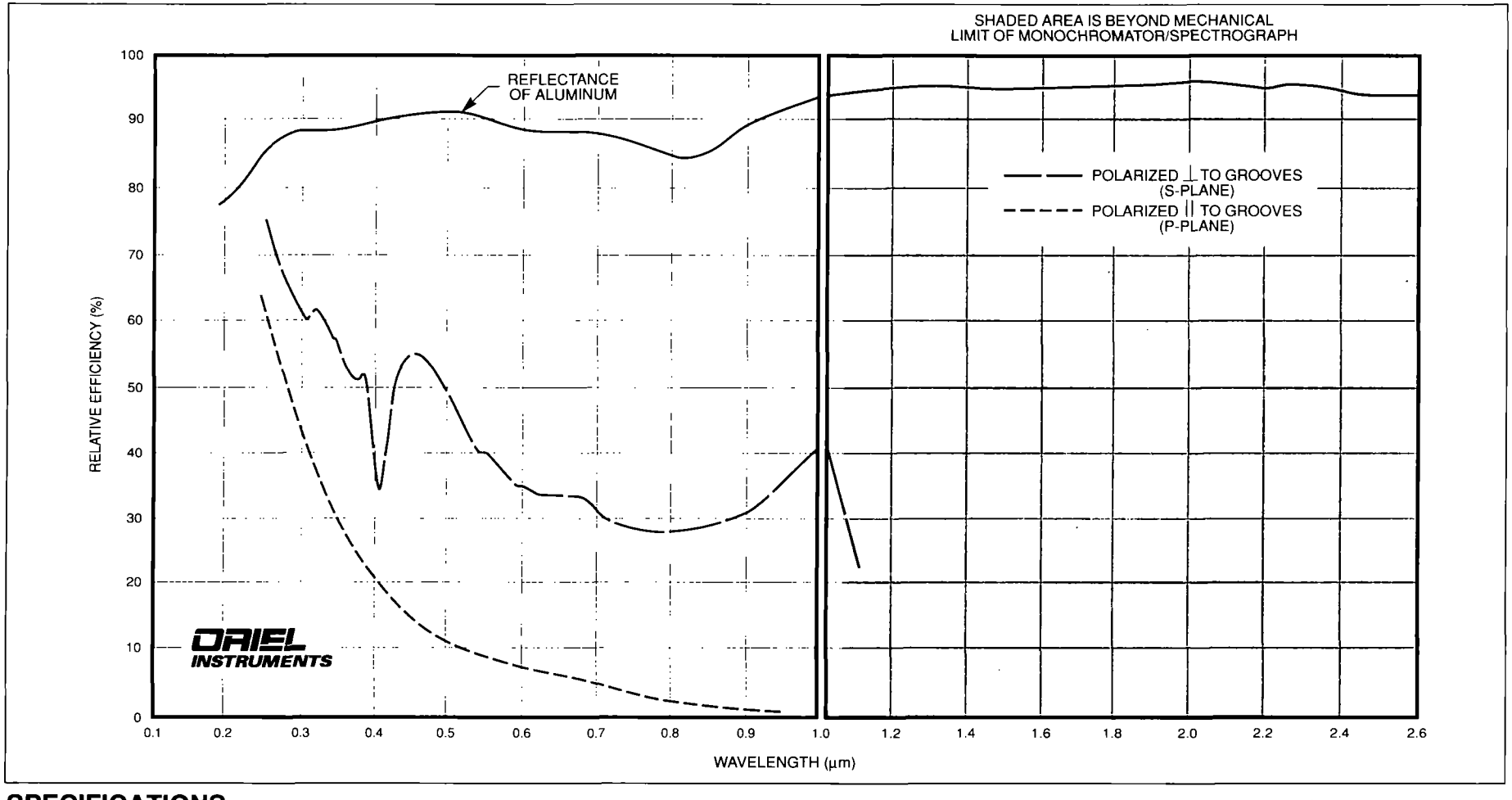


SPECIFICATIONS

Line Density:	300 l/mm	Usable Wavelength Region[2]:	245-1500 nm
Blaze Wavelength:	500 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	12.8 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrograph):	325 nm	Unmounted equivalent grating (page):	77939/77940 (73)
Primary Wavelength Region[1]:	250-1150 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

GRATING ASSEMBLY: 77753 1/4 m Monochromator/Spectrograph Grating



SPECIFICATIONS

Line Density:	1800 l/mm	Usable Wavelength Region[2]:	250-1050 nm+
Blaze Wavelength:	500 nm	77250 1/8 m Monochromator equivalent grating (page):	77309 (30)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77253 (43)
Reciprocal Dispersion at Blaze Wavelength:	2.1 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77421 (60)
Array Bandpass (For a 25 mm Spectrograph):	52 nm	Unmounted equivalent grating (page):	77905/77906 (74)
Primary Wavelength Region[1]:	300-1050 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

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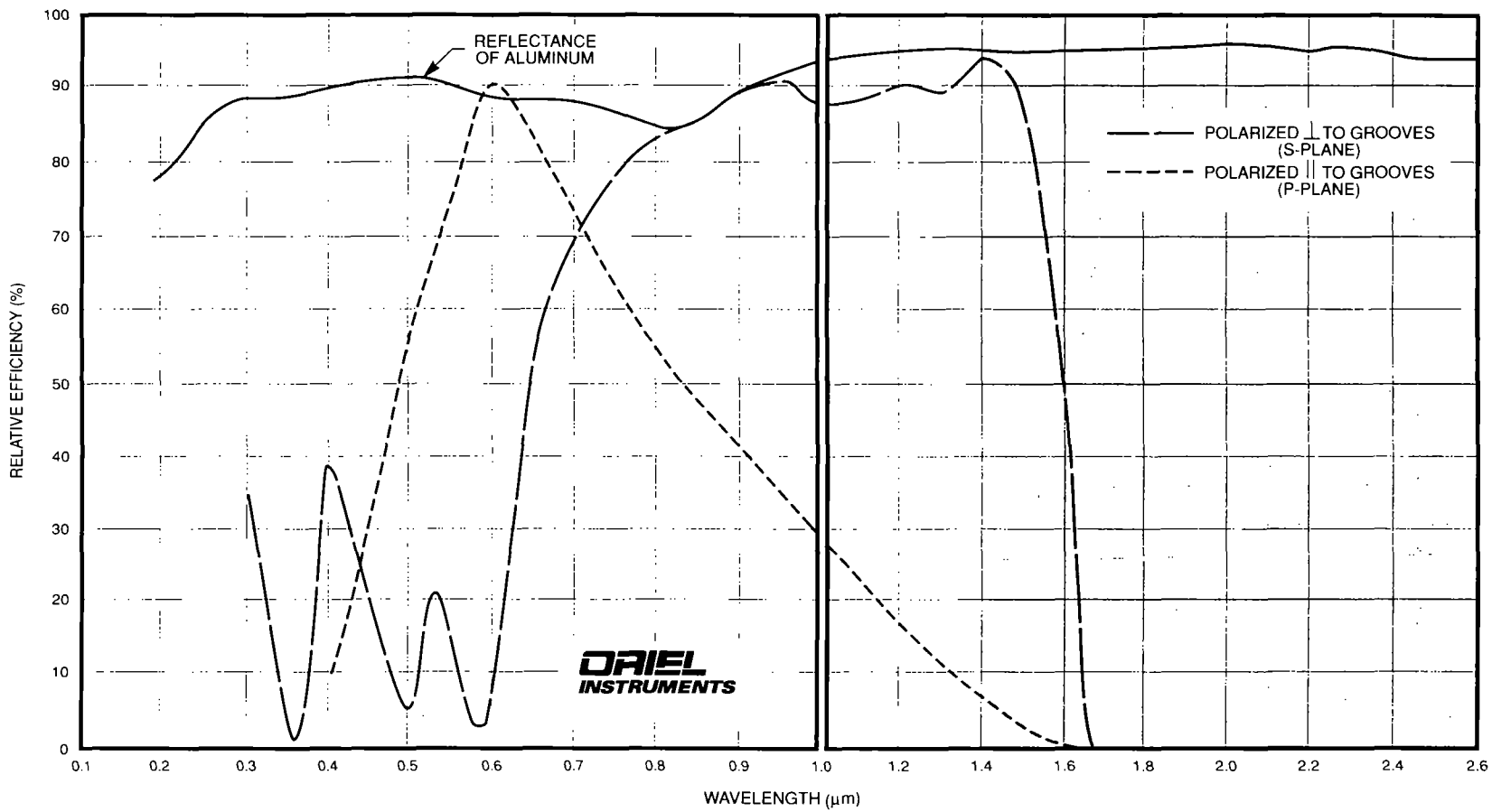
GRATING ASSEMBLY: 77752 1/4 m Monochromator/Spectrograph Grating

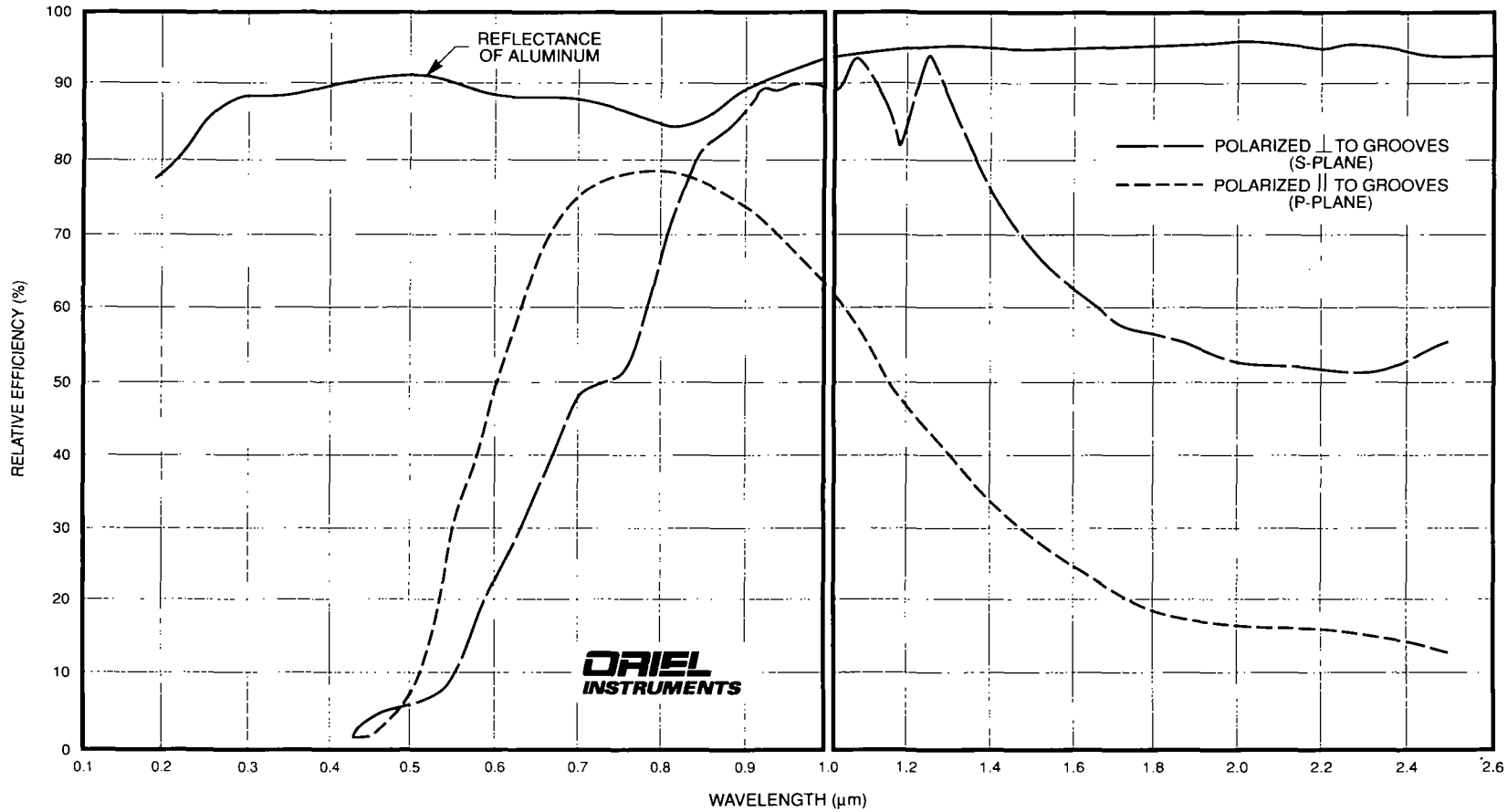


SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	400-1400 nm+
Blaze Wavelength:	750 nm	77250 1/8 m Monochromator equivalent grating (page):	77306 (31)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77229 (45)
Reciprocal Dispersion at Blaze Wavelength:	3.1 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77412 (62)
Array Bandpass (For a 25 mm Spectrograph):	79 nm	Unmounted equivalent grating (page):	77913/77914 (78)
Primary Wavelength Region[1]:	450-1400 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77745 1/4 m Monochromator/Spectrograph Grating



SPECIFICATIONS

Line Density:	*600 l/mm*	*Usable Wavelength Region[2]:*	*550-2500 nm*
Blaze Wavelength:	1000 nm	77250 1/8 m Monochromator equivalent grating (page):	77299 (33)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77234 (47)
Reciprocal Dispersion at Blaze Wavelength:	6.4 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrograph):	163 nm	Unmounted equivalent grating (page):	77927/77928 (82)
Primary Wavelength Region[1]:	600-2500 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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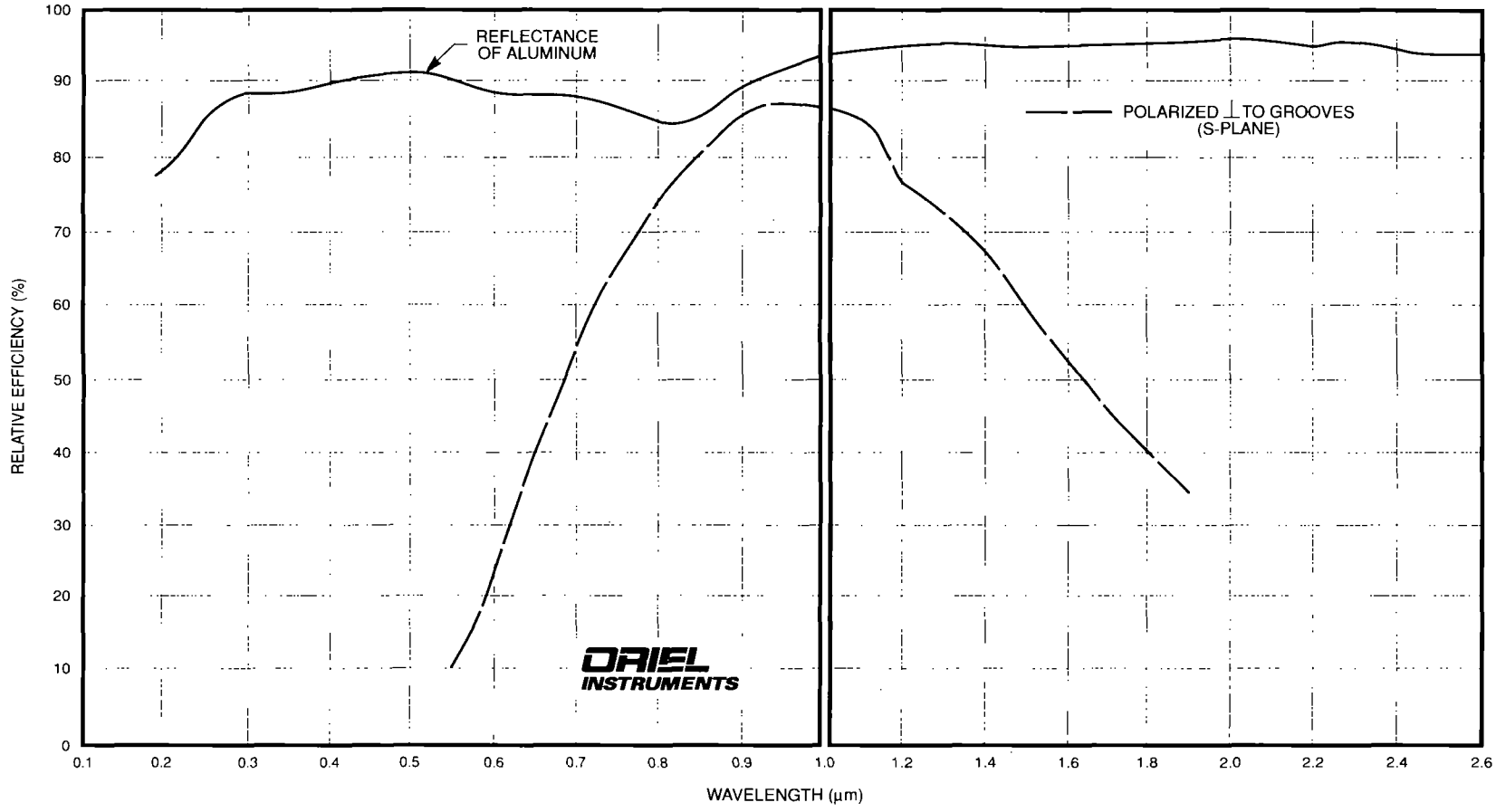
GRATING ASSEMBLY: 77749 1/4 m Monochromator/Spectrograph Grating

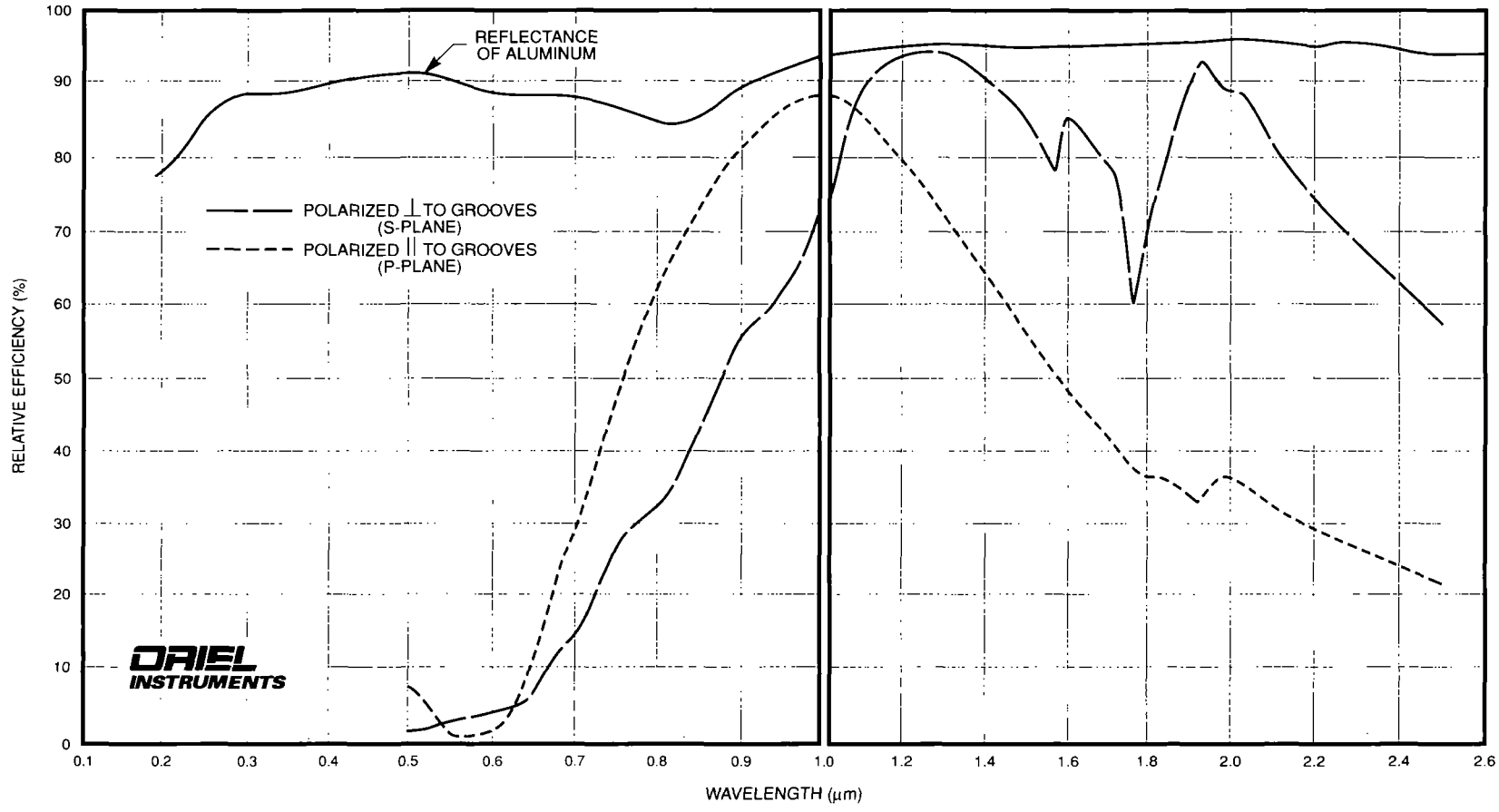


SPECIFICATIONS

Line Density:	200 l/mm	Usable Wavelength Region[2]:	550-2400 nm
Blaze Wavelength:	1000 nm	77250 1/8 m Monochromator equivalent grating (page):	77307 (34)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77244 (48)
Reciprocal Dispersion at Blaze Wavelength:	19.3 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrograph):	490 nm	Unmounted equivalent grating (page):	77945/77946 (83)
Primary Wavelength Region[1]:	600-2200 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

GRATING ASSEMBLY: 77746 1/4 m Monochromator/Spectrograph Grating



SPECIFICATIONS

Line Density:	400 l/mm	Usable Wavelength Region[2]:	650-3000 nm
Blaze Wavelength:	1200 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	9.7 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrograph):	246 nm	Unmounted equivalent grating (page):	77935/77936 (84)
Primary Wavelength Region[1]:	700-2500 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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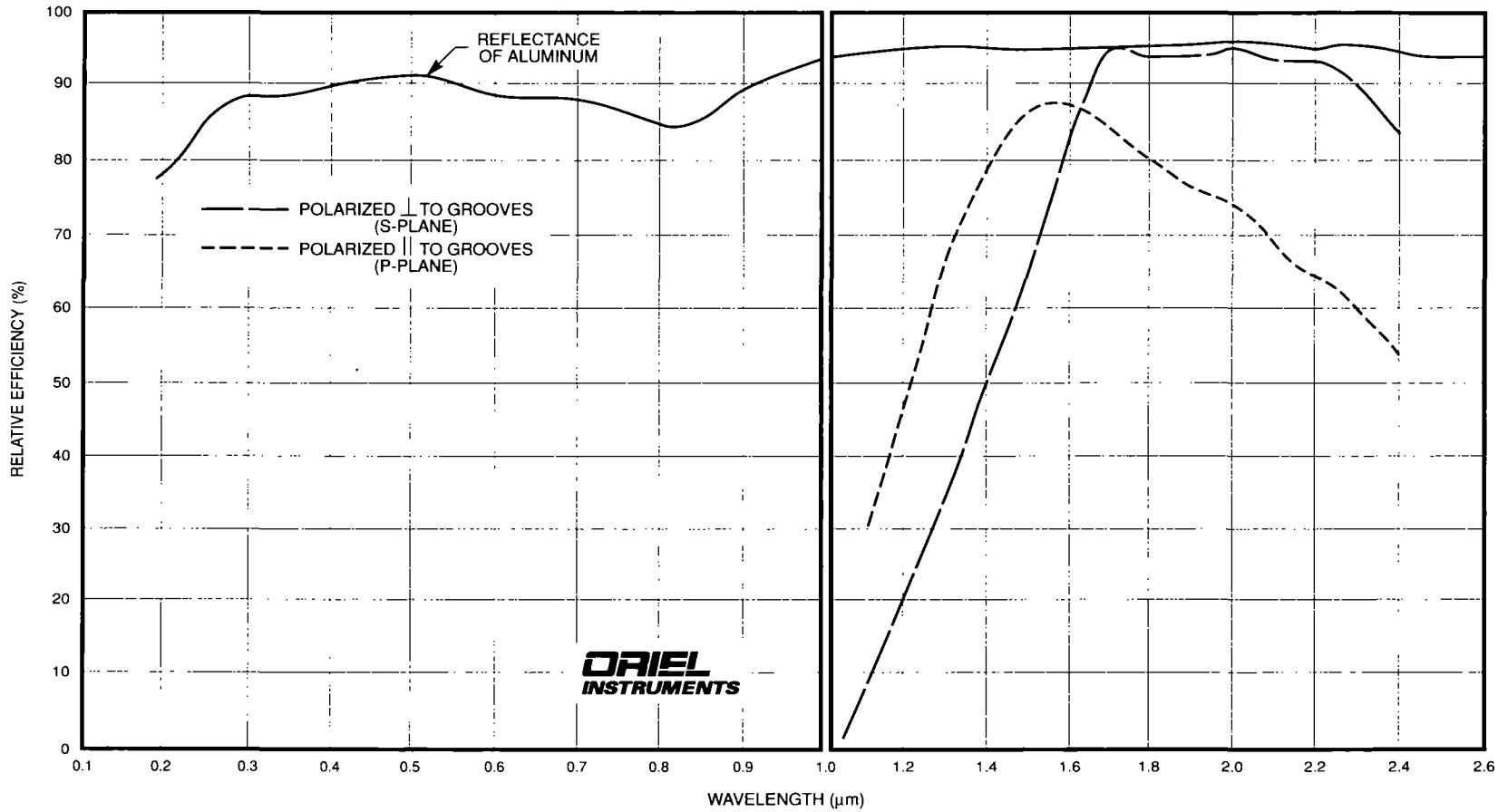
GRATING ASSEMBLY: 77748 1/4 m Monochromator/Spectrograph Grating

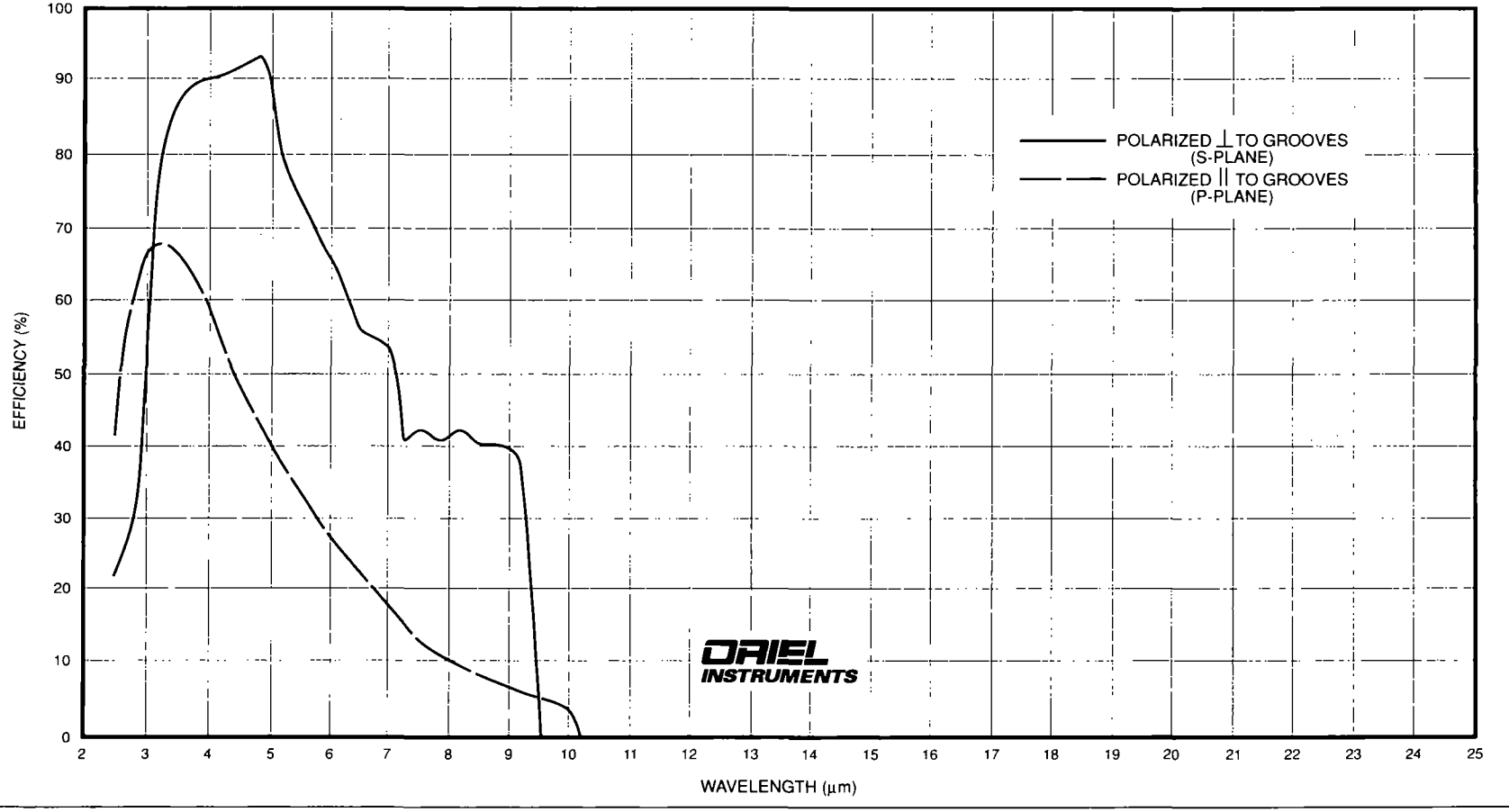


SPECIFICATIONS

Line Density:	300 l/mm	Usable Wavelength Region[2]:	1000-4000 nm
Blaze Wavelength:	2000 nm	77250 1/8 m Monochromator equivalent grating (page):	77300 (35)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77235 (49)
Reciprocal Dispersion at Blaze Wavelength:	12.9 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrograph):	325 nm	Unmounted equivalent grating (page):	77941/77942 (85)
Primary Wavelength Region[1]:	1100-3400 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

GRATING ASSEMBLY: 77750 1/4 m Monochromator/Spectrograph Grating



SPECIFICATIONS

Line Density:	150 l/mm	Usable Wavelength Region[2]:	2.5-9.5 µm
Blaze Wavelength:	4 µm	77250 1/8 m Monochromator equivalent grating (page):	77301 (36)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77236 (50)
Reciprocal Dispersion at Blaze Wavelength:	25.8 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrograph):	653 nm	Unmounted equivalent grating (page):	77947/77948 (86)
Primary Wavelength Region[1]:	2.5-9 µm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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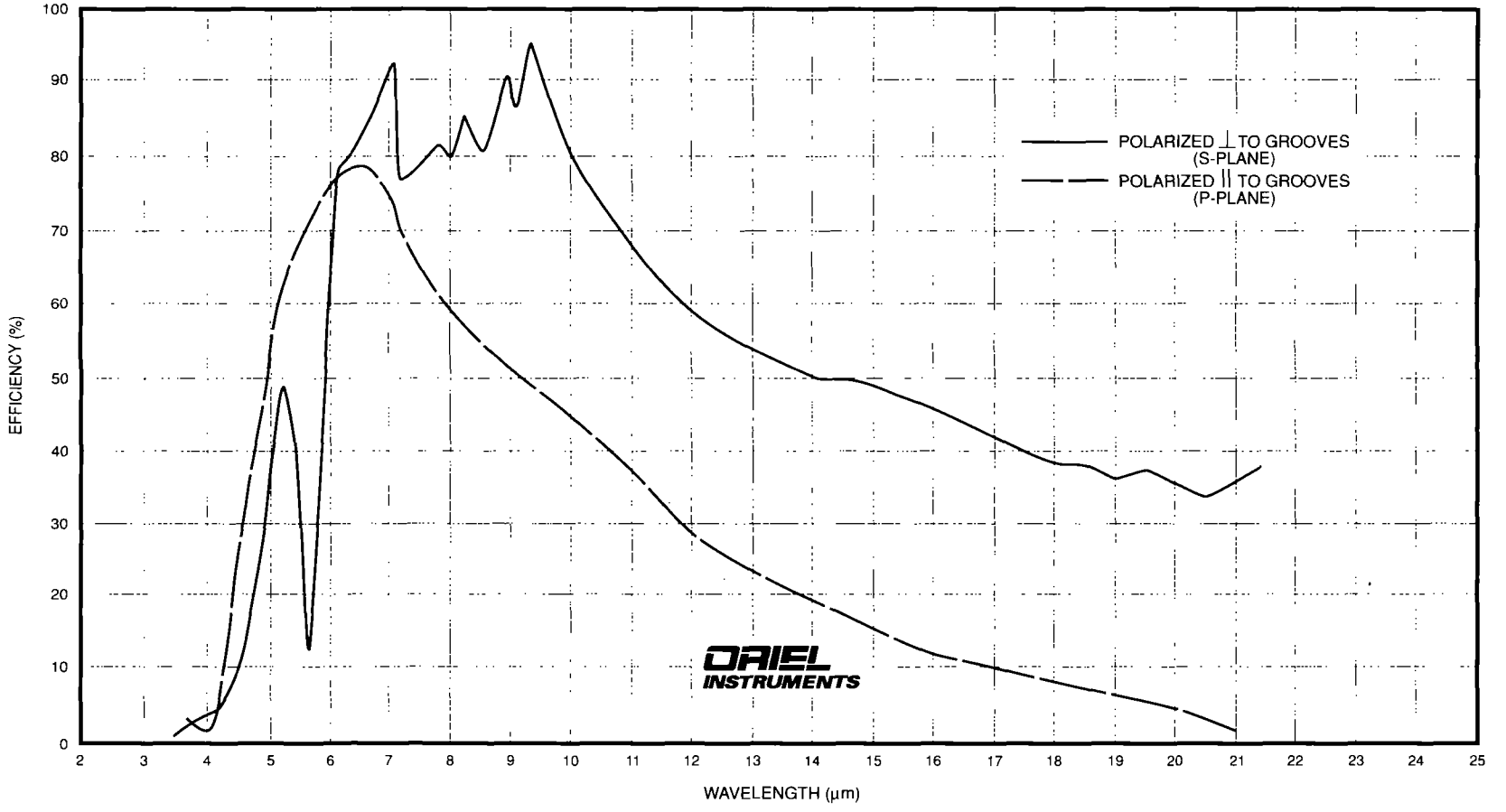
GRATING ASSEMBLY: 77751 1/4 m Monochromator/Spectrograph Grating

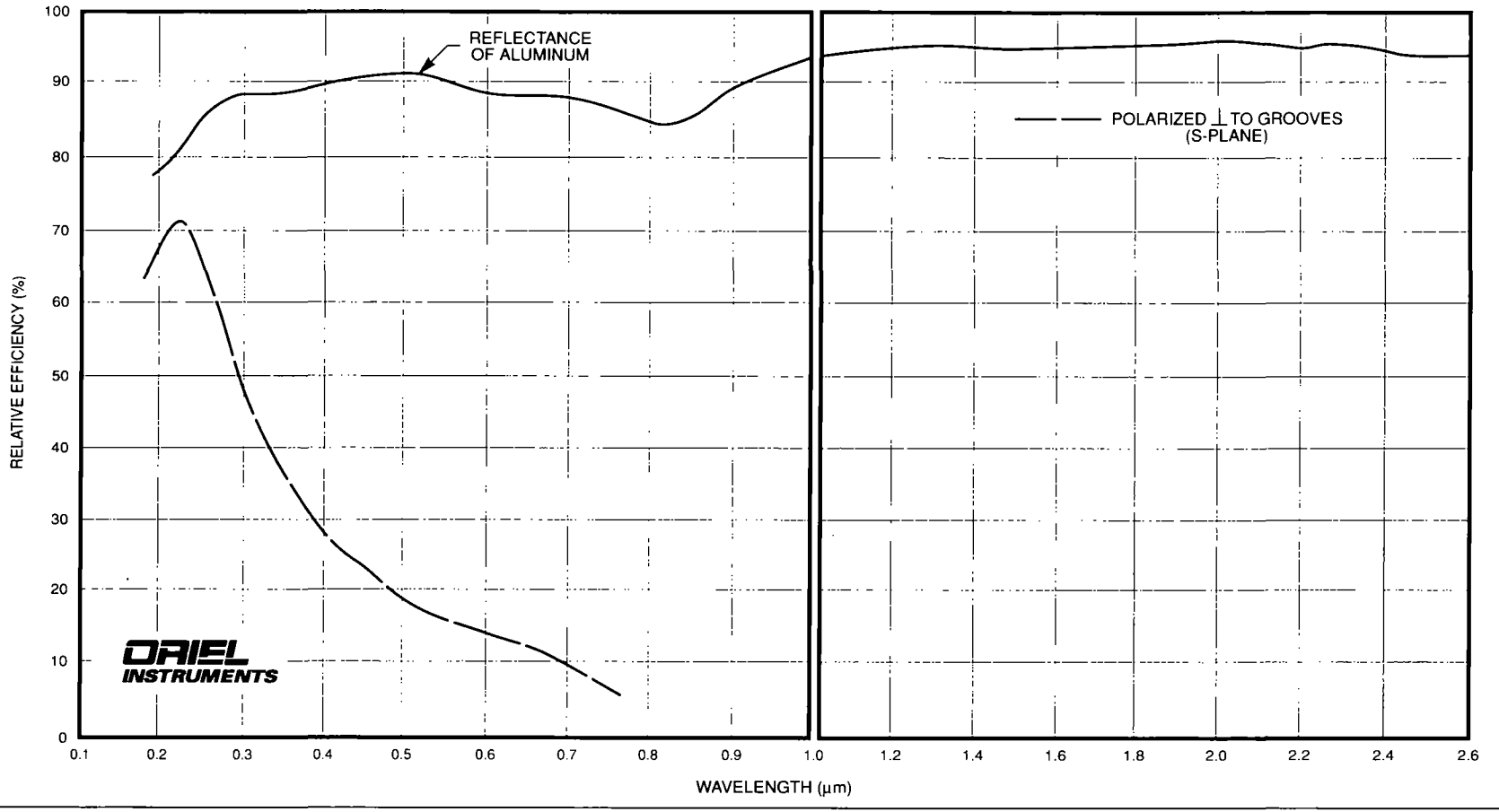


SPECIFICATIONS

Line Density:	75 l/mm	Usable Wavelength Region[2]:	4.5-21 µm
Blaze Wavelength:	7 µm	77250 1/8 m Monochromator equivalent grating (page):	77302 (37)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77237 (51)
Reciprocal Dispersion at Blaze Wavelength:	51.7 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrograph:	1300 nm	Unmounted equivalent grating (page):	77951/77952 (88)
Primary Wavelength Region[1]:	4.5-20 µm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

GRATING ASSEMBLY: 77304 1/8 m Monochromator Grating



SPECIFICATIONS

Line Density:	600 l/mm
Blaze Wavelength:	200 nm
Type:	Ruled
Reciprocal Dispersion at Blaze Wavelength:	13.3 nm/mm
Wavelength Counter Multiplier:	2
Primary Wavelength Region[1]:	180-500 nm
Usable Wavelength Region[2]:	175-700 nm
77700 Series Monochromator/Spectrograph equivalent grating (page):	77743 (12)
77200 1/4 m Monochromator equivalent grating (page):	77239 (39)
77400 1/8 m Spectrograph equivalent grating (page):	77413 (52)
Unmounted equivalent grating (page):	77917/77918 (64)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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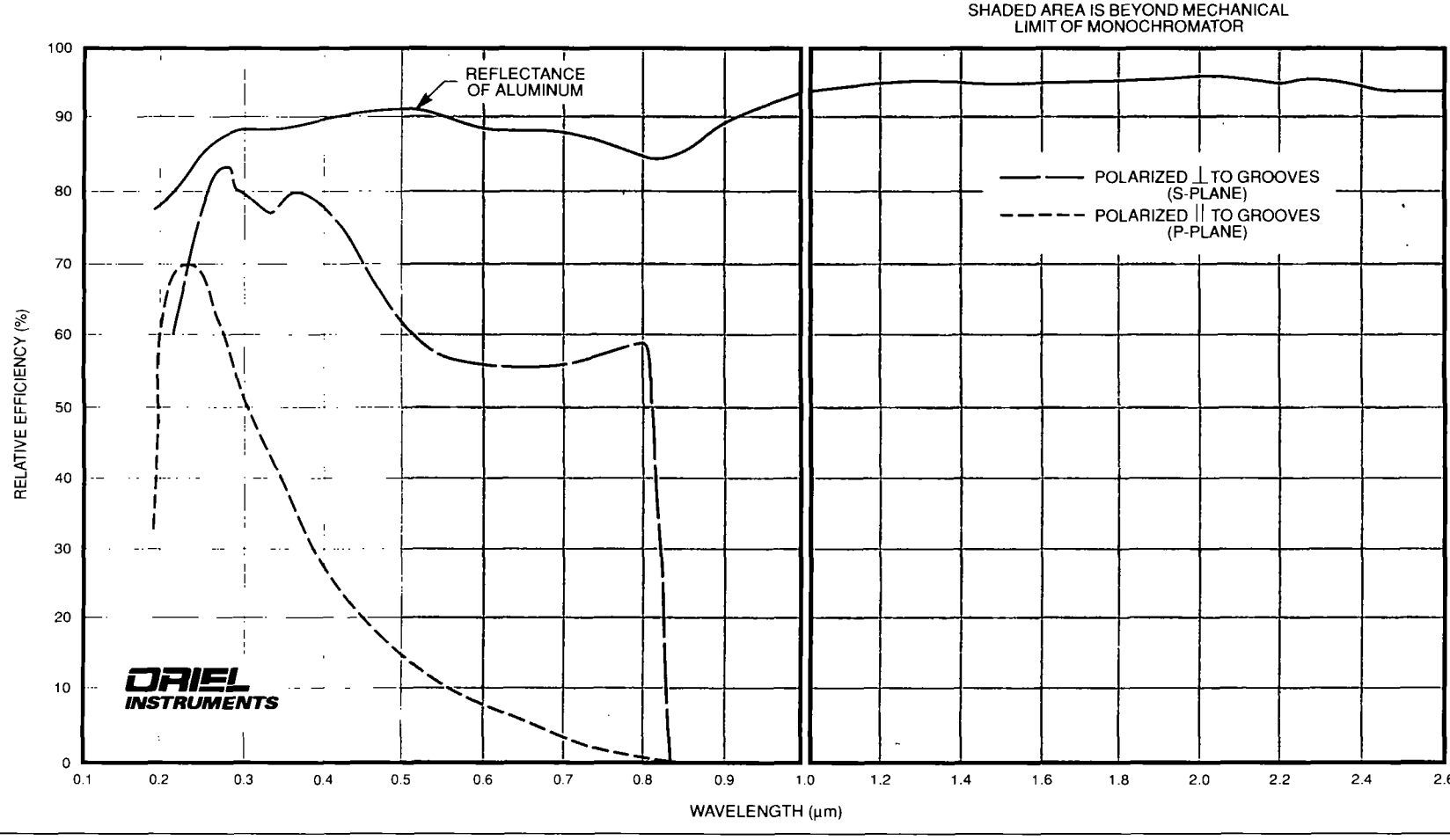
GRATING ASSEMBLY: 77308 1/8 m Monochromator Grating

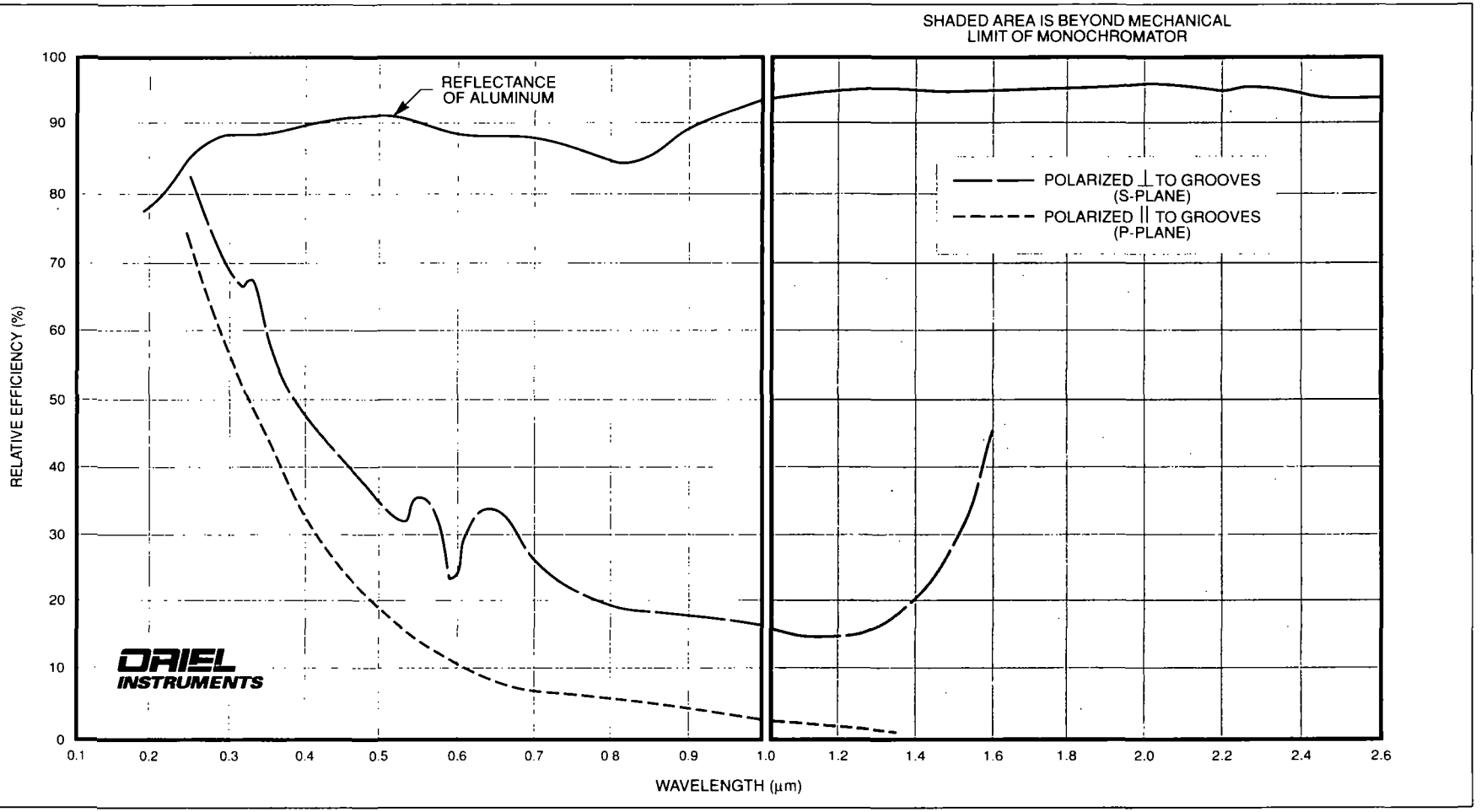


SPECIFICATIONS

Line Density:	2400 l/mm	Usable Wavelength Region[2]:	180-500 nm+
Blaze Wavelength:	250 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77740 (13)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77230 (40)
Reciprocal Dispersion at Blaze Wavelength:	3.3 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77419 (53)
Wavelength Counter Multiplier:	0.5	Unmounted equivalent grating (page):	77901/77902 (65)
Primary Wavelength Region[1]:	200-500 nm+		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77296 1/8 m Monochromator Grating



SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	175-1000 nm
Blaze Wavelength:	250 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77741 (14)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77231 (41)
Reciprocal Dispersion at Blaze Wavelength:	6.7 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77410 (54)
Wavelength Counter Multiplier:	1	Unmounted equivalent grating (page):	77907/77908 (66)
Primary Wavelength Region[1]:	180-650 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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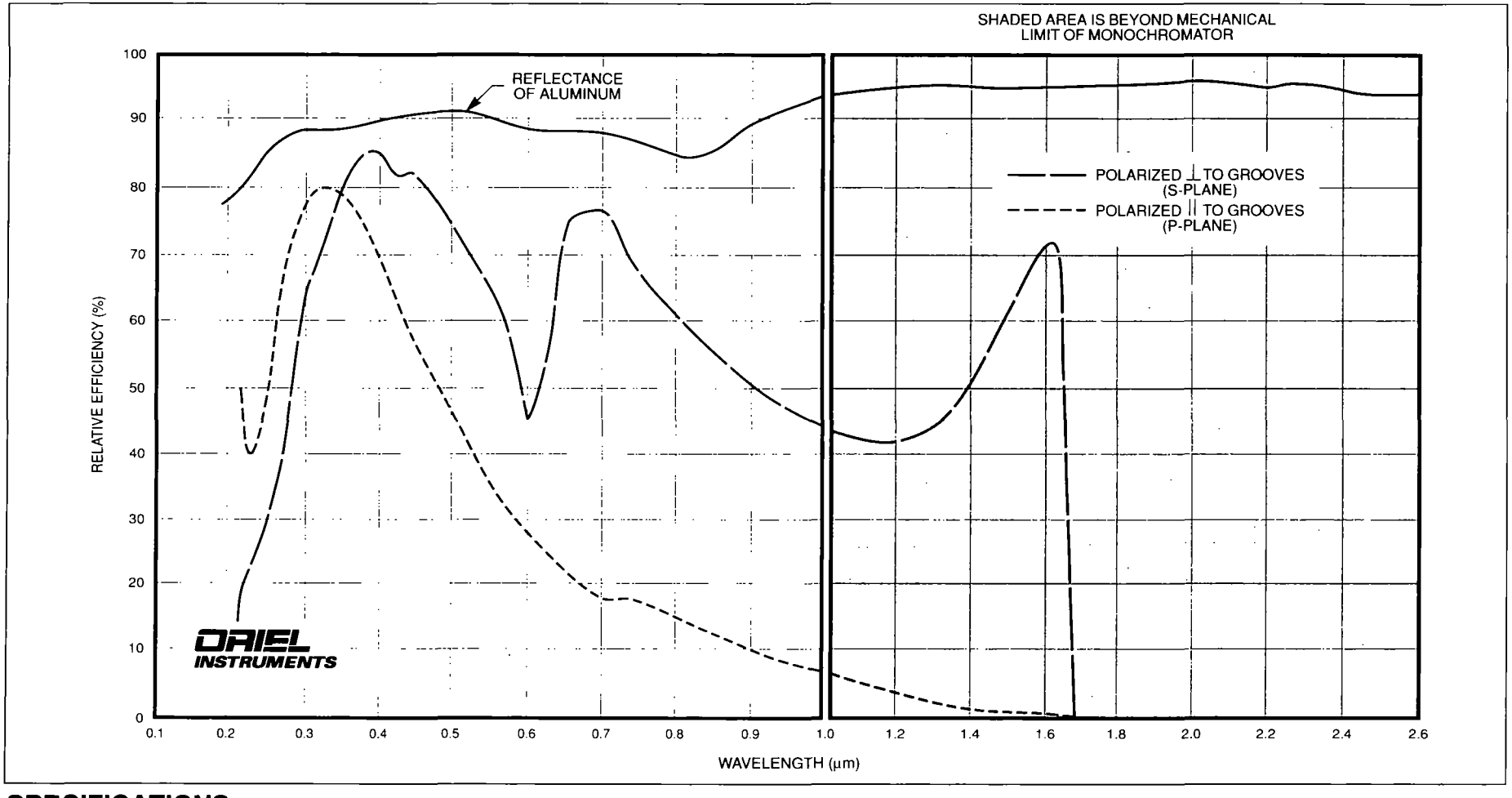
GRATING ASSEMBLY: 77298 1/8 m Monochromator Grating

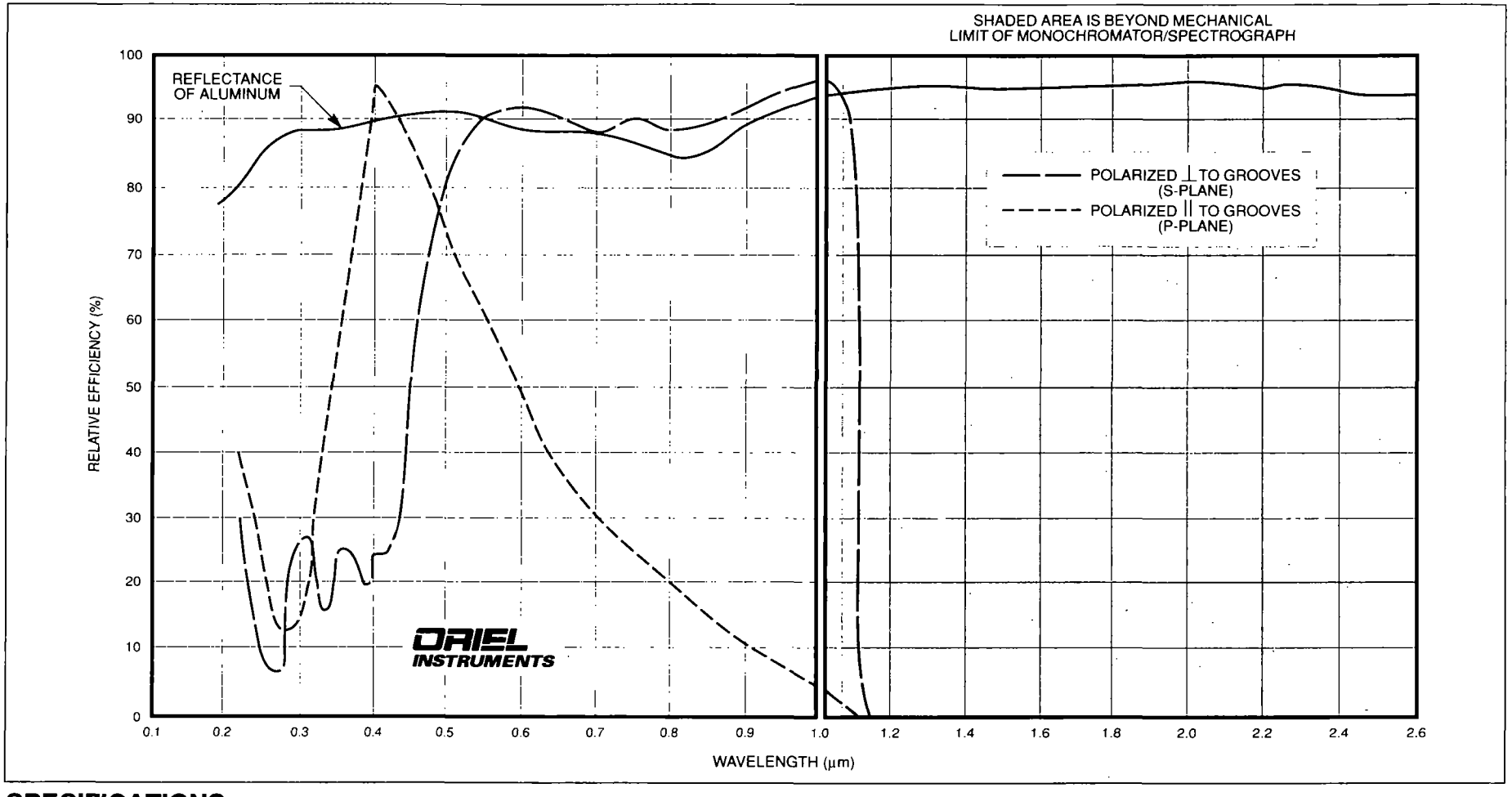


SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	180-1000 nm+
Blaze Wavelength:	350 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77742 (15)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77233 (42)
Reciprocal Dispersion at Blaze Wavelength:	6.6 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77411 (57)
Wavelength Counter Multiplier:	1	Unmounted equivalent grating (page):	77909/77910 (69)
Primary Wavelength Region[1]:	200-1000 nm+		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77309 1/8 m Monochromator Grating



SPECIFICATIONS

Line Density:	1800 l/mm	Usable Wavelength Region[2]:	250-750 nm+
Blaze Wavelength:	500 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77753 (18)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77253 (43)
Reciprocal Dispersion at Blaze Wavelength:	4.1 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77421 (60)
Wavelength Counter Multiplier:	0.66	Unmounted equivalent grating (page):	77905/77906 (74)
Primary Wavelength Region[1]:	300-750 nm+		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+*The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.*

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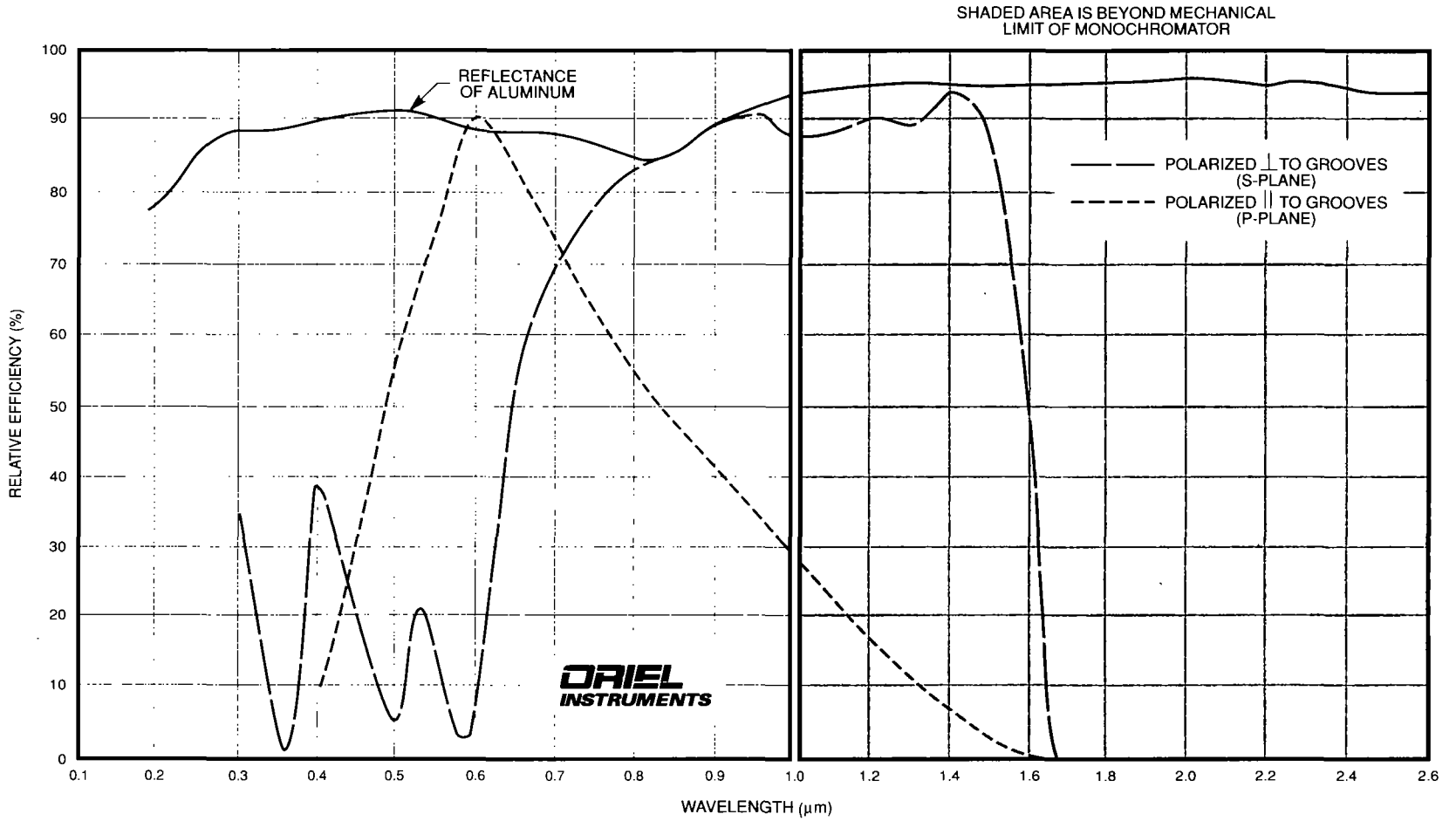
GRATING ASSEMBLY: 77306 1/8 m Monochromator Grating

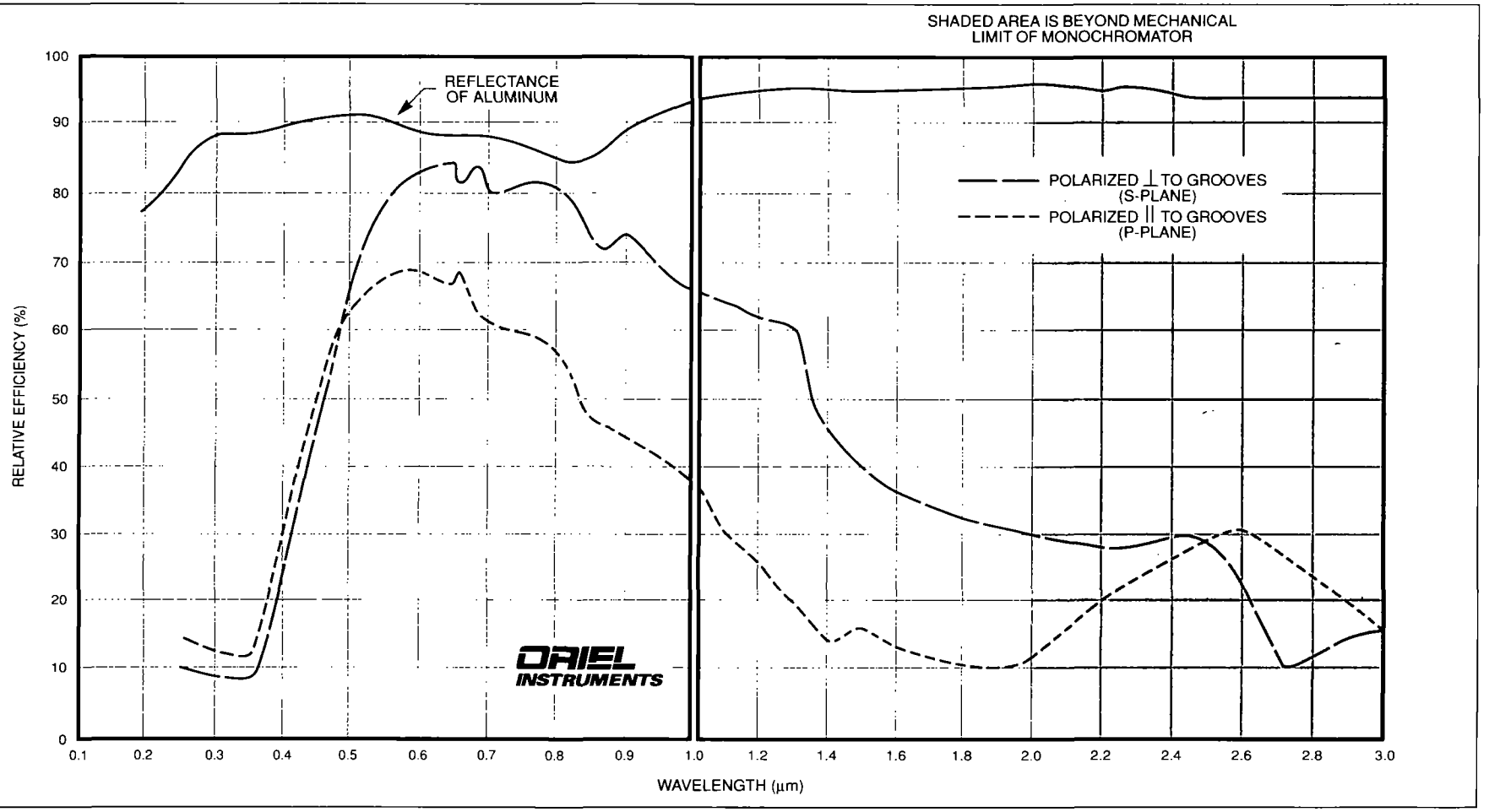


SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	400-1000 nm+
Blaze Wavelength:	750 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77752 (19)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77229 (45)
Reciprocal Dispersion at Blaze Wavelength:	6.2 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77412 (62)
Wavelength Counter Multiplier:	1	Unmounted equivalent grating (page):	77913/77914 (78)
Primary Wavelength Region[1]:	450-1000 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77305 1/8 m Monochromator Grating



SPECIFICATIONS

Line Density:	600 l/mm	Usable Wavelength Region[2]:	400-2000 nm+
Blaze Wavelength:	750 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77243 (46)
Reciprocal Dispersion at Blaze Wavelength:	13.2 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77415 (63)
Wavelength Counter Multiplier:	2	Unmounted equivalent grating (page):	77925/77926 (79)
Primary Wavelength Region[1]:	450-2000 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

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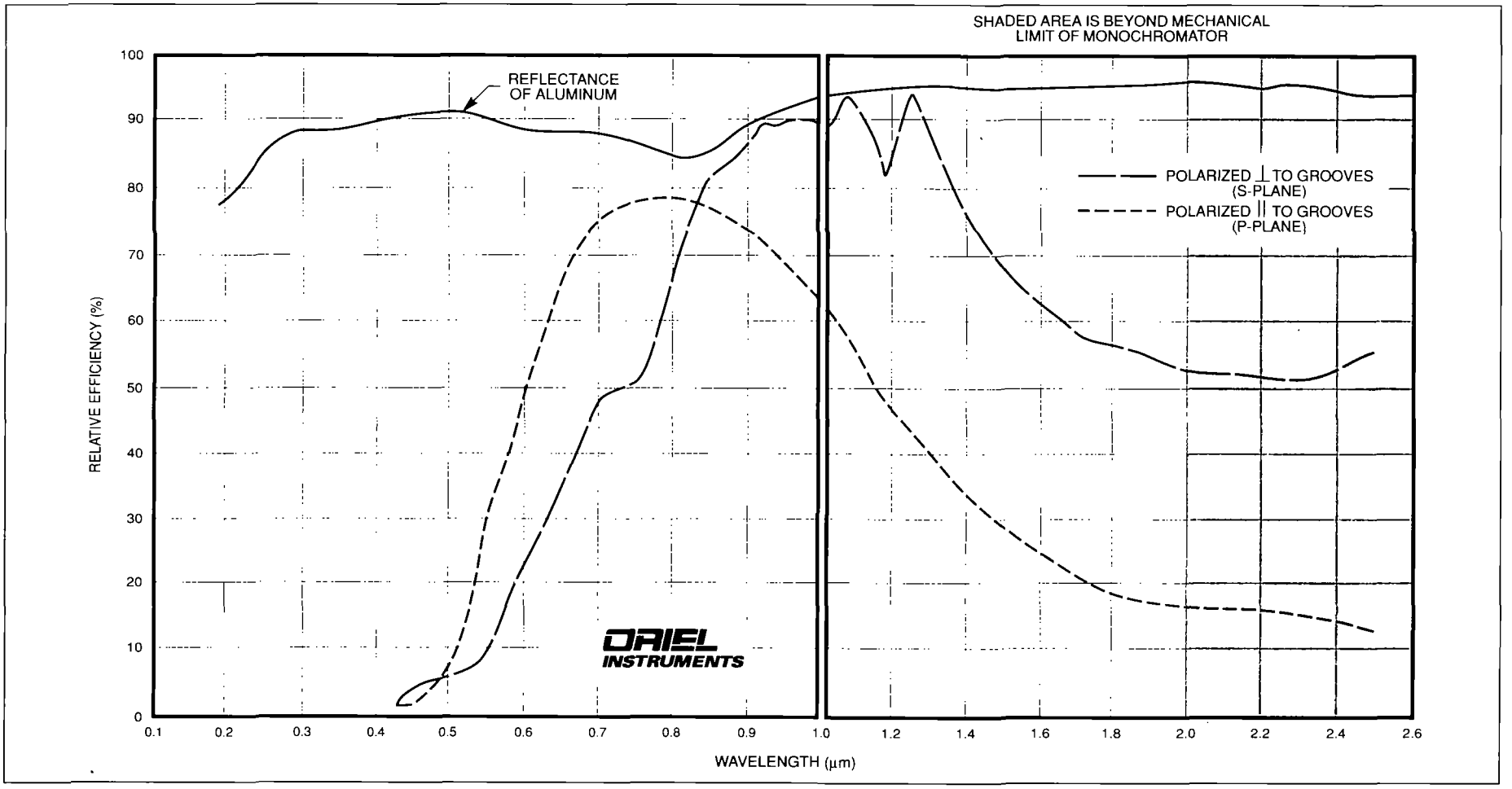
GRATING ASSEMBLY: 77299 1/8 m Monochromator Grating

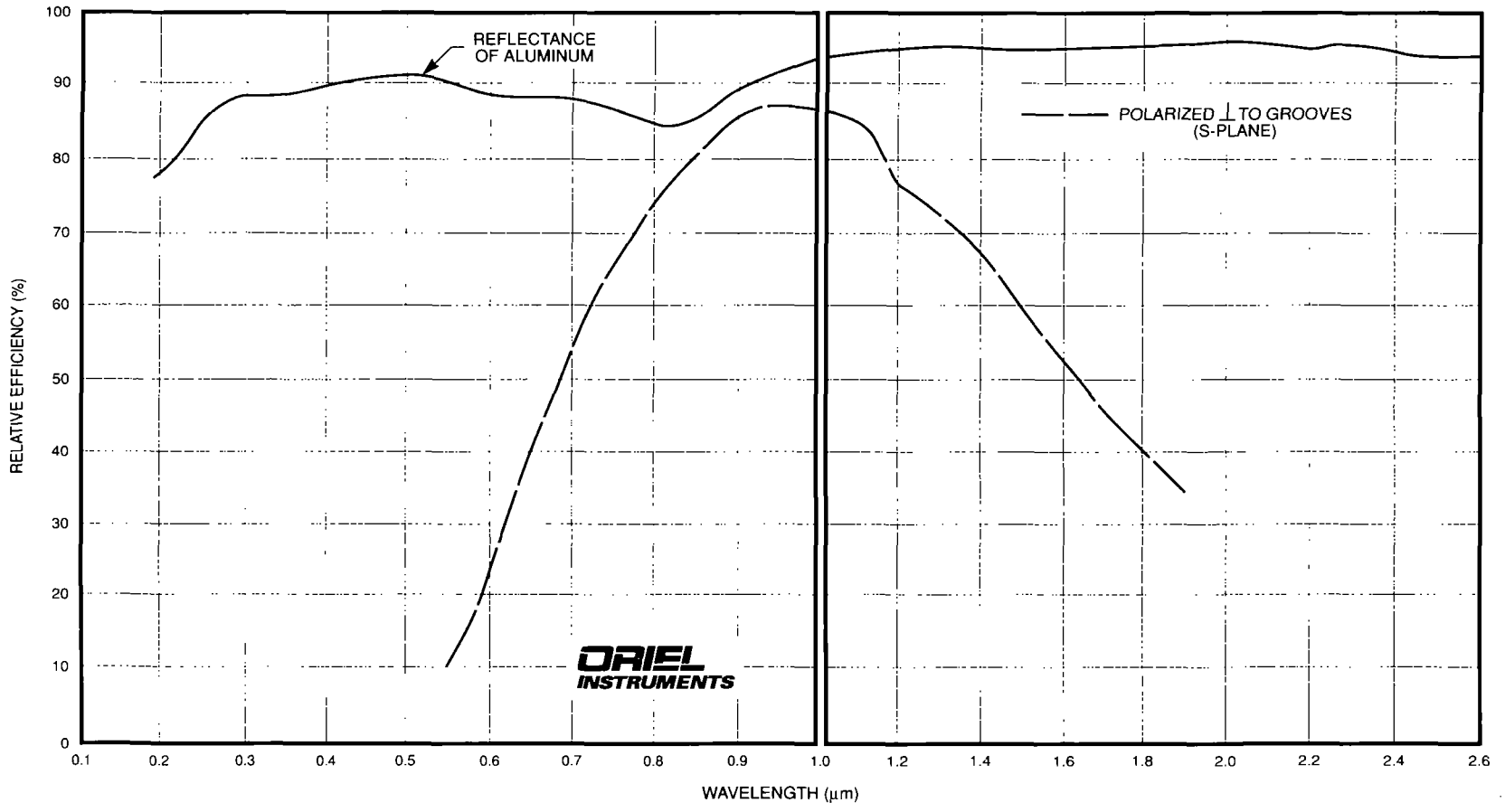


SPECIFICATIONS

Line Density:	600 l/mm	Usable Wavelength Region[2]:	550-2000 nm+
Blaze Wavelength:	1000 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77745 (20)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77234 (47)
Reciprocal Dispersion at Blaze Wavelength:	13 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	2	Unmounted equivalent grating (page):	77927/77928 (82)
Primary Wavelength Region[1]:	600-2000 nm+		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77307 1/8 m Monochromator Grating



SPECIFICATIONS

Line Density:	200 l/mm	Usable Wavelength Region[2]:	550-2400 nm
Blaze Wavelength:	1000 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77749 (21)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77244 (48)
Reciprocal Dispersion at Blaze Wavelength:	40 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	6	Unmounted equivalent grating (page):	77945/77946 (83)
Primary Wavelength Region[1]:	600-2200 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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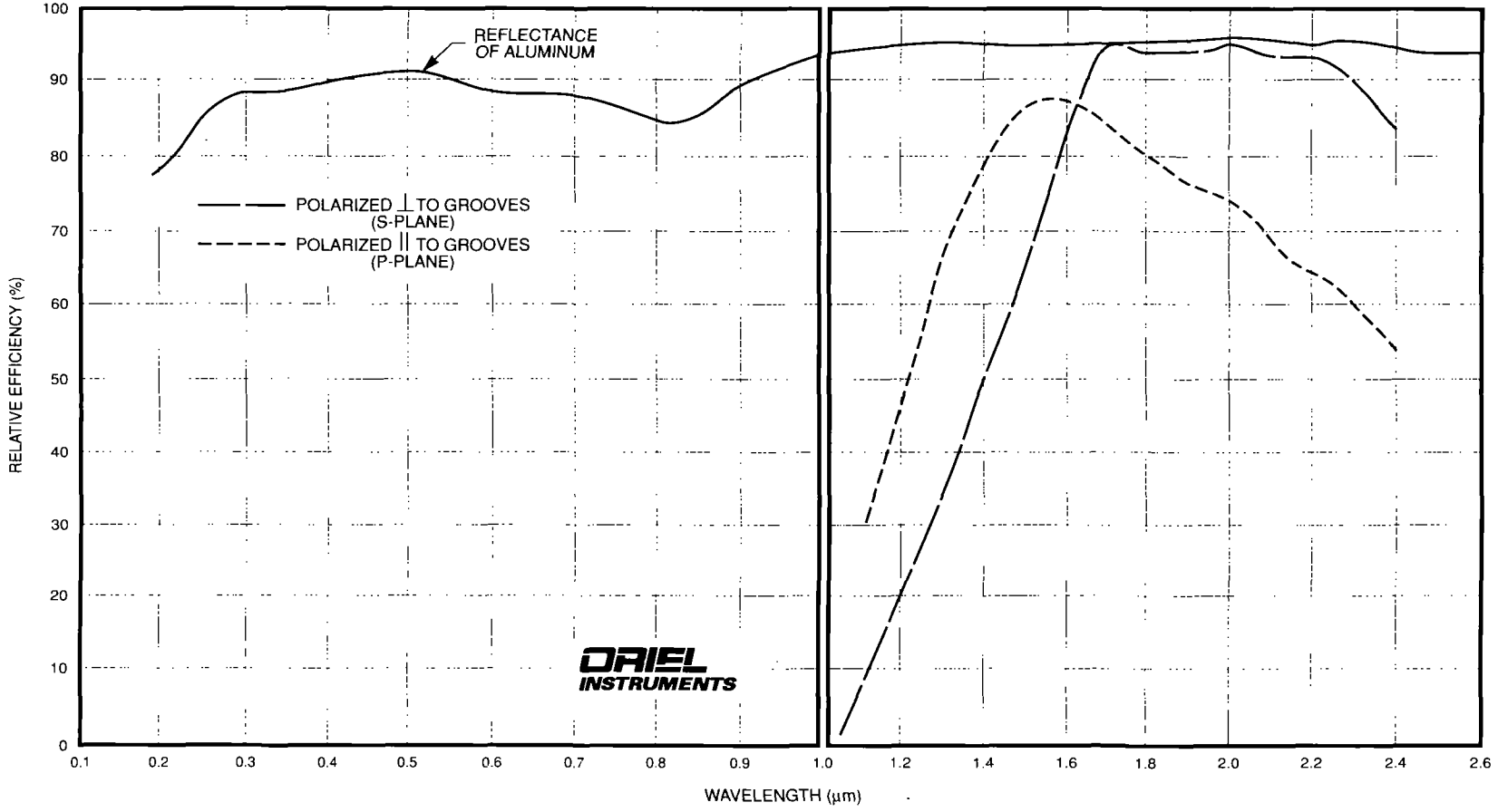
GRATING ASSEMBLY: 77300 1/8 m Monochromator Grating

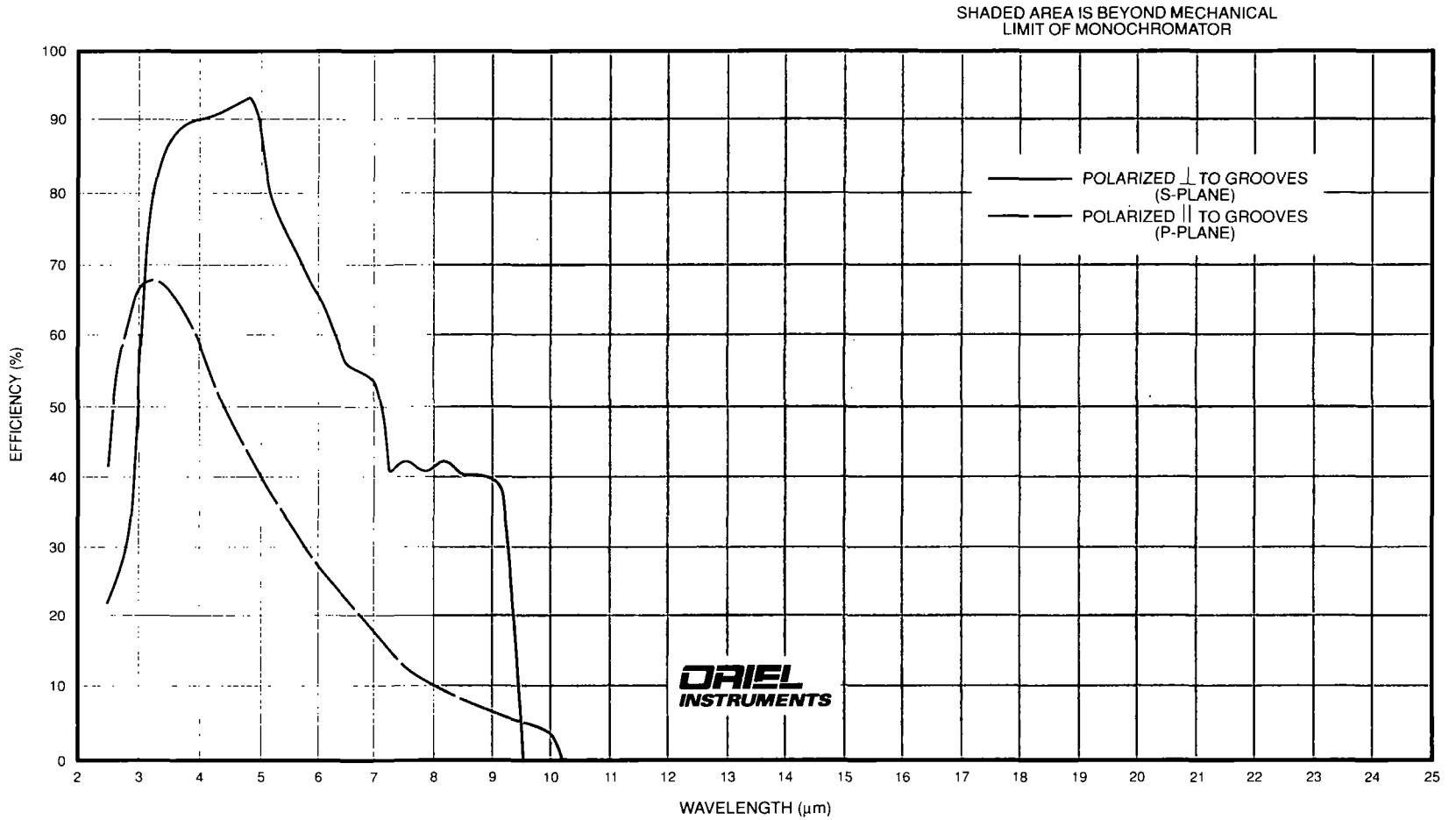


SPECIFICATIONS

Line Density:	300 l/mm	Usable Wavelength Region[2]:	1000-4000 nm
Blaze Wavelength:	2000 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77748 (23)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77235 (49)
Reciprocal Dispersion at Blaze Wavelength:	26 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	4	Unmounted equivalent grating (page):	77941/77942 (85)
Primary Wavelength Region[1]:	1100-3400 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

GRATING ASSEMBLY: 77301 1/8 m Monochromator Grating



SPECIFICATIONS

Line Density:	150 l/mm	Usable Wavelength Region[2]:	2.5-8 µm+
Blaze Wavelength:	4 µm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77750 (24)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77236 (50)
Reciprocal Dispersion at Blaze Wavelength:	52 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	8	Unmounted equivalent grating (page):	77947/77948 (86)
Primary Wavelength Region[1]:	2.5-8 µm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

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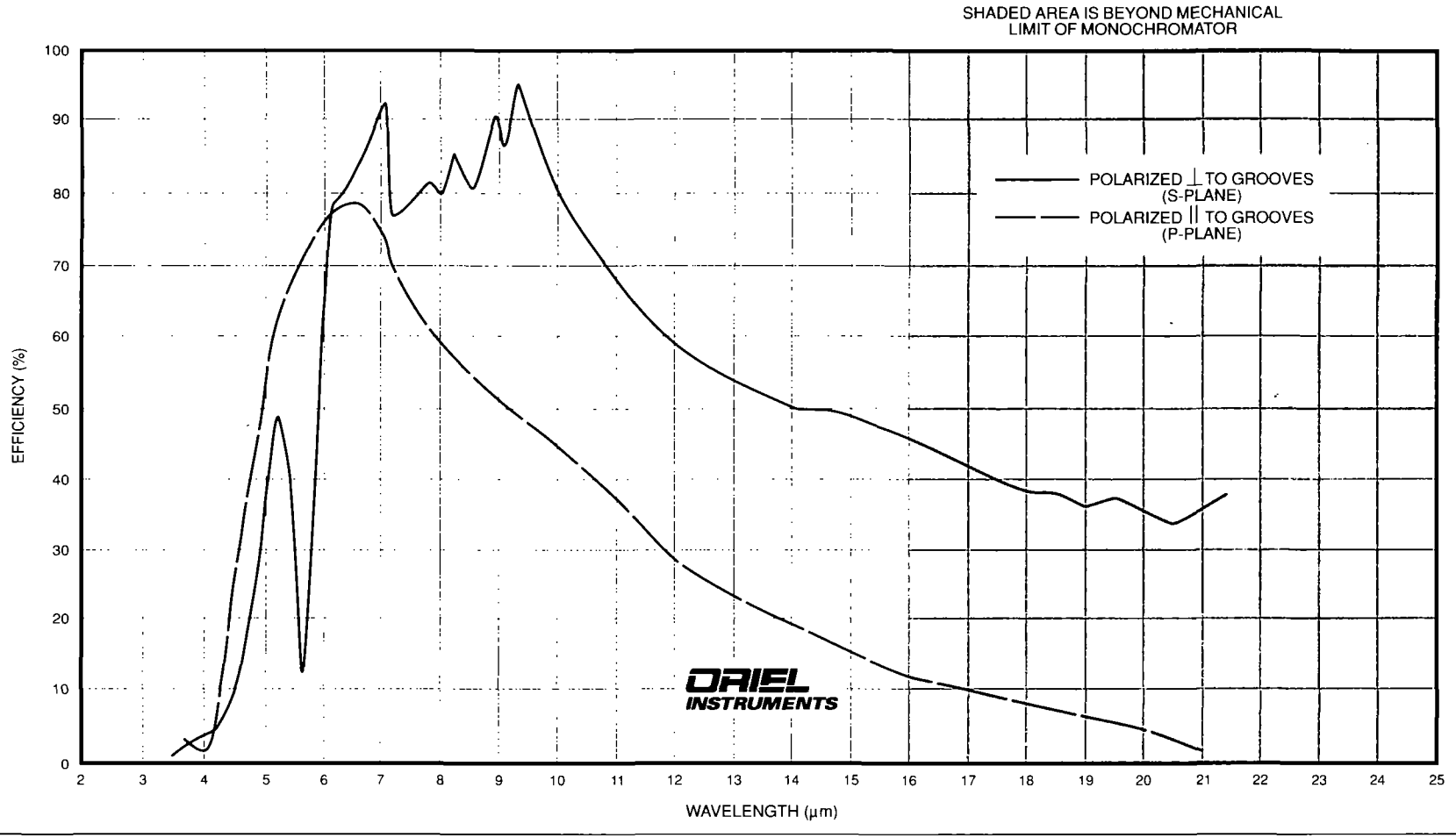
GRATING ASSEMBLY: 77302 1/8 m Monochromator Grating

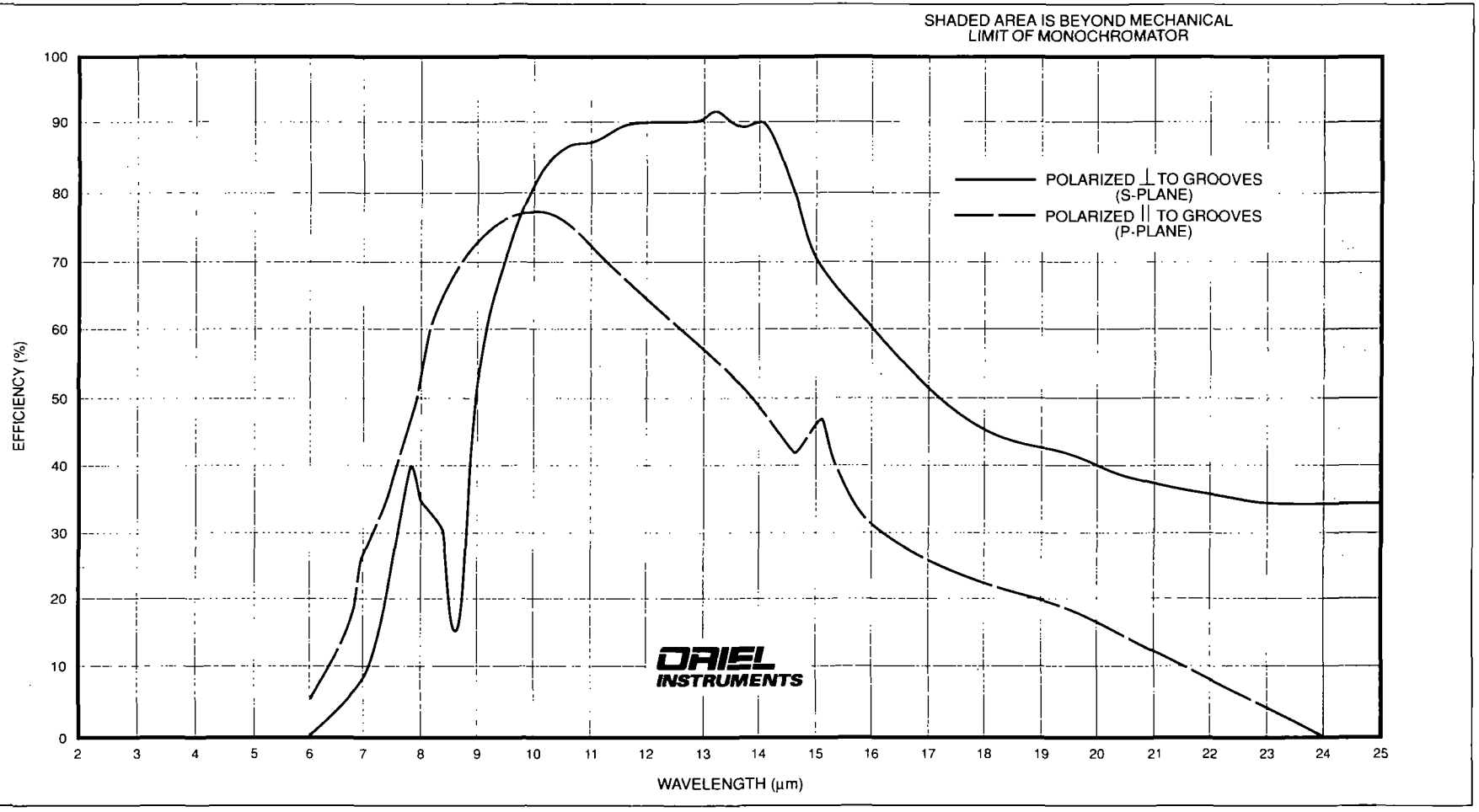


SPECIFICATIONS

Line Density:	75 l/mm	Usable Wavelength Region[2]:	4.5-16 µm+
Blaze Wavelength:	7 µm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77751 (25)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77237 (51)
Reciprocal Dispersion at Blaze Wavelength:	105 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	16	Unmounted equivalent grating (page):	77951/77952 (88)
Primary Wavelength Region[1]:	4.5-16 µm+		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77303 1/8 m Monochromator Grating



SPECIFICATIONS

Line Density:	50 l/mm	Usable Wavelength Region[2]:	6.5-24 µm
Blaze Wavelength:	11 µm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	157 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	24	Unmounted equivalent grating (page):	77953/77954 (89)
Primary Wavelength Region[1]:	7-23 µm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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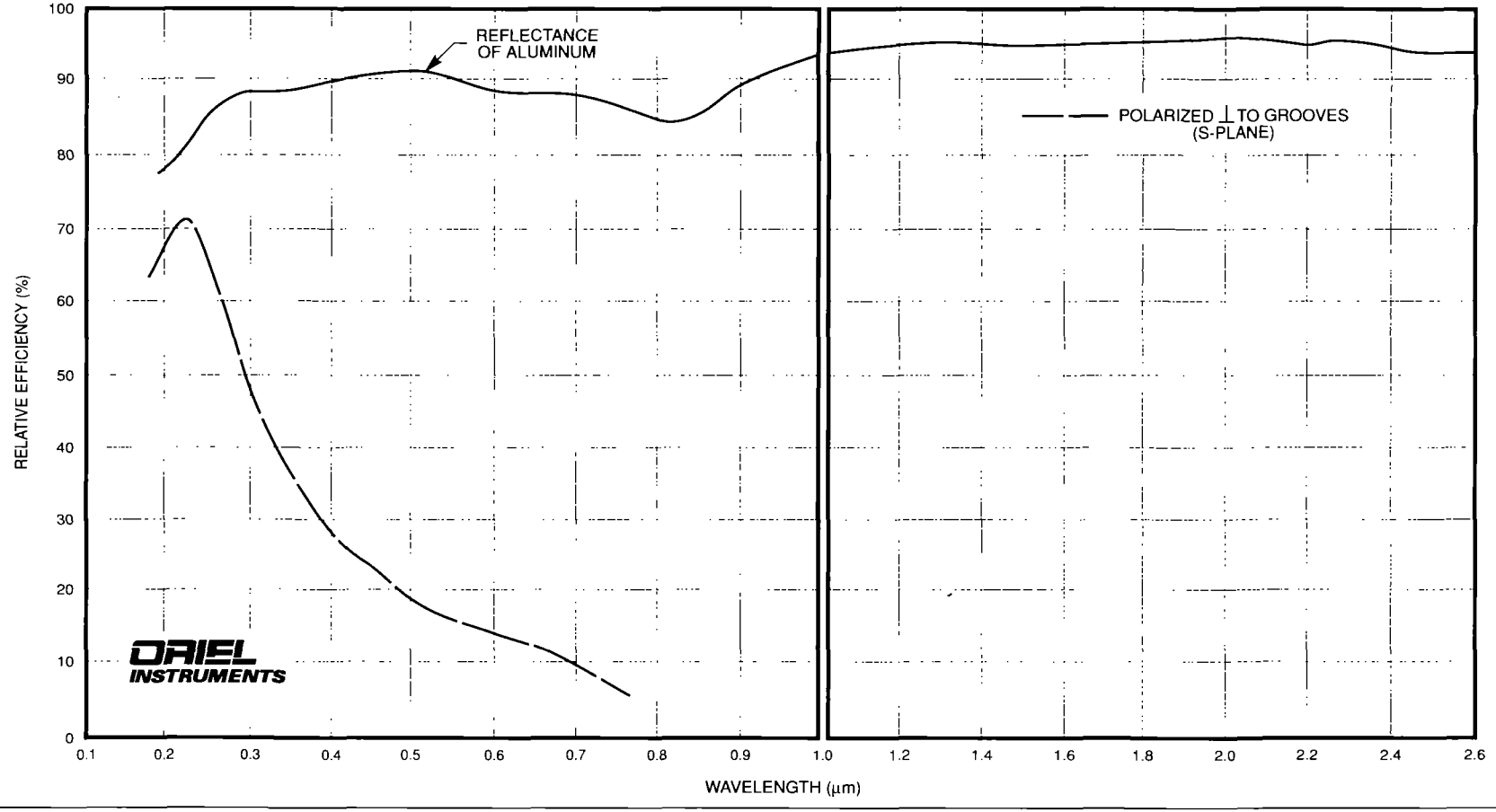
GRATING ASSEMBLY: 77239 1/4 m Monochromator Grating

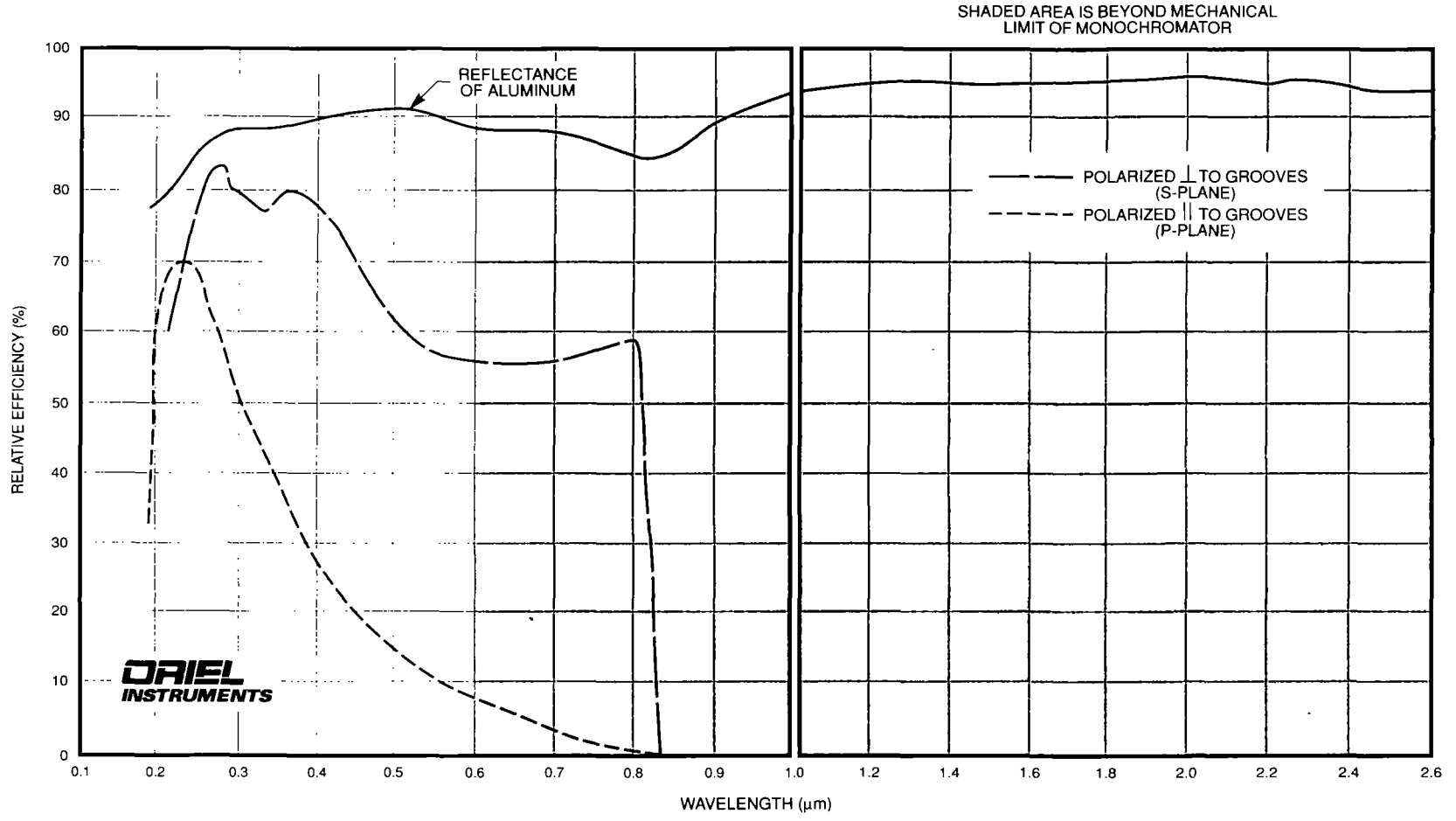


SPECIFICATIONS

Line Density:	600 l/mm	Usable Wavelength Region[2]:	175-700 nm
Blaze Wavelength:	200 nm	*77700 Series* Monochromator/Spectrograph equivalent grating (page):	77743 (12)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77304 (26)
Reciprocal Dispersion at Blaze Wavelength:	6.4 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77413 (52)
Wavelength Counter Multiplier:	2	Unmounted equivalent grating (page):	77917/77918 (64)
Primary Wavelength Region[1]:	180-500 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

GRATING ASSEMBLY: 77230 1/4 m Monochromator Grating



SPECIFICATIONS

Line Density:	2400 l/mm	Usable Wavelength Region[2]:	180-600 nm+
Blaze Wavelength:	250 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77740 (13)
Type:	Holographic	77250 1/8 m Monochromator equivalent grating (page):	77308 (27)
Reciprocal Dispersion at Blaze Wavelength:	1.4 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77419 (53)
Wavelength Counter Multiplier:	0.5	Unmounted equivalent grating (page):	77901/77902 (65)
Primary Wavelength Region[1]:	200-600 nm+		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

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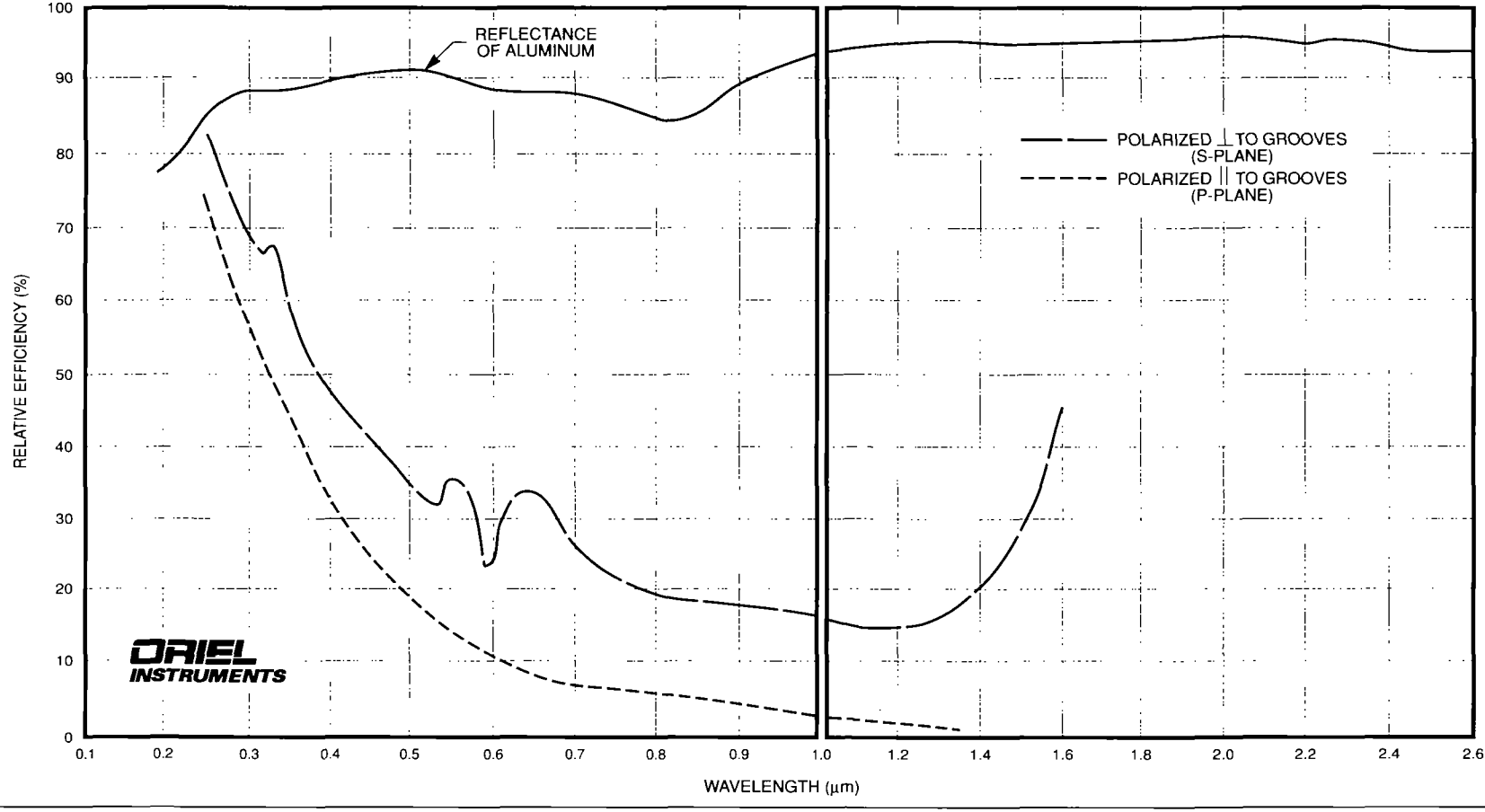
GRATING ASSEMBLY: 77231 1/4 m Monochromator Grating

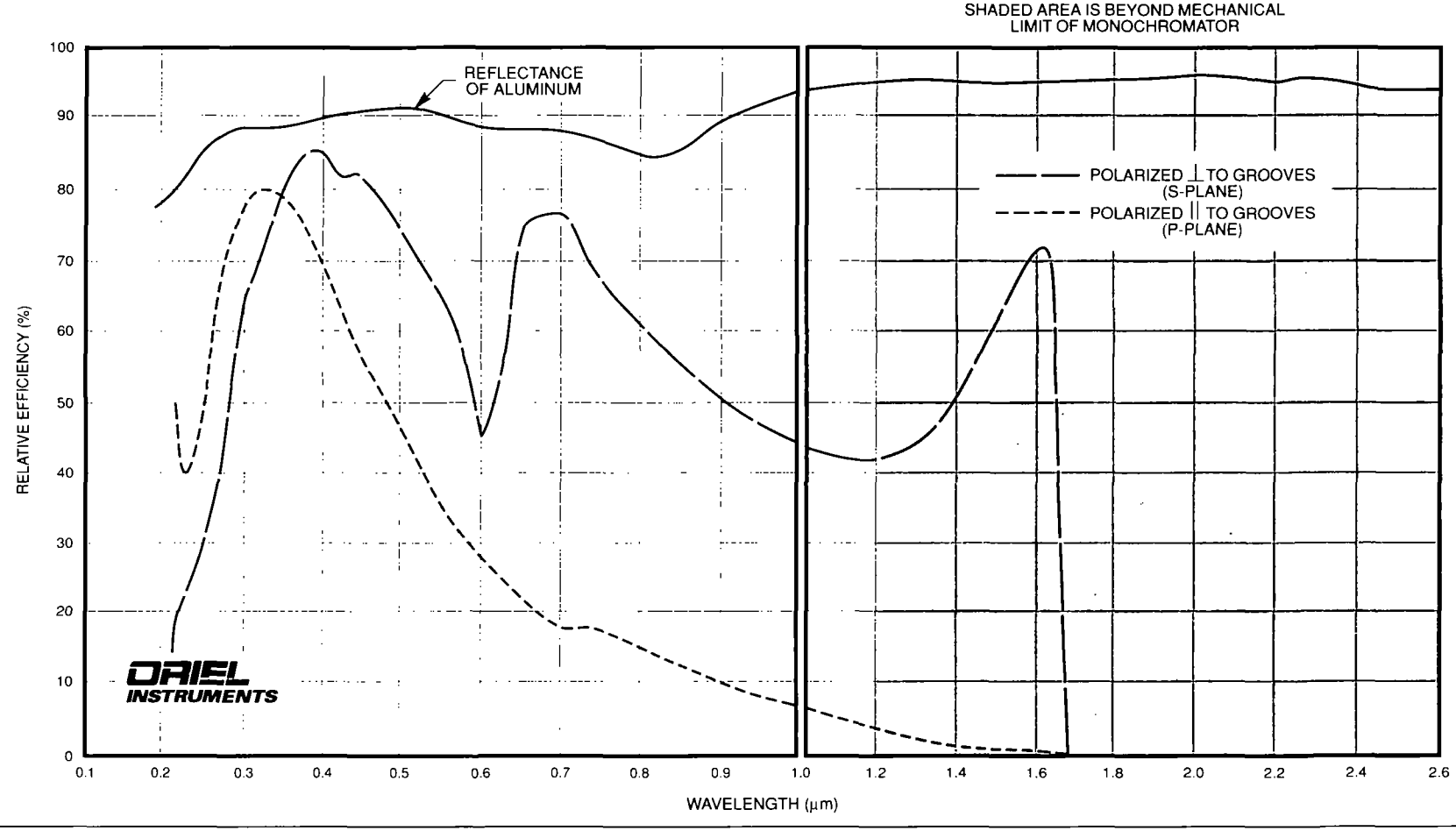


SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	175-1000 nm
Blaze Wavelength:	250 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77741 (14)
Type:	Holographic	77250 1/8 m Monochromator equivalent grating (page):	77296 (28)
Reciprocal Dispersion at Blaze Wavelength:	3.1 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77410 (54)
Wavelength Counter Multiplier:	1	Unmounted equivalent grating (page):	77907/77908 (66)
Primary Wavelength Region[1]:	180-650 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

GRATING ASSEMBLY: 77233 1/4 m Monochromator Grating



SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	180-1200 nm+
Blaze Wavelength:	350 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77742 (15)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77298 (29)
Reciprocal Dispersion at Blaze Wavelength:	3 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77411 (57)
Wavelength Counter Multiplier:	1	Unmounted equivalent grating (page):	77909/77910 (69)
Primary Wavelength Region[1]:	200-1200 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

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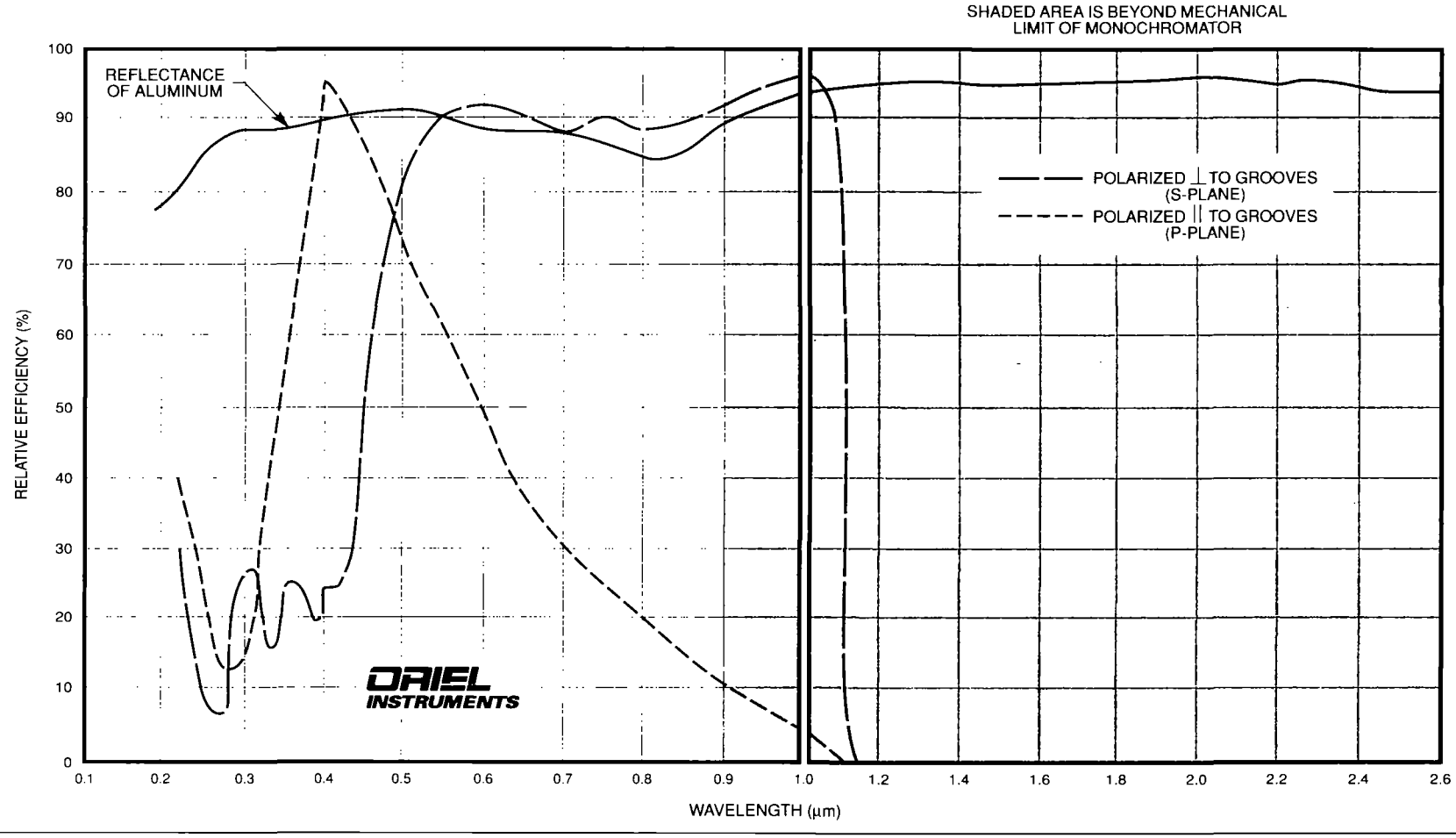
GRATING ASSEMBLY: 77253 1/4 m Monochromator Grating

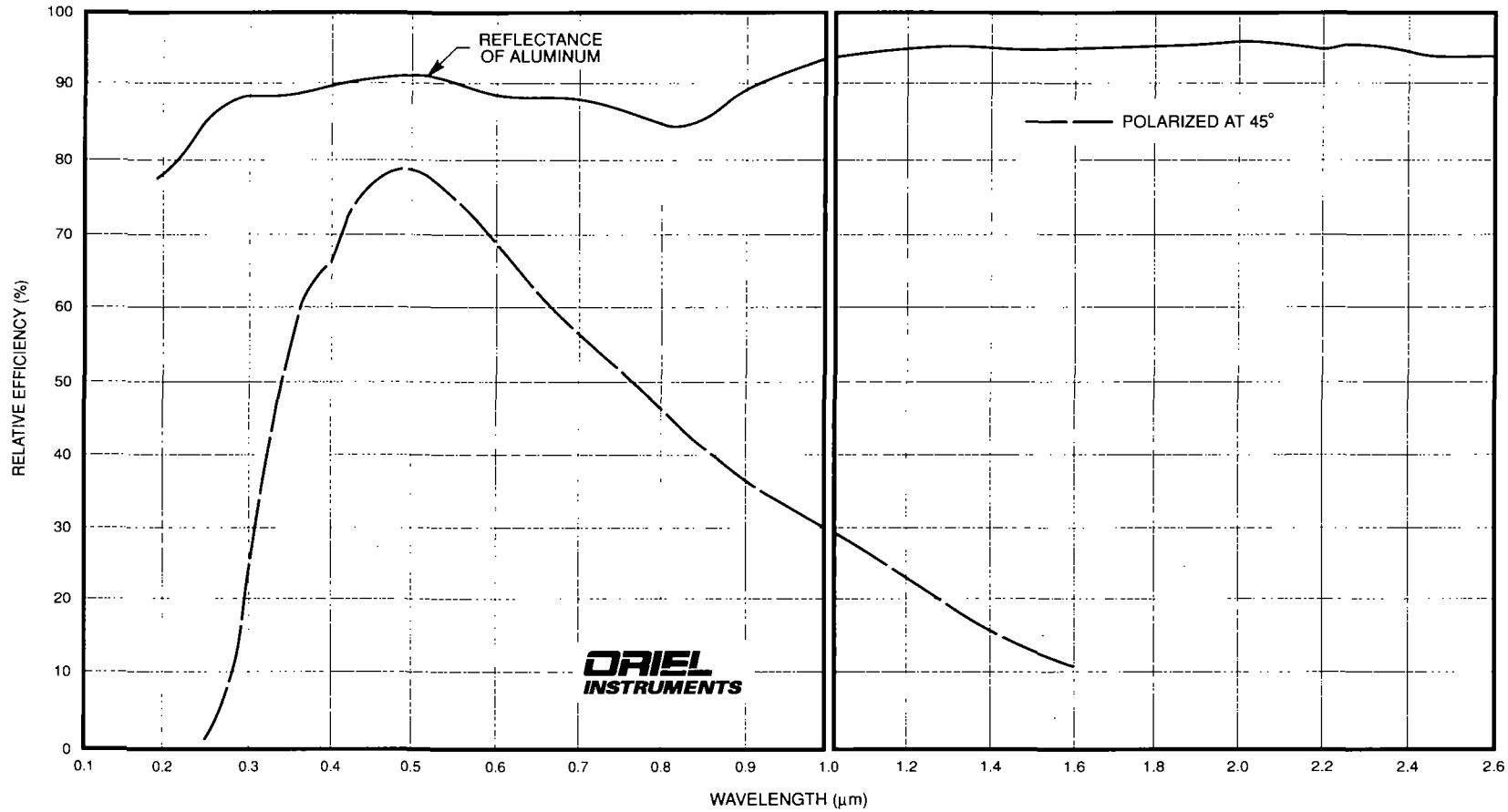


SPECIFICATIONS

Line Density:	1800 l/mm	Usable Wavelength Region[2]:	250-900 nm+
Blaze Wavelength:	500 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77753 (18)
Type:	Holographic	77250 1/8 m Monochromator equivalent grating (page):	77309 (30)
Reciprocal Dispersion at Blaze Wavelength:	1.7 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77421 (60)
Wavelength Counter Multiplier:	0.66	Unmounted equivalent grating (page):	77905/77906 (74)
Primary Wavelength Region[1]:	300-900 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77240 1/4 m Monochromator Grating



SPECIFICATIONS

Line Density:	400 l/mm	Usable Wavelength Region[2]:	270-1600 nm
Blaze Wavelength:	500 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	9.4 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77417 (61)
Wavelength Counter Multiplier:	3	Unmounted equivalent grating (page):	77931/77932 (77)
Primary Wavelength Region[1]:	300-1200 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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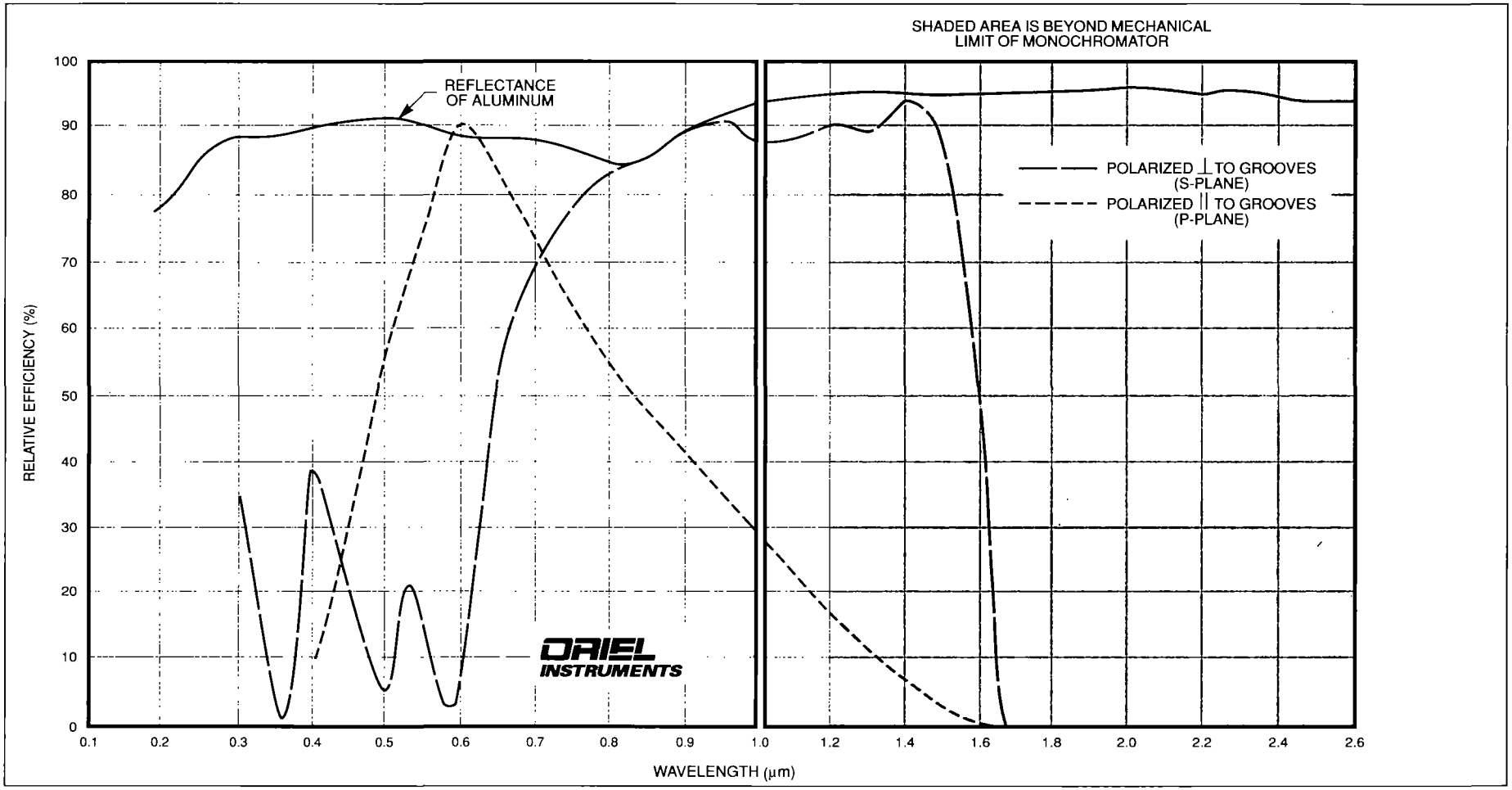
GRATING ASSEMBLY: 77229 1/4 m Monochromator Grating

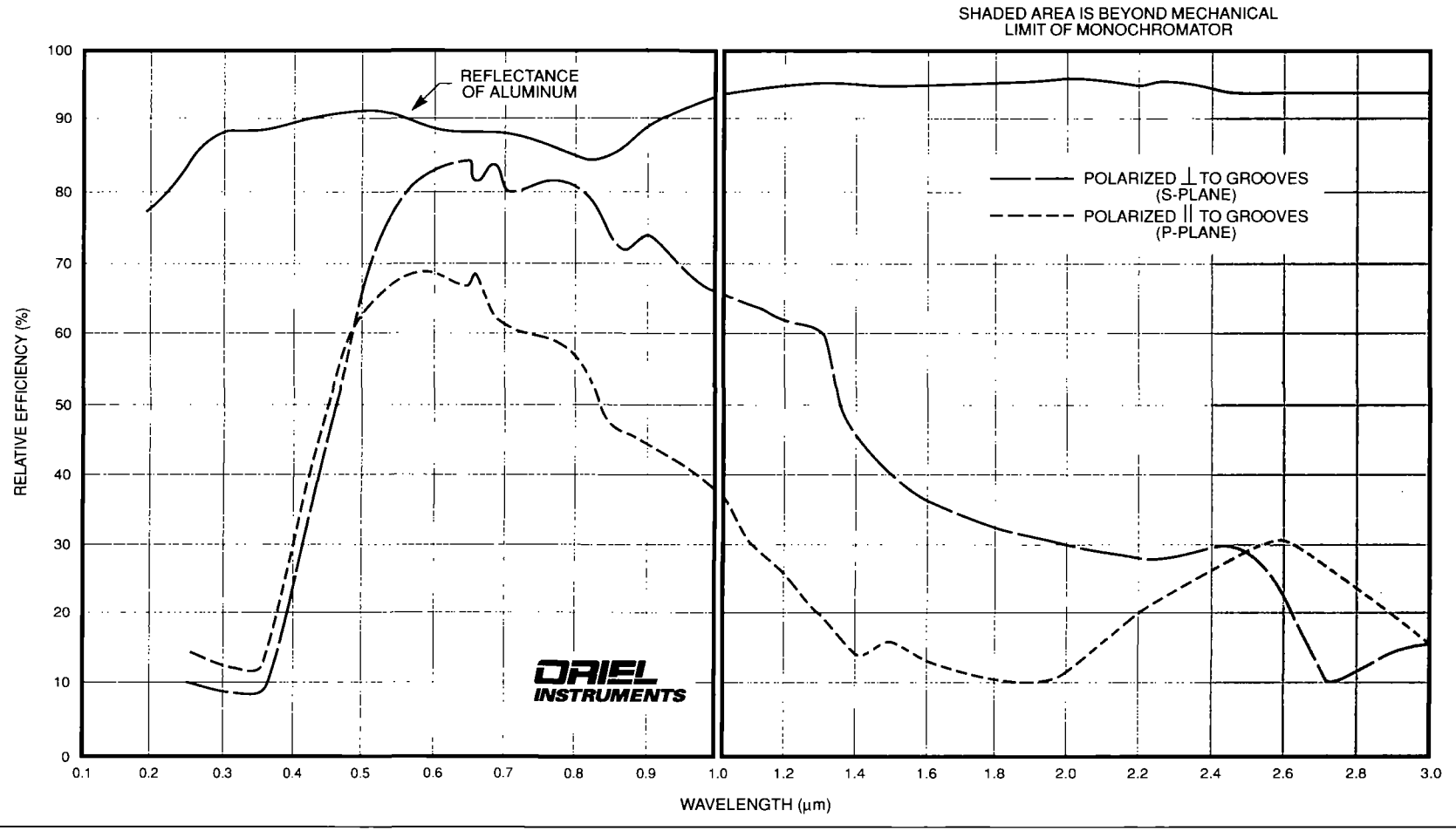


SPECIFICATIONS

Line Density:	1200 l/mm	Usable Wavelength Region[2]:	400-1200 nm+
Blaze Wavelength:	750 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77752 (19)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77306 (31)
Reciprocal Dispersion at Blaze Wavelength:	2.5 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77412 (62)
Wavelength Counter Multiplier:	1	Unmounted equivalent grating (page):	77913/77914 (78)
Primary Wavelength Region[1]:	450-1200 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77243 1/4 m Monochromator Grating



SPECIFICATIONS

Line Density:	600 l/mm	Usable Wavelength Region[2]:	400-2400 nm+
Blaze Wavelength:	750 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77305 (32)
Reciprocal Dispersion at Blaze Wavelength:	6 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	77415 (63)
Wavelength Counter Multiplier:	2	Unmounted equivalent grating (page):	77925/77926 (79)
Primary Wavelength Region[1]:	450-2400 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

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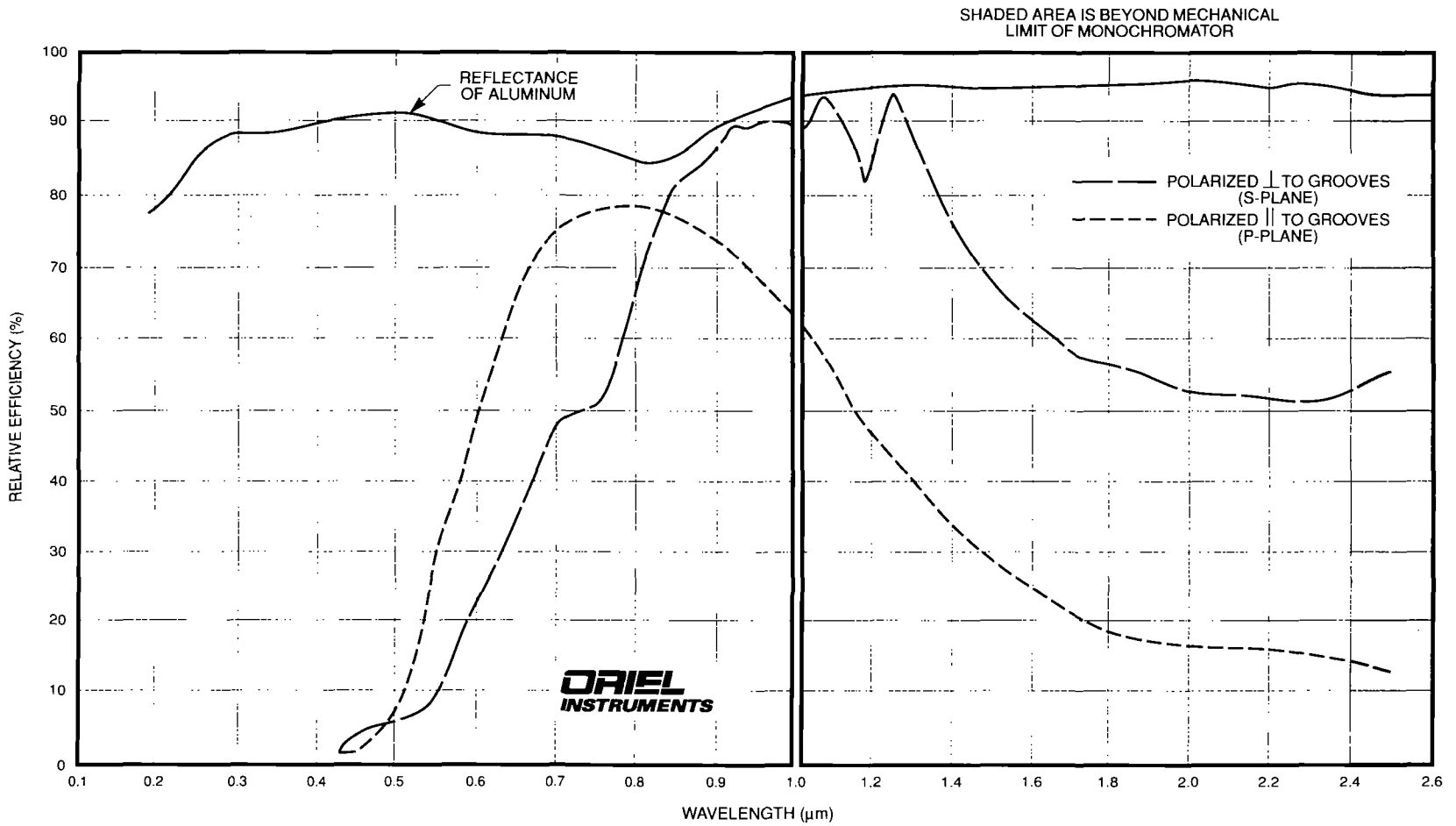
GRATING ASSEMBLY: 77234 1/4 m Monochromator Grating

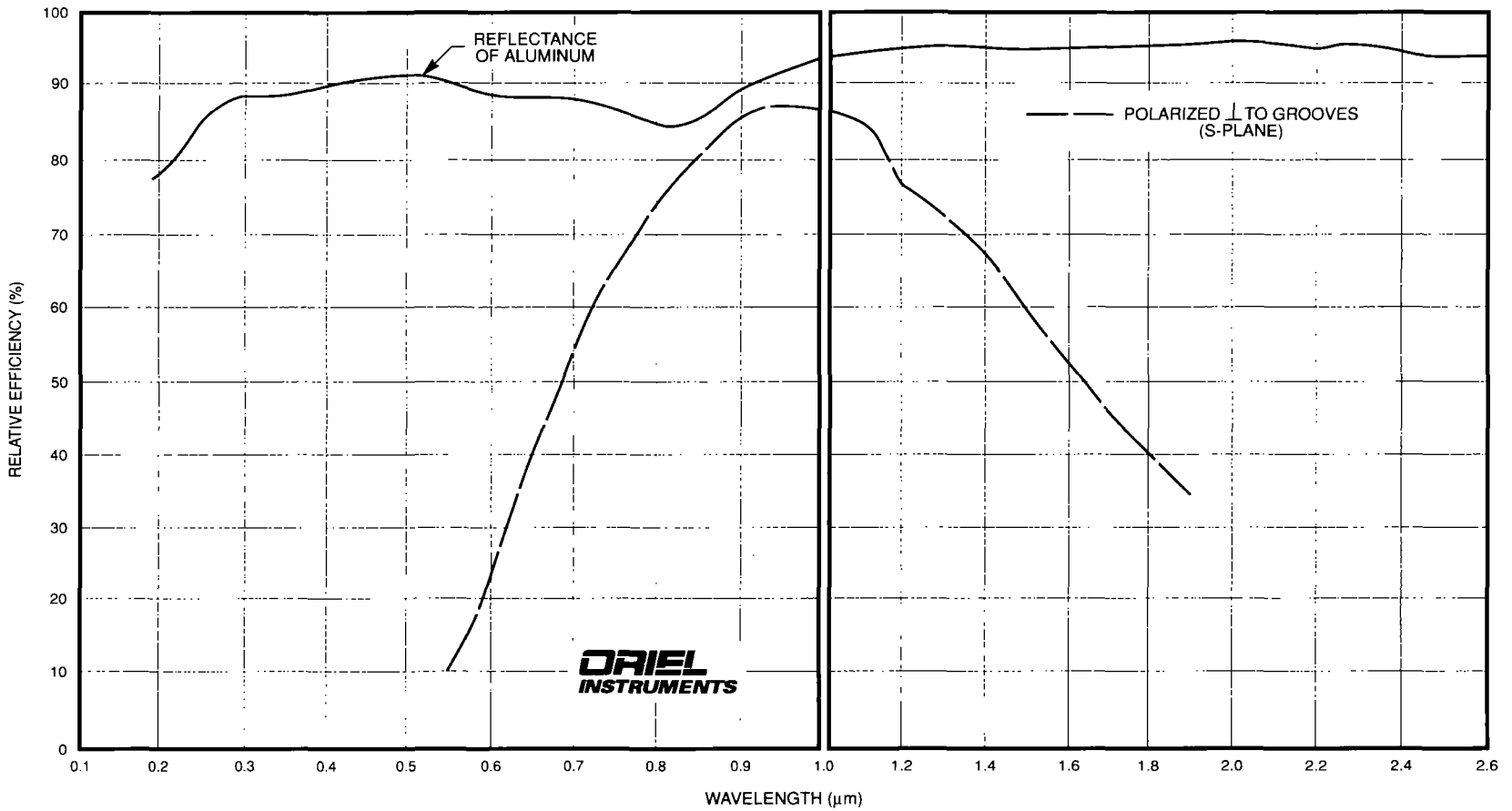


SPECIFICATIONS

Line Density:	600 l/mm	Usable Wavelength Region[2]:	550-2400 nm+
Blaze Wavelength:	1000 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77745 (20)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77299 (33)
Reciprocal Dispersion at Blaze Wavelength:	5.7 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	2	Unmounted equivalent grating (page):	77927/77928 (82)
Primary Wavelength Region[1]:	600-2400 nm+		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77244 1/4 m Monochromator Grating



SPECIFICATIONS

Line Density:	200 l/mm	Usable Wavelength Region[2]:	550-2400 nm
Blaze Wavelength:	1000 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77749 (21)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77307 (34)
Reciprocal Dispersion at Blaze Wavelength:	18.9 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	6	Unmounted equivalent grating (page):	77945/77946 (83)
Primary Wavelength Region[1]:	600-2200 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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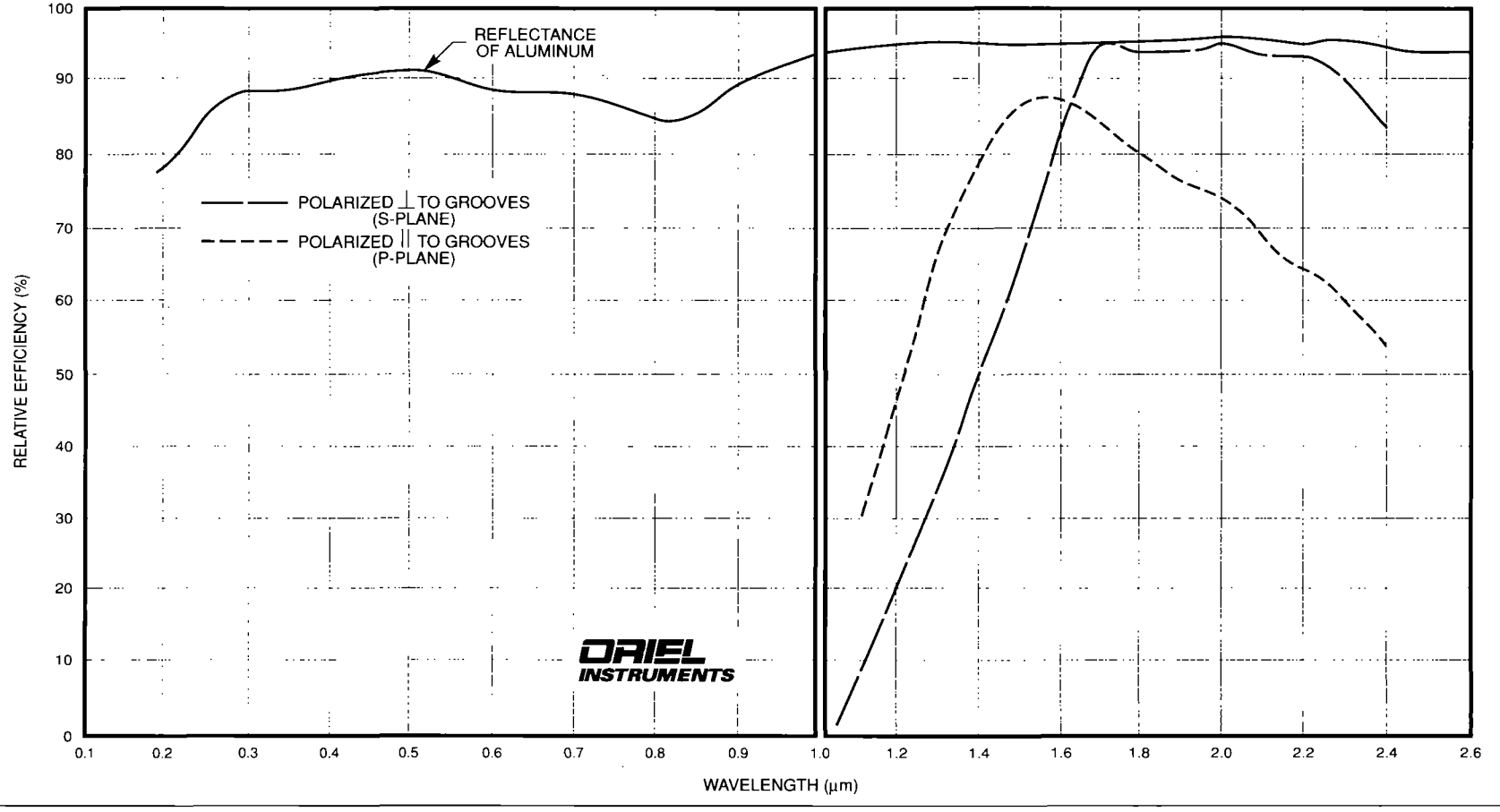
GRATING ASSEMBLY: 77235 1/4 m Monochromator Grating

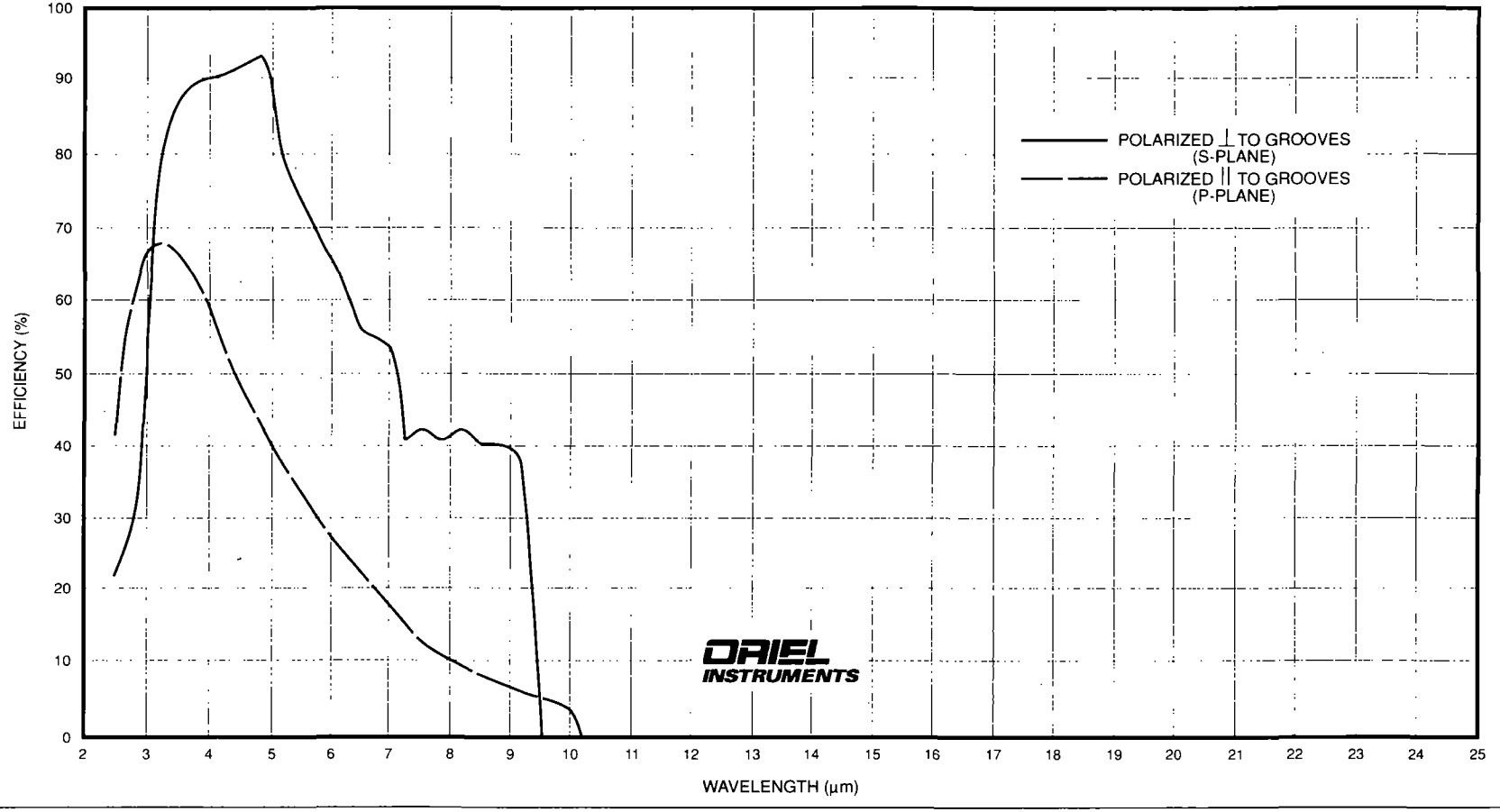


SPECIFICATIONS

Line Density:	300 l/mm	Usable Wavelength Region[2]:	1000-4000 nm
Blaze Wavelength:	2000 nm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77748 (23)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77300 (35)
Reciprocal Dispersion at Blaze Wavelength:	11.4 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	4	Unmounted equivalent grating (page):	77941/77942 (85)
Primary Wavelength Region[1]:	1100-3400 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

GRATING ASSEMBLY: 77236 1/4 m Monochromator Grating



SPECIFICATIONS

Line Density:	150 l/mm	Usable Wavelength Region[2]:	2.5-9.5 µm
Blaze Wavelength:	4 µm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77750 (24)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77301 (36)
Reciprocal Dispersion at Blaze Wavelength:	23 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	8	Unmounted equivalent grating (page):	77947/77948 (86)
Primary Wavelength Region[1]:	2.5-9 µm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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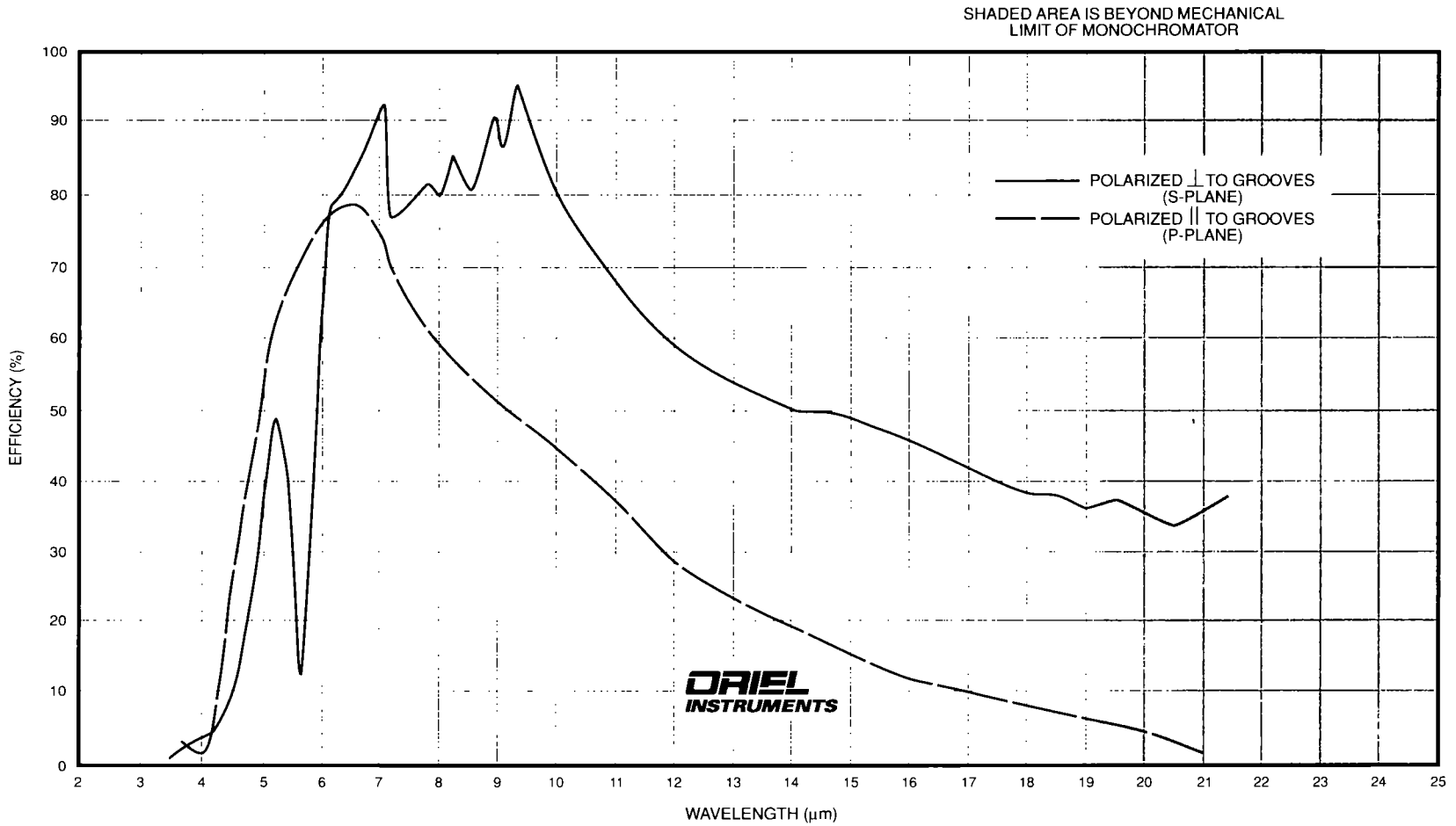
GRATING ASSEMBLY: 77237 1/4 m Monochromator Grating

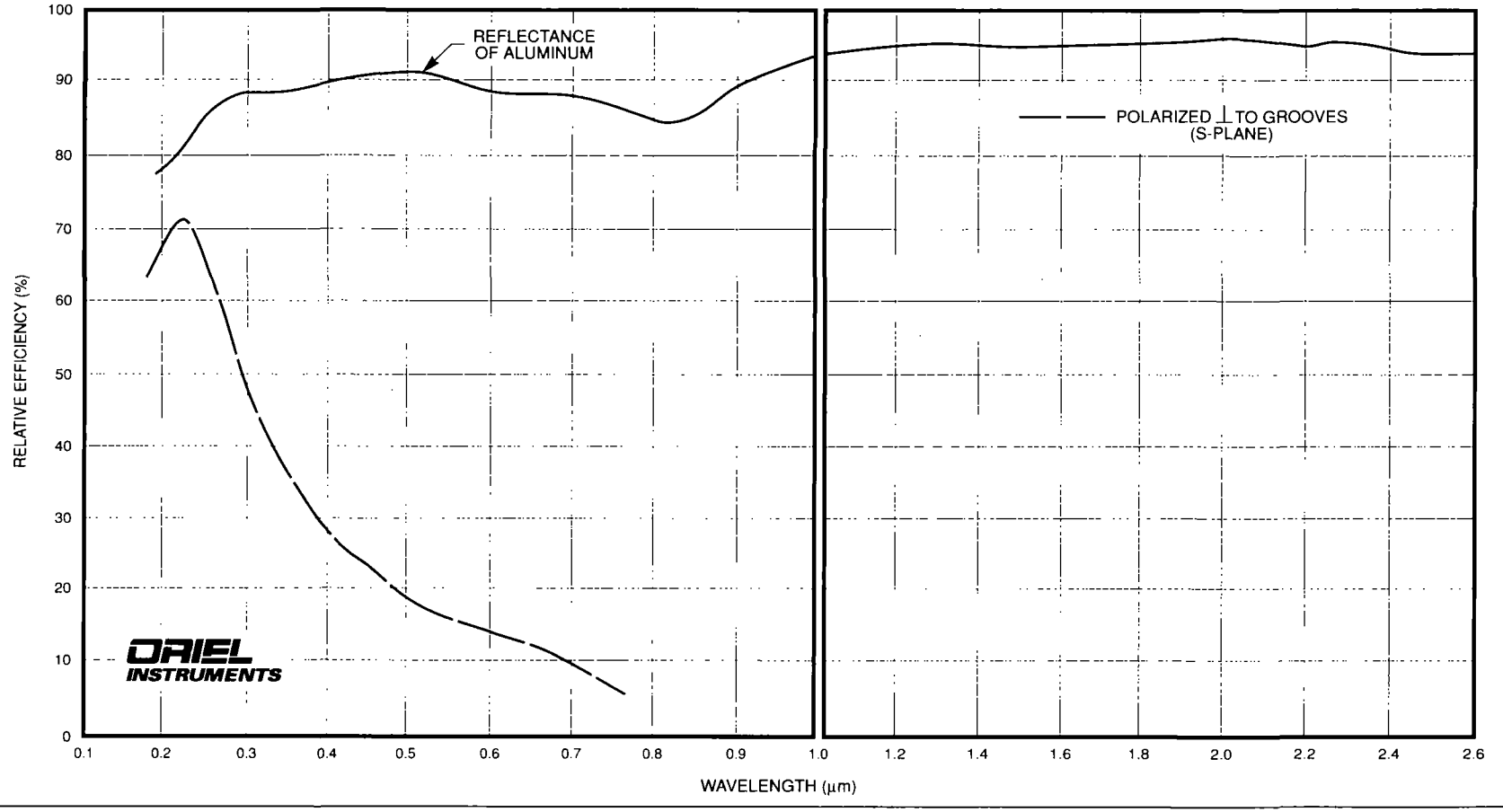


SPECIFICATIONS

Line Density:	75 l/mm	Usable Wavelength Region[2]:	4.5-19.2 µm+
Blaze Wavelength:	7 µm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77751 (25)
Type:	Ruled	77250 1/8 m Monochromator equivalent grating (page):	77302 (37)
Reciprocal Dispersion at Blaze Wavelength:	47 nm/mm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Wavelength Counter Multiplier:	16	Unmounted equivalent grating (page):	77951/77952 (88)
Primary Wavelength Region[1]:	4.5-19.2 µm+		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the monochromator.

GRATING ASSEMBLY: 77413 1/8 m Spectrograph Grating



SPECIFICATIONS

Line Density:	600 l/mm	Primary Wavelength Region[1]:	180-500 nm
Blaze Wavelength:	200 nm	Usable Wavelength Region[2]:	175-700 nm
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	77743 (12)
Reciprocal Dispersion at Blaze Wavelength:	13.3 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	77304 (26)
Array Bandpass (For a 25 mm Spectrographic Field):	337 nm	77200 1/4 m Monochromator equivalent grating (page):	77239 (39)
Micrometer Conversion Multiplier:	200 nm/mm	Unmounted equivalent grating (page):	77917/77918 (64)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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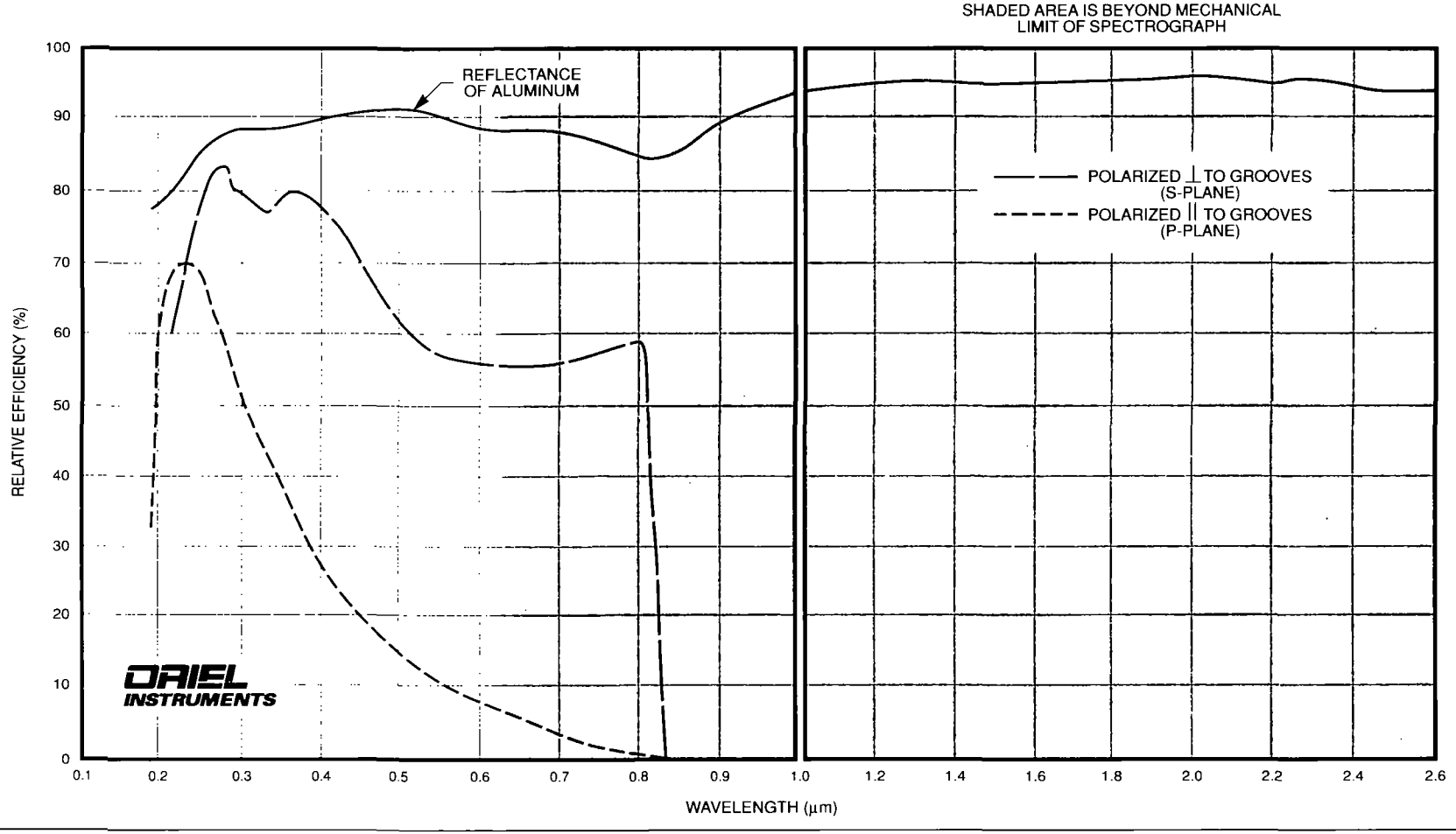
GRATING ASSEMBLY: 77419 1/8 m Spectrograph Grating

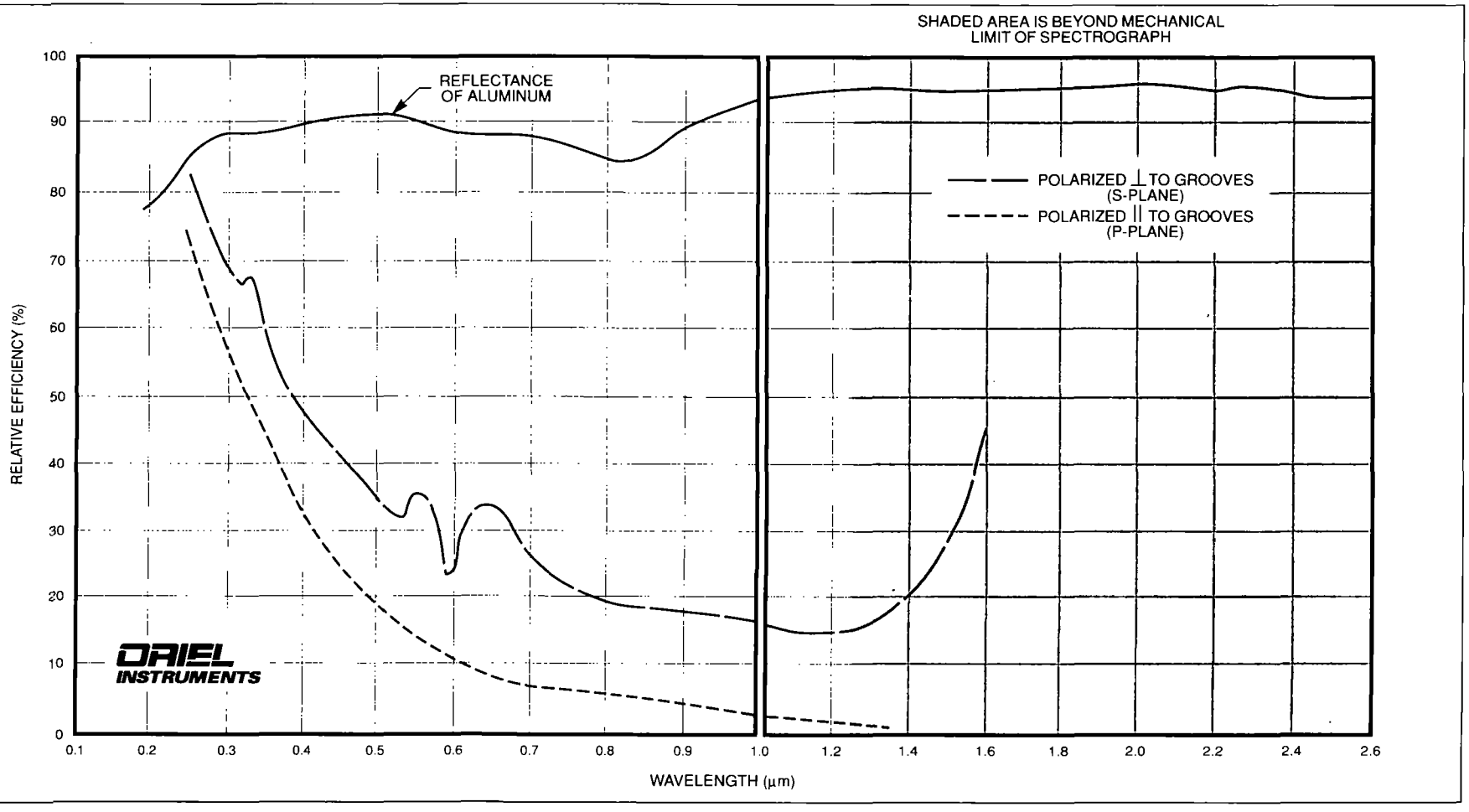


SPECIFICATIONS

Line Density:	2400 l/mm	Primary Wavelength Region[1]:	200-625 nm+
Blaze Wavelength:	250 nm	Usable Wavelength Region[2]:	180-625 nm+
Type:	Holographic	77700 Series Monochromator/Spectrograph equivalent grating (page):	77740 (13)
Reciprocal Dispersion at Blaze Wavelength:	3.0 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	77308 (27)
Array Bandpass (For a 25 mm Spectrographic Field):	76 nm	77200 1/4 m Monochromator equivalent grating (page):	77230 (40)
Micrometer Conversion Multiplier:	50 nm/mm	Unmounted equivalent grating (page):	77901/77902 (65)

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the spectrograph.

GRATING ASSEMBLY: 77410 1/8 m Spectrograph Grating



SPECIFICATIONS

Line Density:	1200 l/mm	Primary Wavelength Region[1]:	180-650 nm
Blaze Wavelength:	250 nm	Usable Wavelength Region[2]:	175-1000 nm
Type:	Holographic	77700 Series Monochromator/Spectrograph equivalent grating (page):	77741 (14)
Reciprocal Dispersion at Blaze Wavelength:	6.5 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	77296 (28)
Array Bandpass (For a 25 mm Spectrographic Field):	164 nm	77200 1/4 m Monochromator equivalent grating (page):	77231 (41)
Micrometer Conversion Multiplier:	100 nm/mm	Unmounted equivalent grating (page):	77907/77908 (66)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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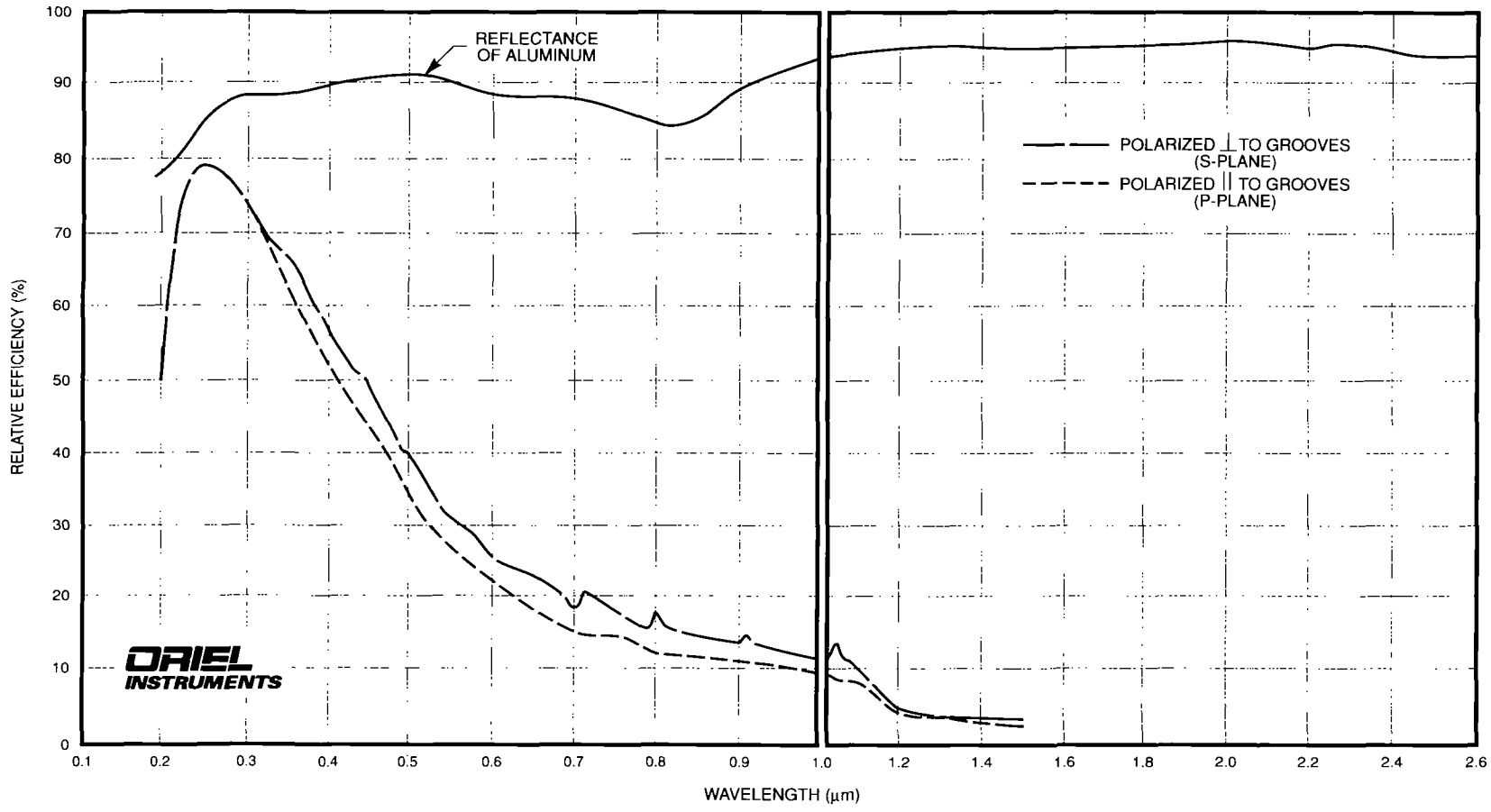
GRATING ASSEMBLY: 77422 1/8 m Spectrograph Grating

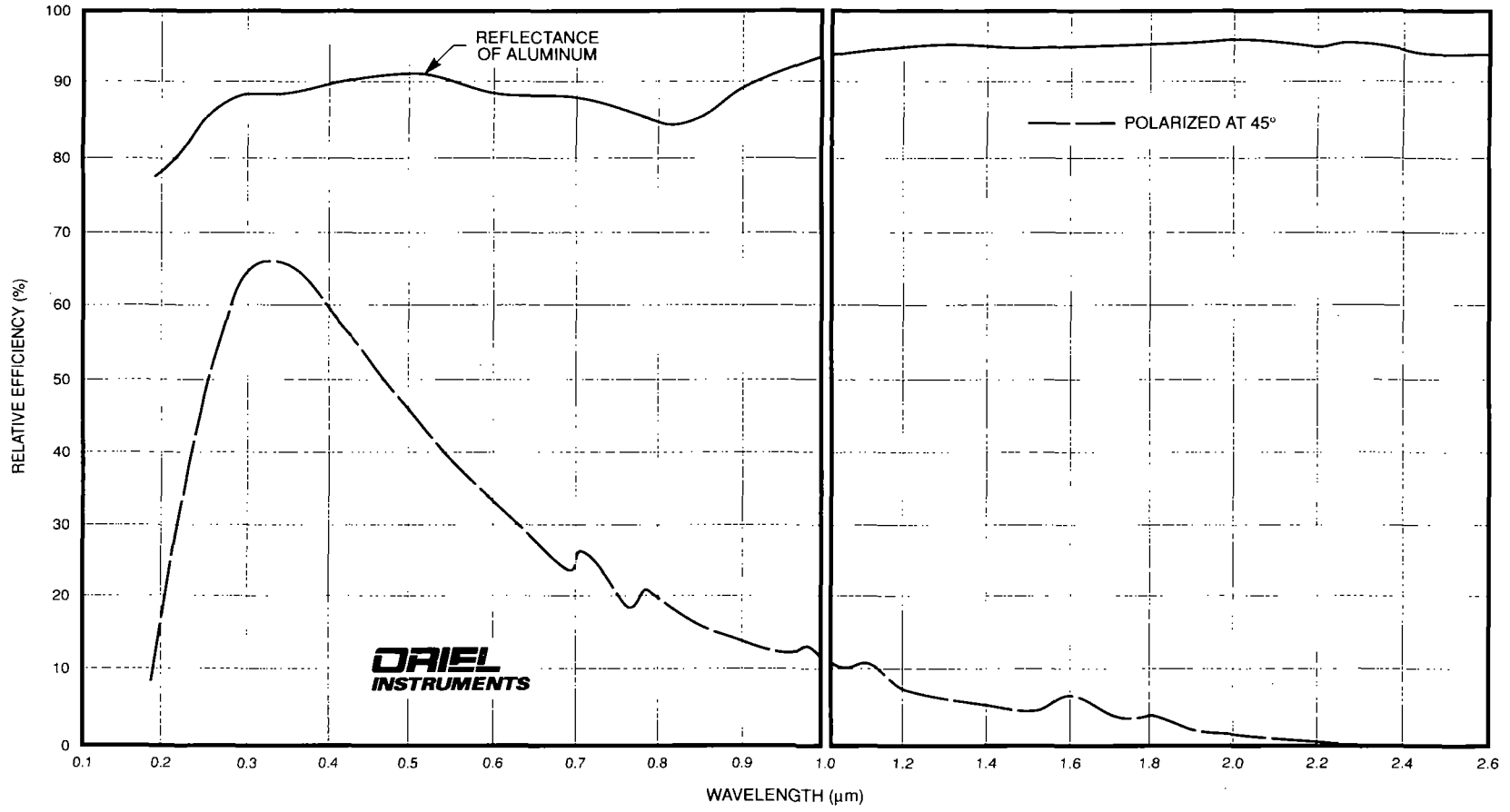


SPECIFICATIONS

Line Density:	300 l/mm	Primary Wavelength Region[1]:	200-750 nm
Blaze Wavelength:	300 nm	Usable Wavelength Region[2]:	180-1000 nm
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	26.8 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrographic Field):	681 nm	77200 1/4 m Monochromator equivalent grating (page):	N/A
Micrometer Conversion Multiplier:	400 nm/mm	Unmounted equivalent grating (page):	77937/77938 (68)

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

GRATING ASSEMBLY: 77416 1/8 m Spectrograph Grating



SPECIFICATIONS

Line Density:	400 l/mm	Primary Wavelength Region[1]:	200-800 nm
Blaze Wavelength:	350 nm	Usable Wavelength Region[2]:	180-1100 nm
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	20 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrographic Field):	507 nm	77200 1/4 m Monochromator equivalent grating (page):	N/A
Micrometer Conversion Multiplier:	300 nm/mm	Unmounted equivalent grating (page):	77929/77930 (70)

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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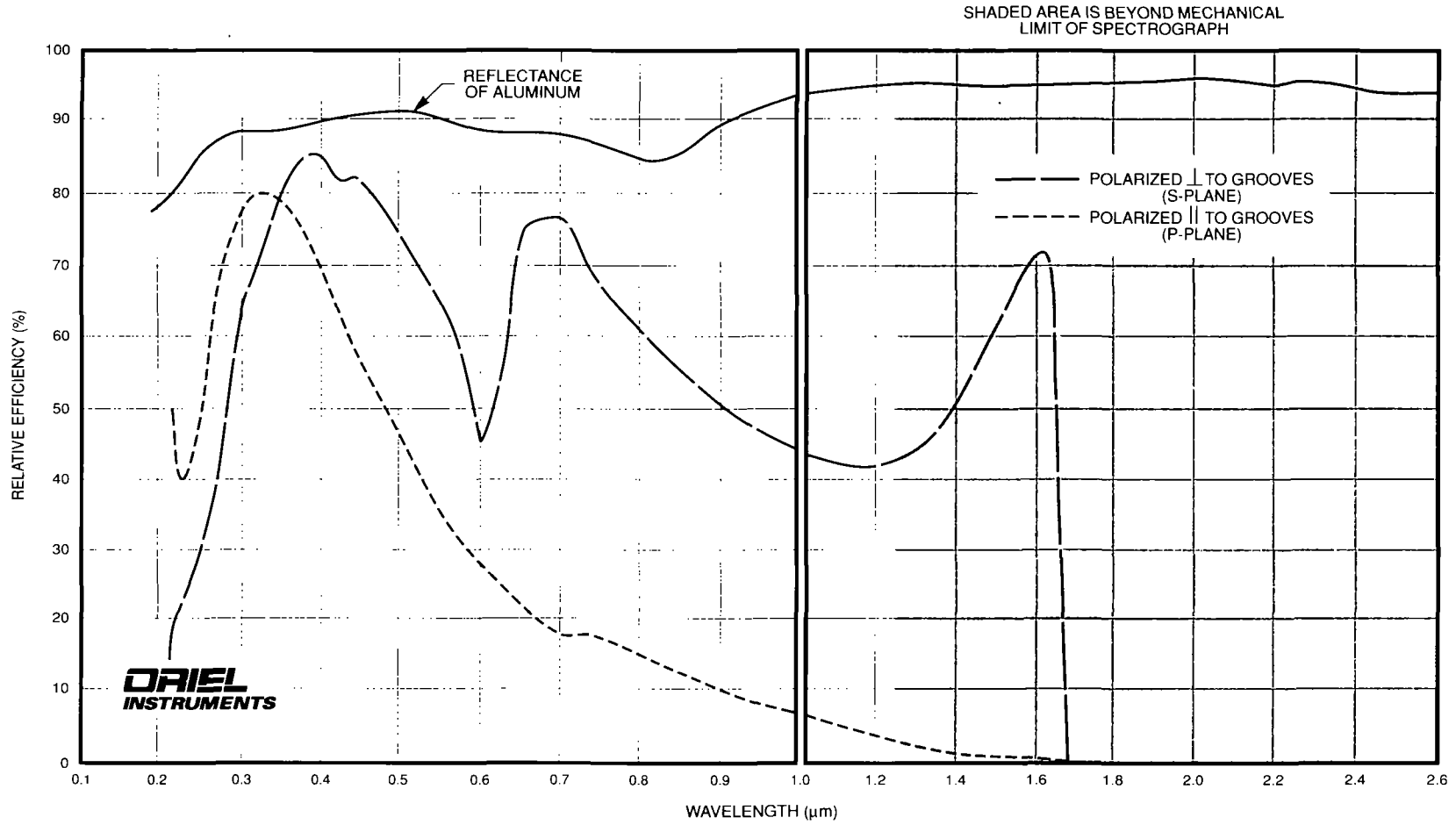
GRATING ASSEMBLY: 77411 1/8 m Spectrograph Grating

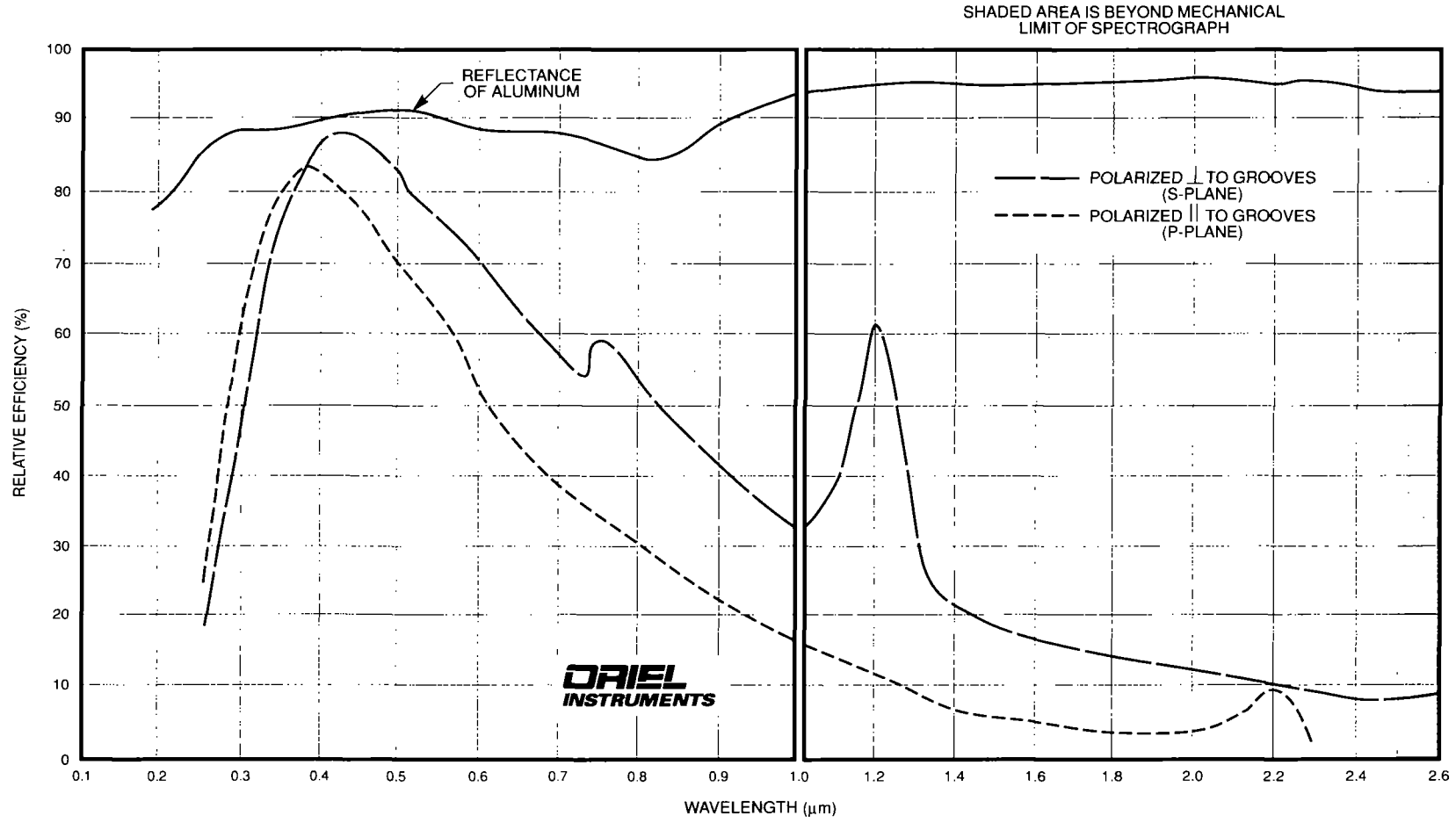


SPECIFICATIONS

Line Density:	1200 l/mm	Primary Wavelength Region[1]:	200-1250 nm+
Blaze Wavelength:	350 nm	Usable Wavelength Region[2]:	180-1250 nm+
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	77742 (15)
Reciprocal Dispersion at Blaze Wavelength:	6.3 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	77298 (29)
Array Bandpass (For a 25 mm Spectrographic Field):	160 nm	77200 1/4 m Monochromator equivalent grating (page):	77233 (42)
Micrometer Conversion Multiplier:	100 nm/mm	Unmounted equivalent grating (page):	77909/77910 (69)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the spectrograph.

GRATING ASSEMBLY: 77414 1/8 m Spectrograph Grating



SPECIFICATIONS

Line Density:	600 l/mm	Primary Wavelength Region[1]:	250-1300 nm
Blaze Wavelength:	400 nm	Usable Wavelength Region[2]:	250-1600 nm
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	77744 (16)
Reciprocal Dispersion at Blaze Wavelength:	13.1 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrographic Field):	332 nm	77200 1/4 m Monochromator equivalent grating (page):	N/A
Micrometer Conversion Multiplier:	200 nm/mm	Unmounted equivalent grating (page):	77921/77922 (72)

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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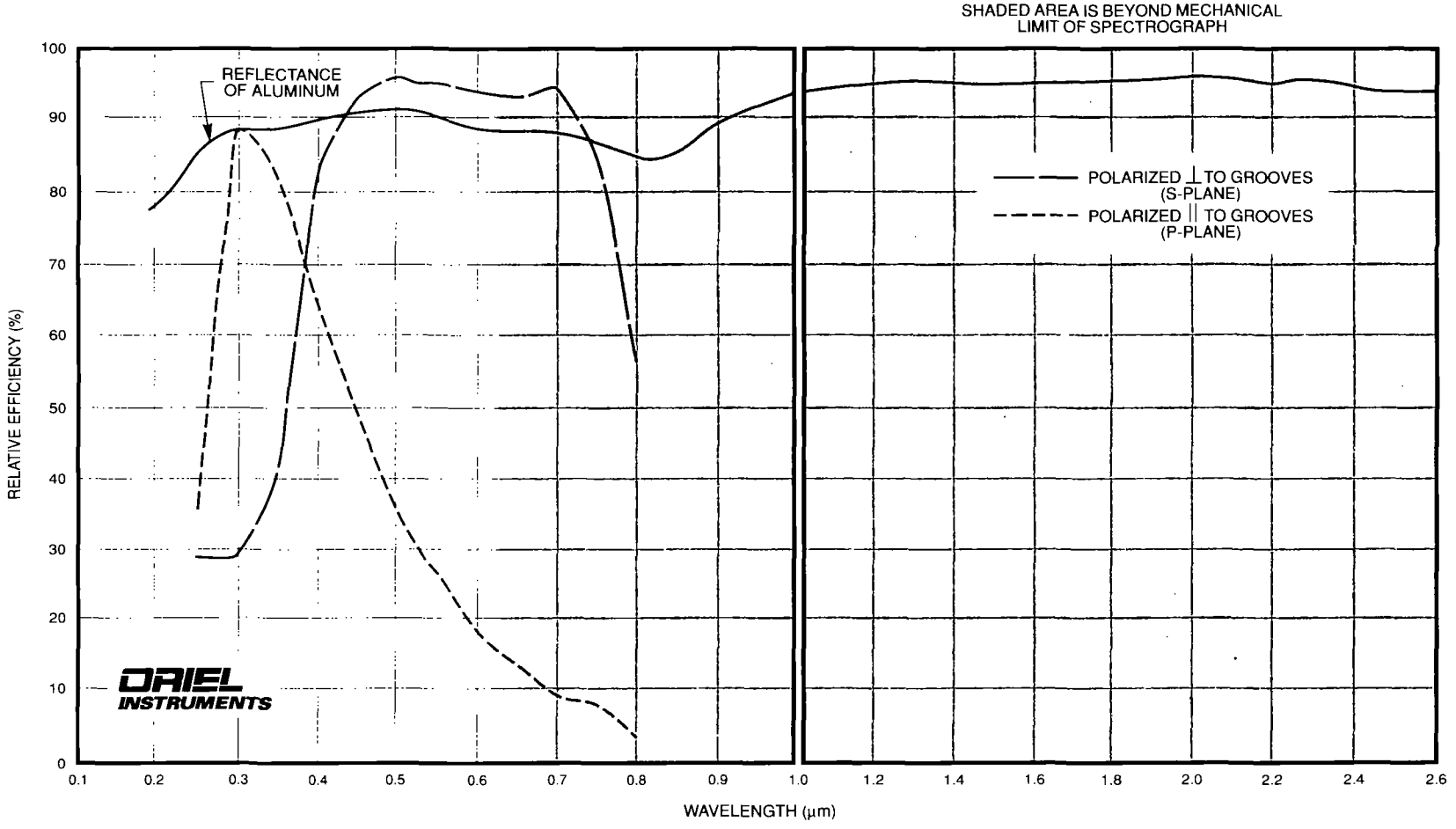
GRATING ASSEMBLY: 77420 1/8 m Spectrograph Grating

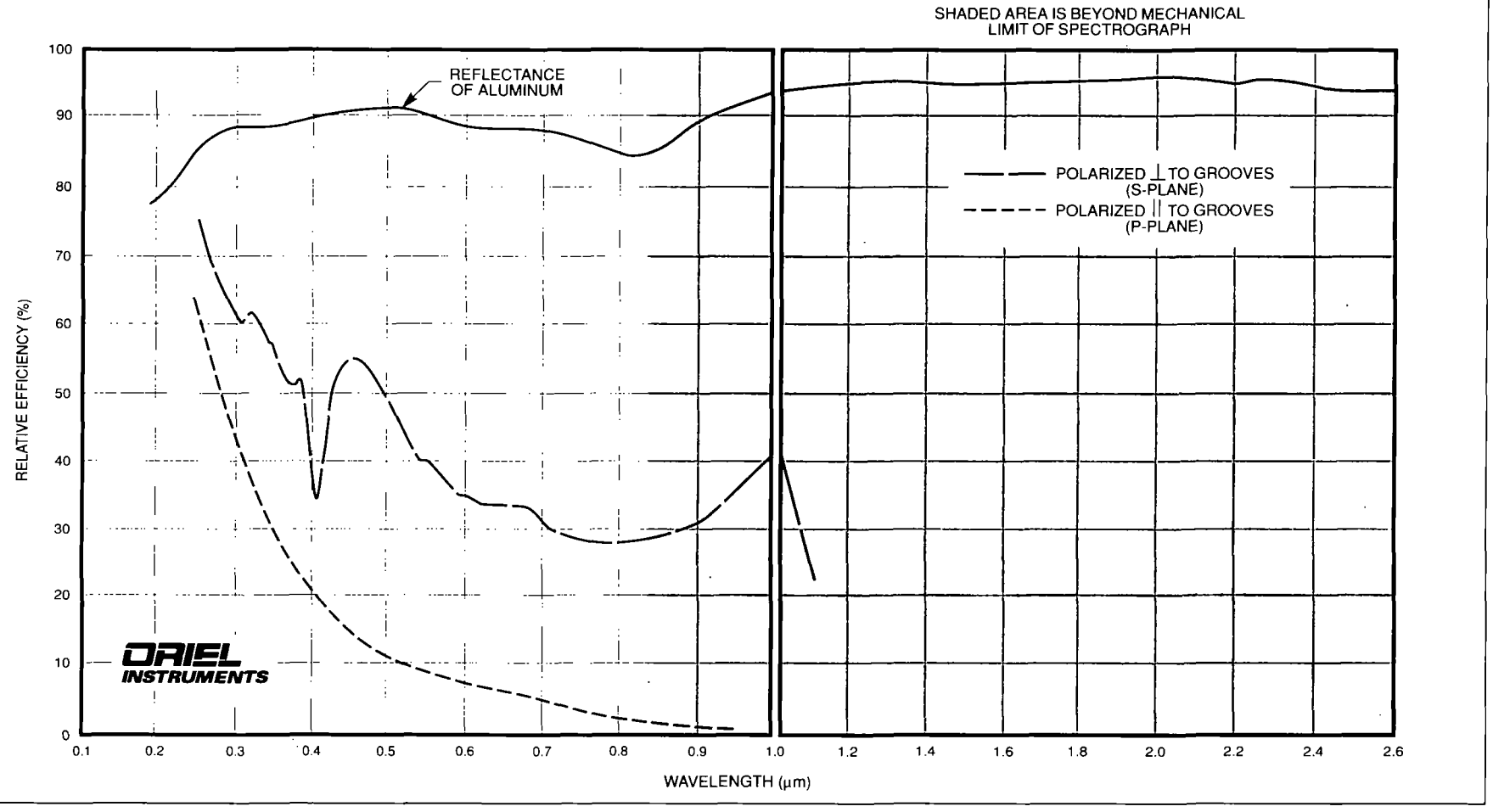


SPECIFICATIONS

Line Density:	2400 l/mm	Primary Wavelength Region[1]:	230-625 nm+
Blaze Wavelength:	400 nm	Usable Wavelength Region[2]:	200-625 nm+
Type:	Holographic	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	2.6 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrographic Field):	65 nm	77200 1/4 m Monochromator equivalent grating (page):	N/A
Micrometer Conversion Multiplier:	50 nm/mm	Unmounted equivalent grating (page):	77903/77904 (71)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the spectrograph.

GRATING ASSEMBLY: 77421 1/8 m Spectrograph Grating



SPECIFICATIONS

Line Density:	1800 l/mm	Primary Wavelength Region[1]:	300-837 nm+
Blaze Wavelength:	500 nm	Usable Wavelength Region[2]:	250-837 nm+
Type:	Holographic	77700 Series Monochromator/Spectrograph equivalent grating (page):	77753 (18)
Reciprocal Dispersion at Blaze Wavelength:	3.5 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	77309 (30)
Array Bandpass (For a 25 mm Spectrographic Field):	90 nm	77200 1/4 m Monochromator equivalent grating (page):	77253 (43)
Micrometer Conversion Multiplier:	67 nm/mm	Unmounted equivalent grating (page):	77905/77906 (74)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the spectrograph.

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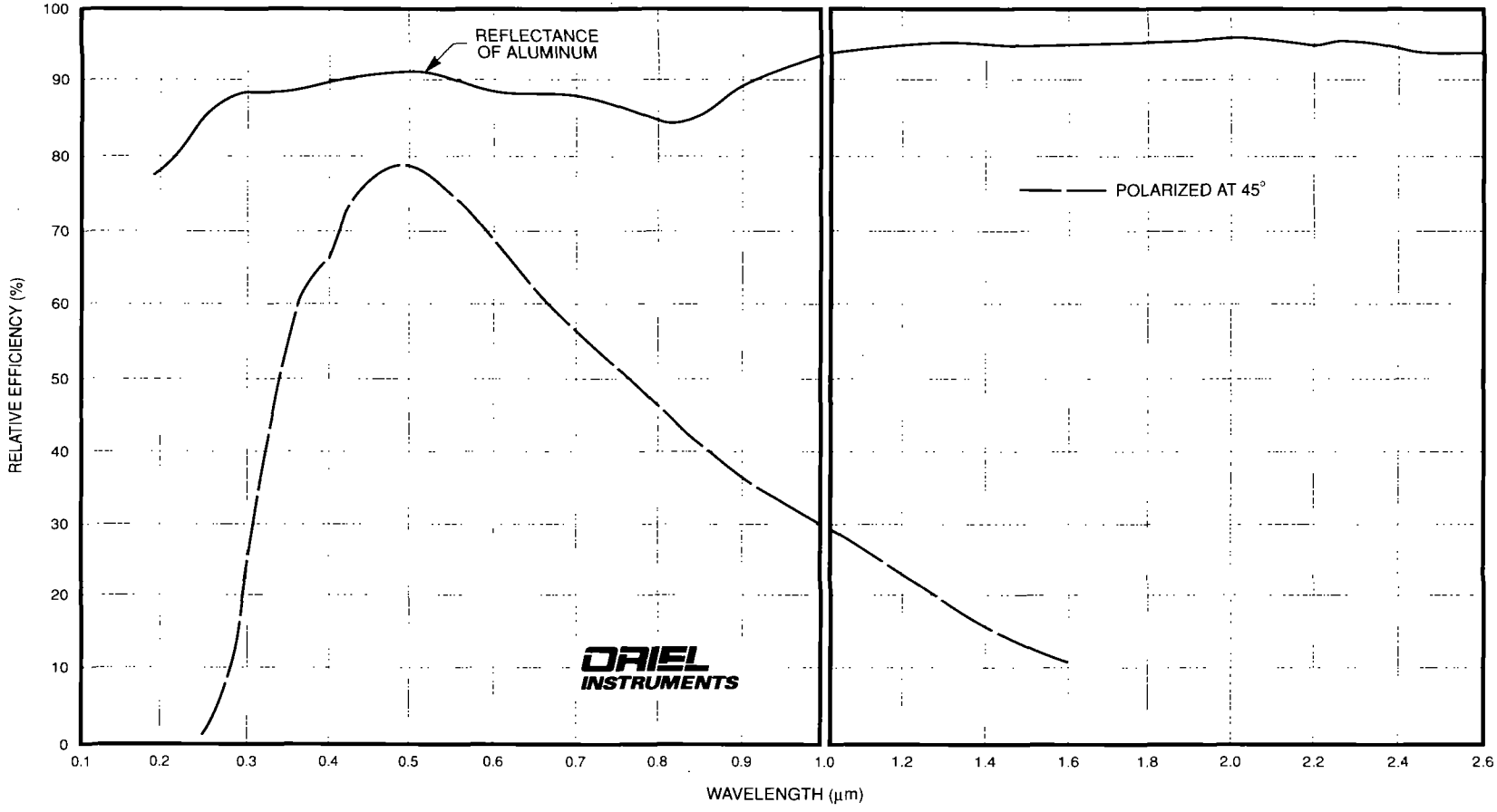
GRATING ASSEMBLY: 77417 1/8 m Spectrograph Grating

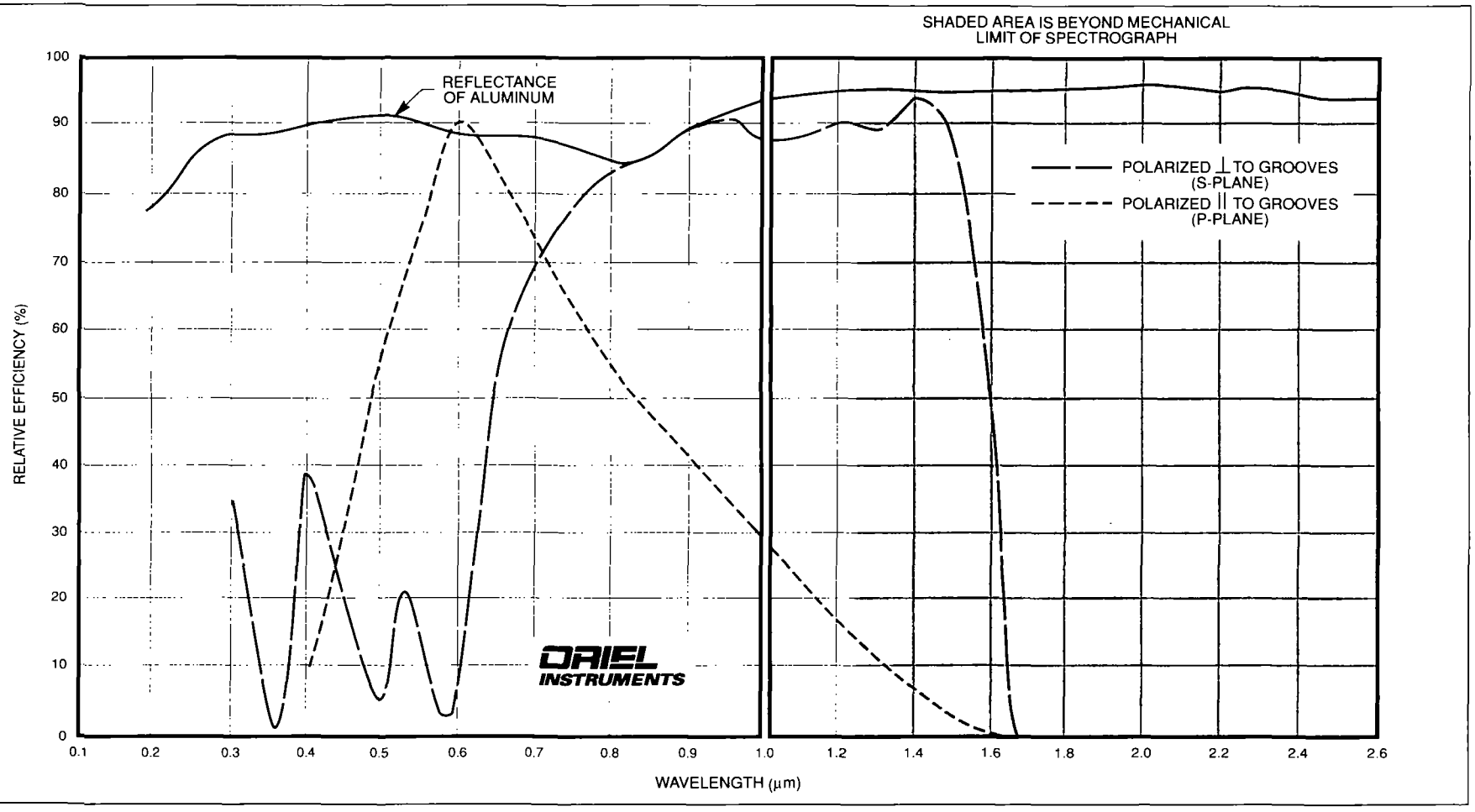


SPECIFICATIONS

Line Density:	400 l/mm	Primary Wavelength Region[1]:	300-1200 nm
Blaze Wavelength:	500 nm	Usable Wavelength Region[2]:	270-1600 nm
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	19.8 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Array Bandpass (For a 25 mm Spectrographic Field):	502 nm	77200 1/4 m Monochromator equivalent grating (page):	77240 (44)
Micrometer Conversion Multiplier:	300 nm/mm	Unmounted equivalent grating (page):	77931/77932 (77)

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

GRATING ASSEMBLY: 77412 1/8 m Spectrograph Grating



SPECIFICATIONS

Line Density:	1200 l/mm	Primary Wavelength Region[1]:	450-1250 nm+
Blaze Wavelength:	750 nm	Usable Wavelength Region[2]:	400-1250 nm+
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	77752 (19)
Reciprocal Dispersion at Blaze Wavelength:	5.3 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	77306 (31)
Array Bandpass (For a 25 mm Spectrographic Field):	135 nm	77200 1/4 m Monochromator equivalent grating (page):	77229 (45)
Micrometer Conversion Multiplier:	100 nm/mm	Unmounted equivalent grating (page):	77913/77914 (78)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+The wavelength region is limited at the long wavelength end by the mechanical constraints of the spectrograph.

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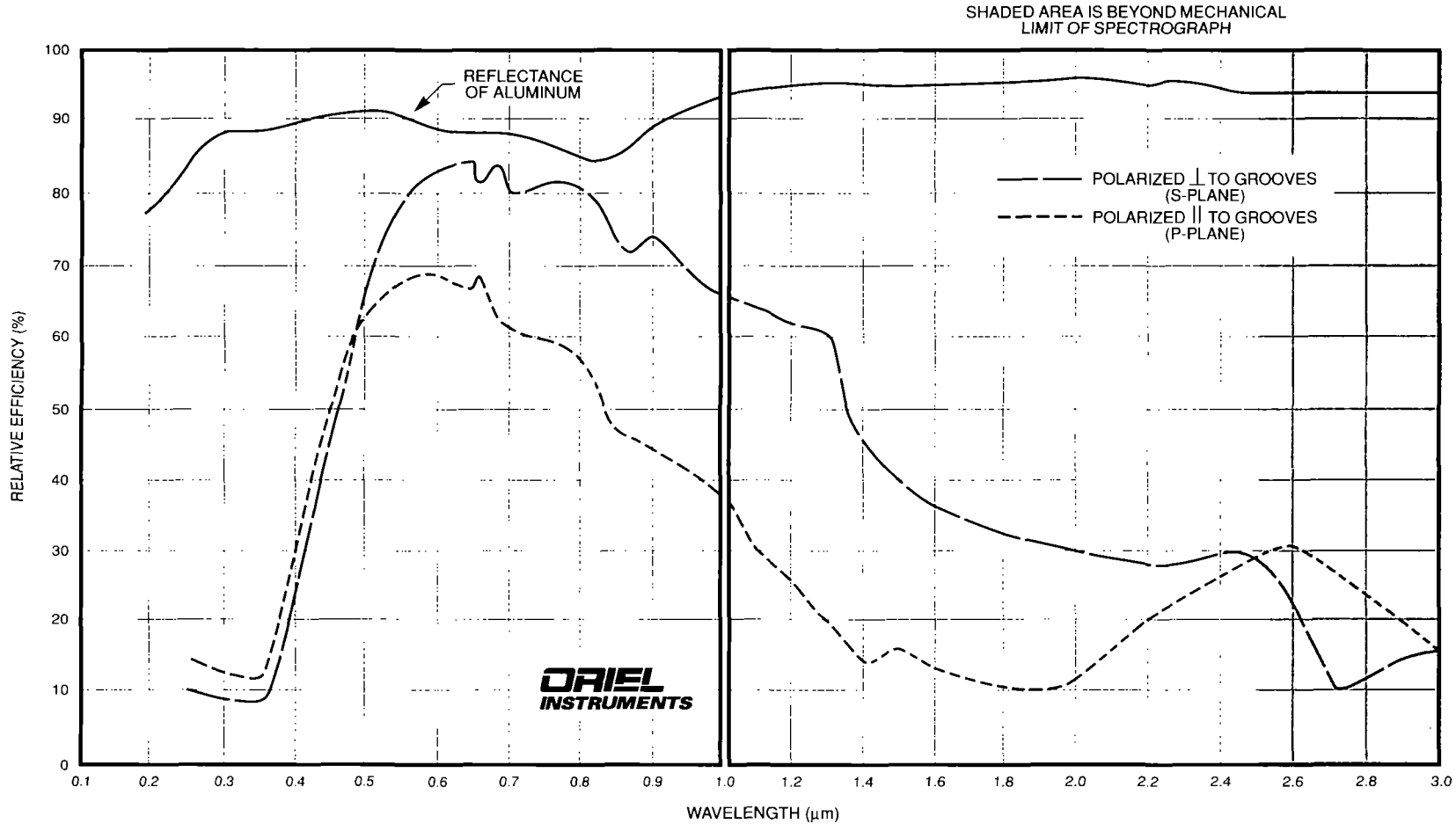
GRATING ASSEMBLY: 77415 1/8 m Spectrograph Grating

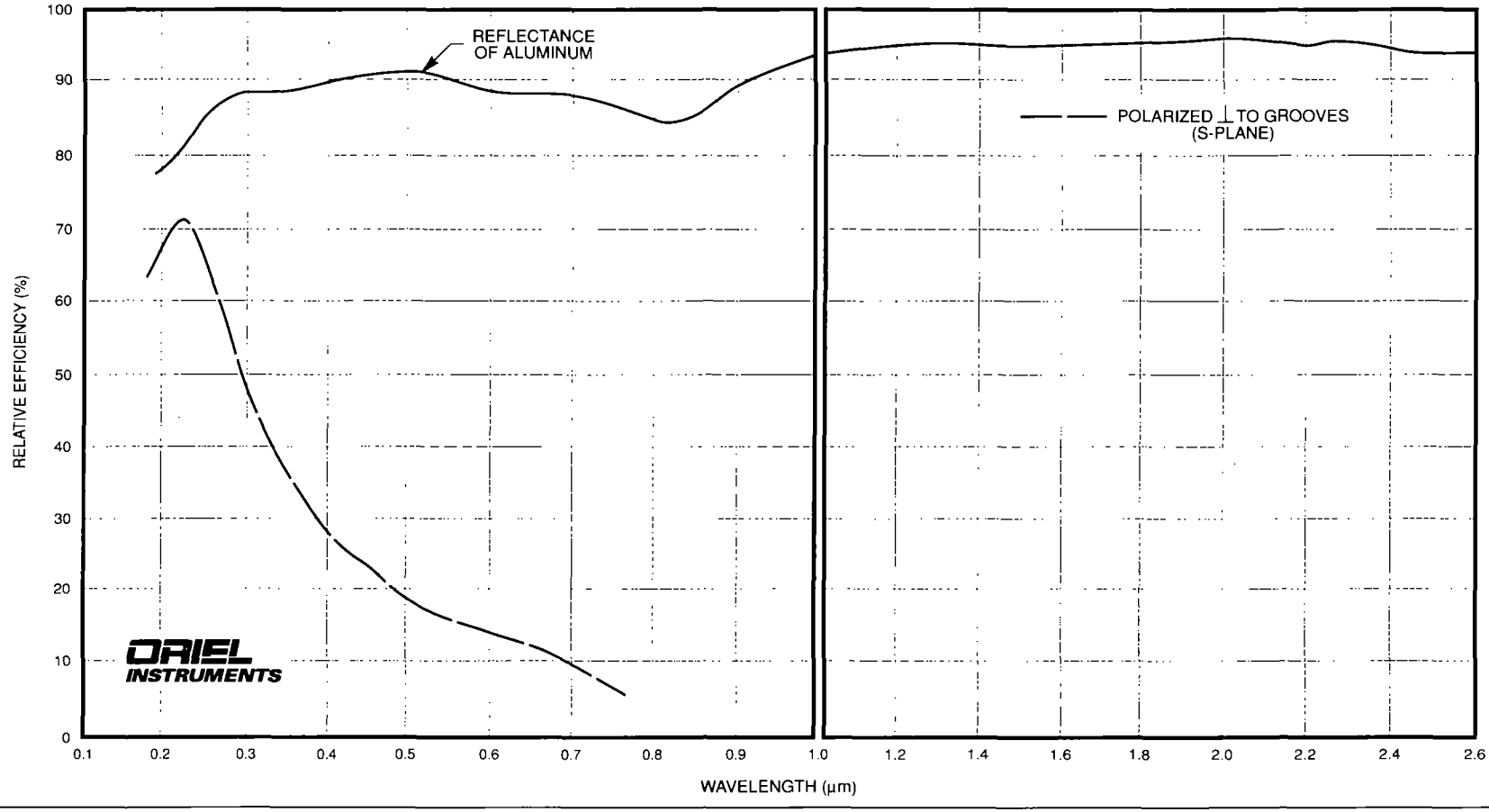


SPECIFICATIONS

Line Density:	600 l/mm	Primary Wavelength Region[1]:	450-2500 nm+
Blaze Wavelength:	750 nm	Usable Wavelength Region[2]:	400-2500 nm+
Type:	Ruled	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Reciprocal Dispersion at Blaze Wavelength:	12.7 nm/mm	77250 1/8 m Monochromator equivalent grating (page):	77305 (32)
Array Bandpass (For a 25 mm Spectrographic Field):	322 nm	77200 1/4 m Monochromator equivalent grating (page):	77243 (46)
Micrometer Conversion Multiplier:	200 nm/mm	Unmounted equivalent grating (page):	77925/77926 (79)

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.
+*The wavelength region is limited at the long wavelength end by the mechanical constraints of the spectrograph.*

77917 (30 x 30 x 3 mm) and 77918 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	600 l/mm
Blaze Wavelength:	200 nm
Type:	Ruled
Primary Wavelength Region[1]:	180-500 nm
Usable Wavelength Region[2]:	175-700 nm

77700 Series Monochromator/Spectrograph equivalent grating (page):	77743 (12)
77250 1/8 m Monochromator equivalent grating (page):	77304 (26)
77200 1/4 m Monochromator equivalent grating (page):	77239 (39)
77400 1/8 m Spectrograph equivalent grating (page):	77413 (52)

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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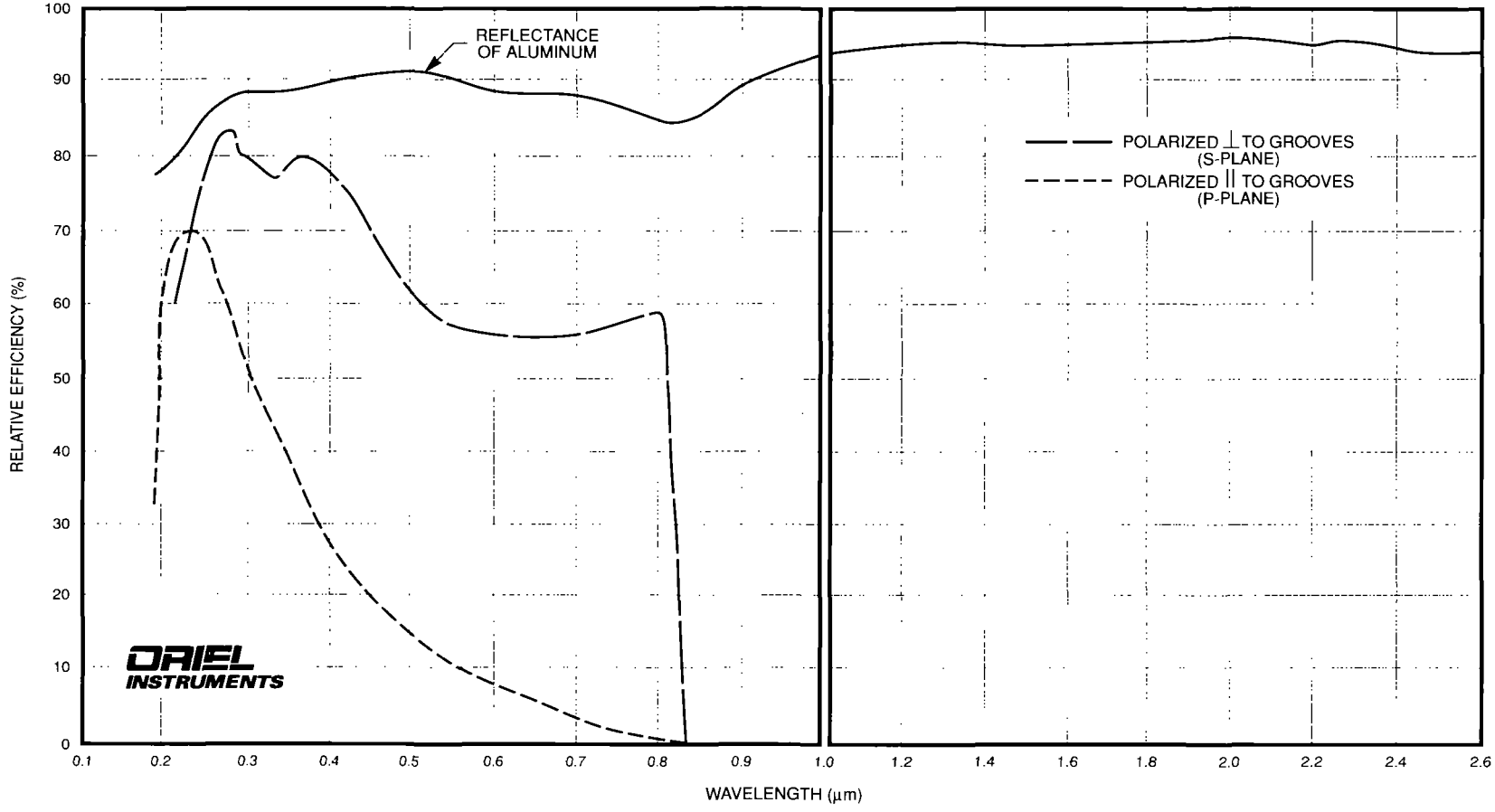
77901 (30 x 30 x 3 mm) and 77902 (50 x 50 x 6 mm) Gratings

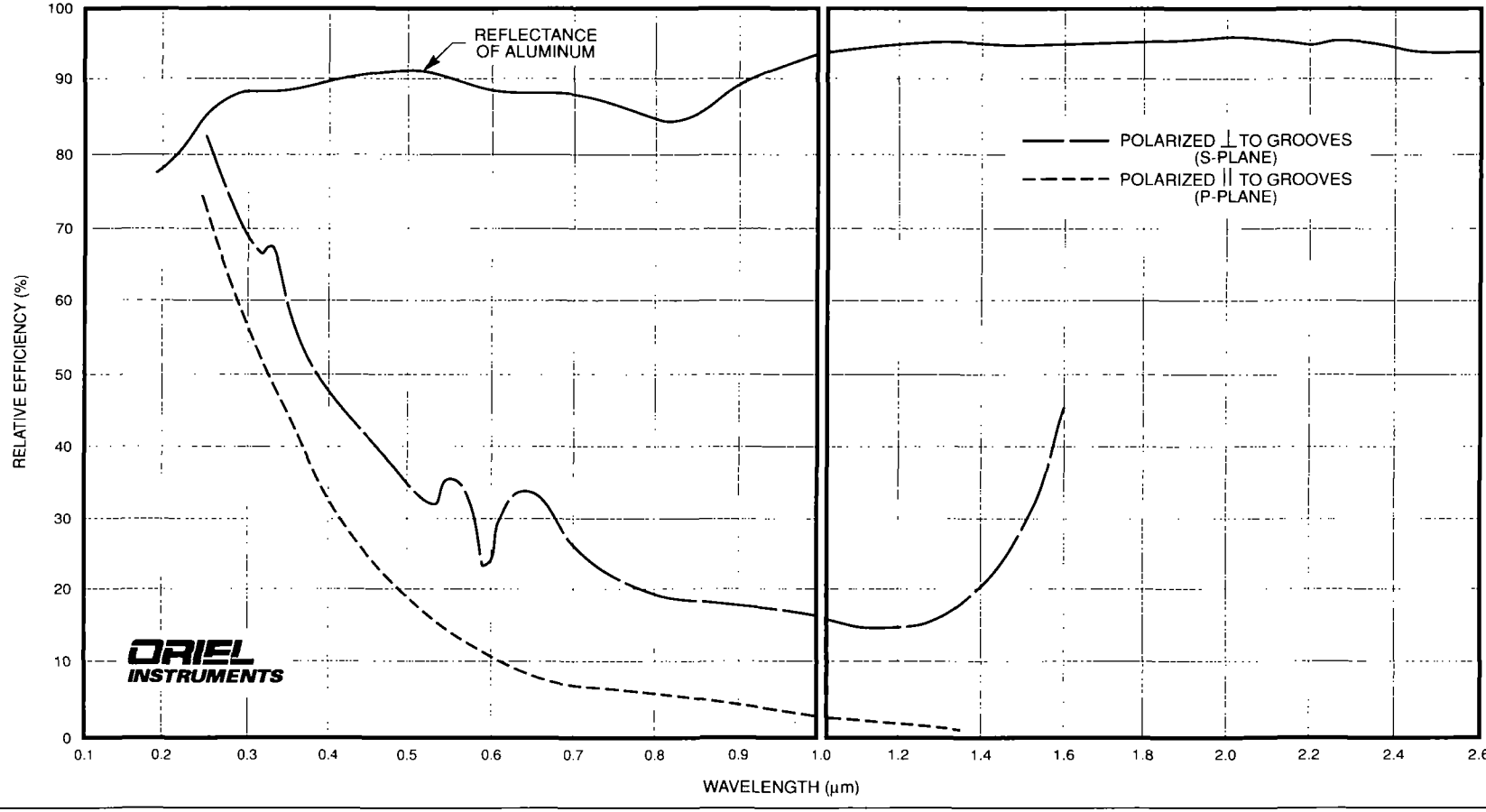


SPECIFICATIONS

Line Density:	2400 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77740 (13)
Blaze Wavelength:	250 nm	77250 1/8 m Monochromator equivalent grating (page):	77308 (27)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77230 (40)
Primary Wavelength Region[1]:	200-750 nm	77400 1/8 m Spectrograph equivalent grating (page):	77419 (53)
Usable Wavelength Region[2]:	180-800 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

77907 (30 x 30 x 3 mm) and 77908 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	1200 l/mm
Blaze Wavelength:	250 nm
Type:	Holographic
Primary Wavelength Region[1]:	180-650 nm
Usable Wavelength Region[2]:	175-1000 nm

77700 Series Monochromator/Spectrograph equivalent grating (page):	77741 (14)
77250 1/8 m Monochromator equivalent grating (page):	77296 (28)
77200 1/4 m Monochromator equivalent grating (page):	77231 (41)
77400 1/8 m Spectrograph equivalent grating (page):	77410 (54)

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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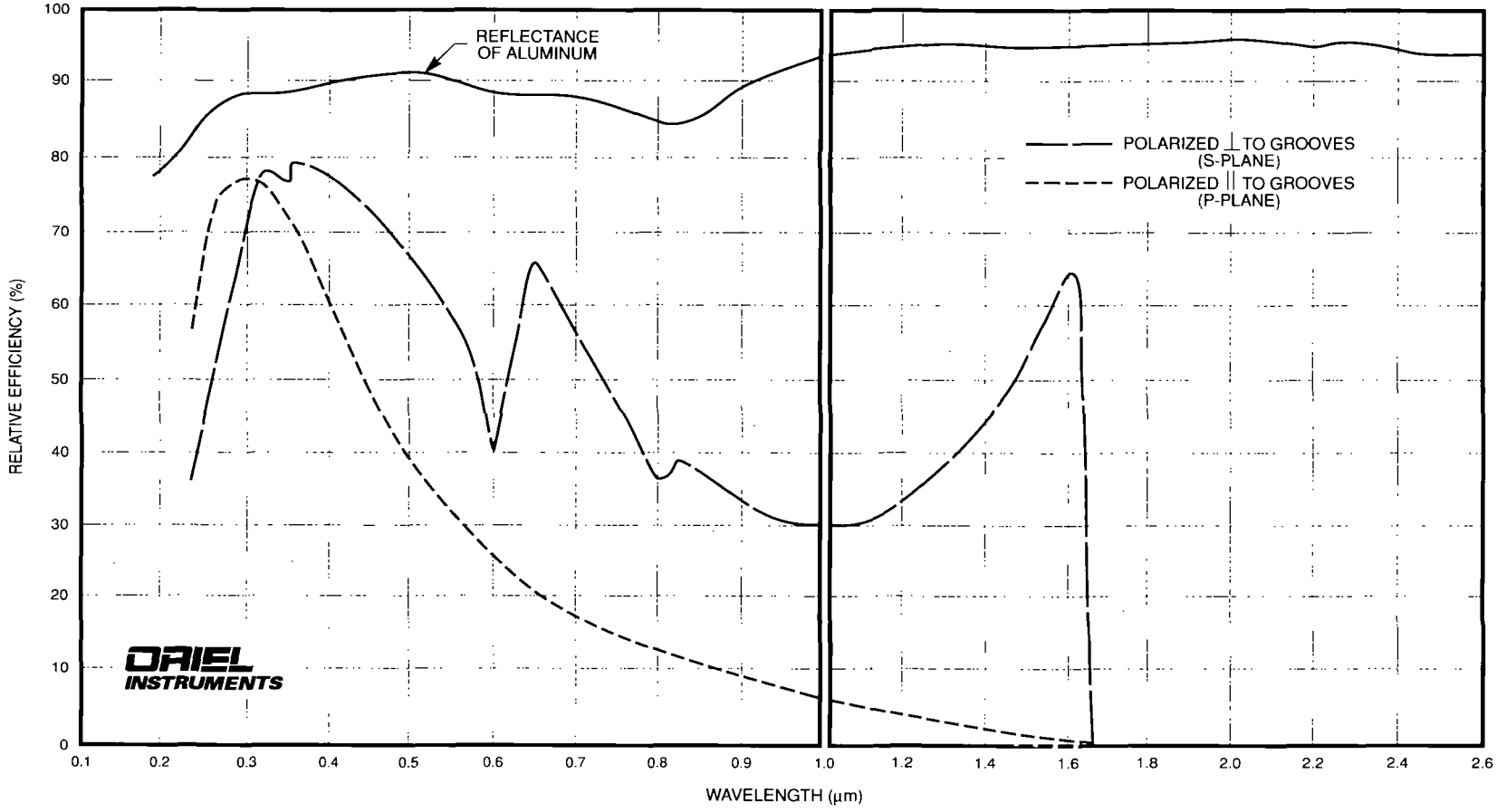
77919 (30 x 30 x 3 mm) and 77920 (50 x 50 x 6 mm) Gratings

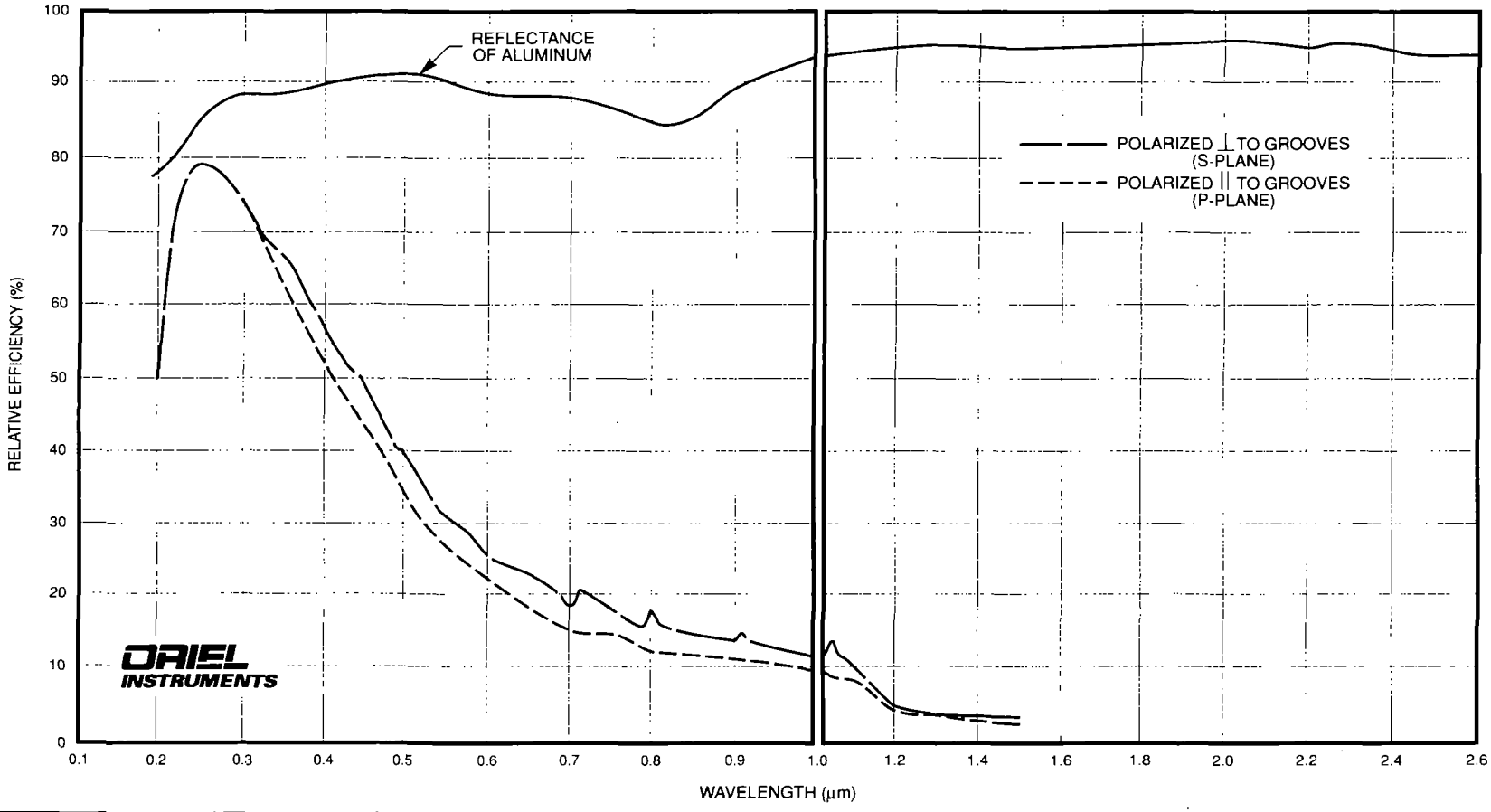


SPECIFICATIONS

Line Density:	600 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	300 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	250-850 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	250-1400 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

77937 (30 x 30 x 3 mm) and 77938 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	300 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	300 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	200-750 nm	77400 1/8 m Spectrograph equivalent grating (page):	77422 (55)
Usable Wavelength Region[2]:	180-1000 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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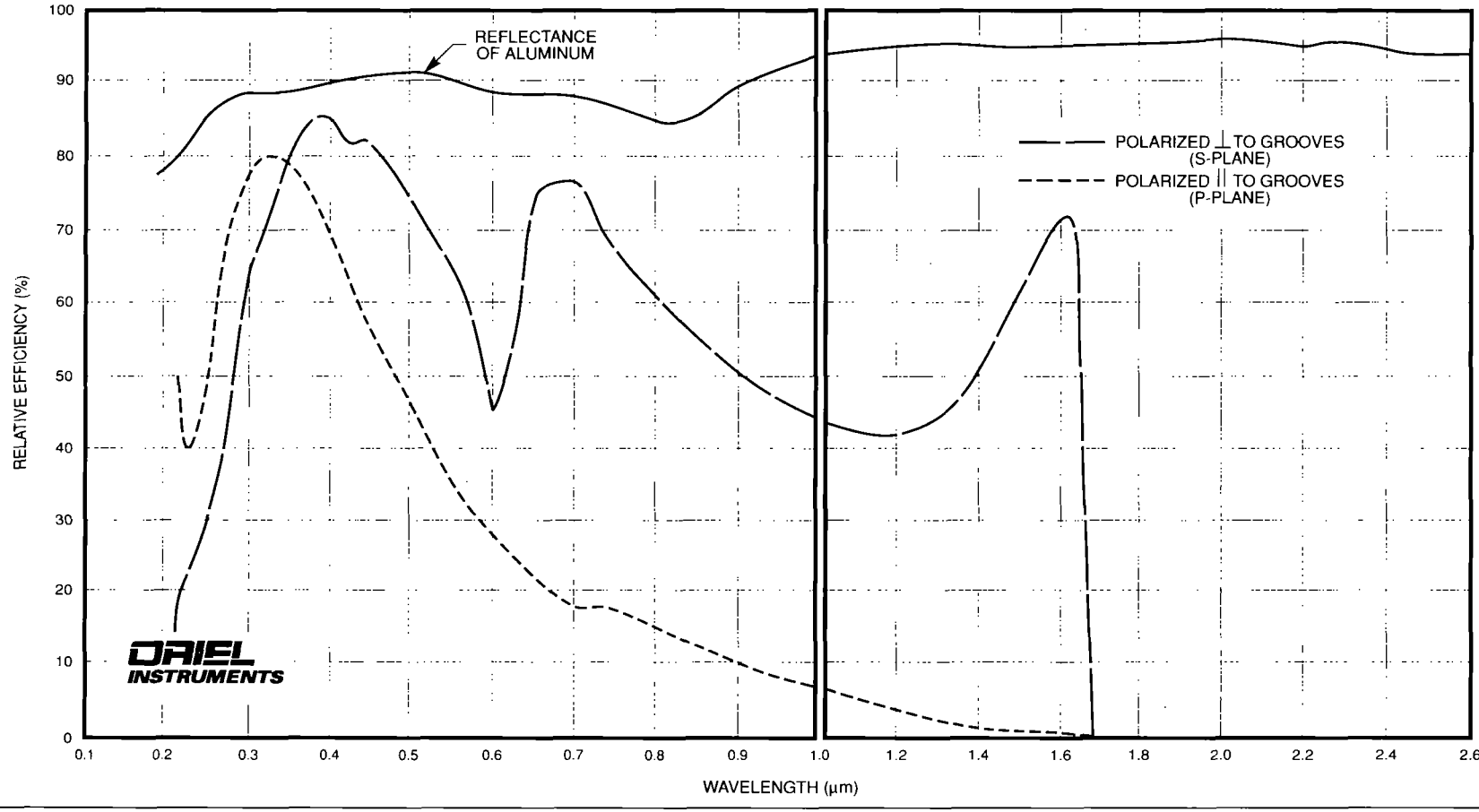
77909 (30 x 30 x 3 mm) and 77910 (50 x 50 x 6 mm) Gratings

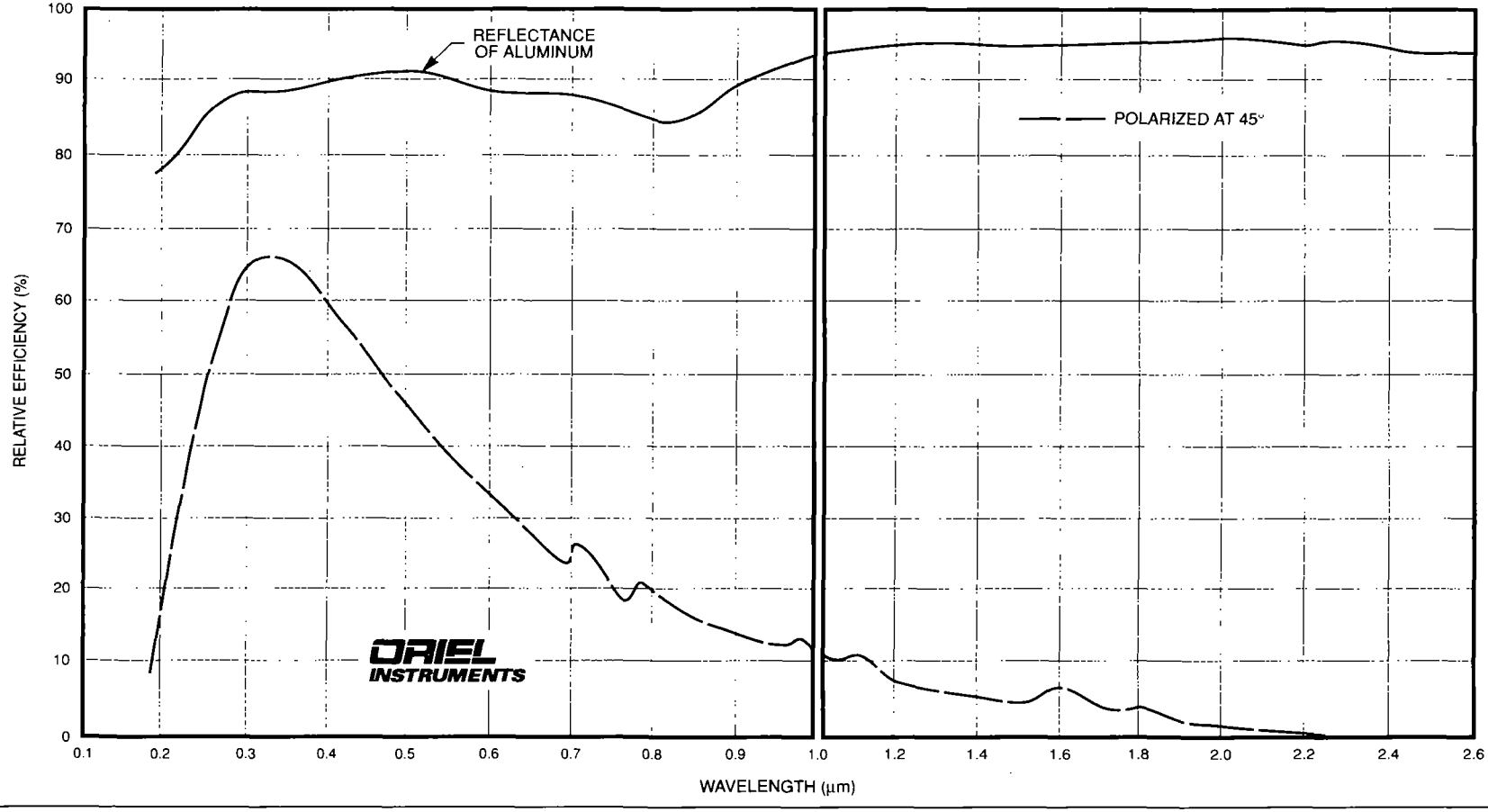


SPECIFICATIONS

Line Density:	1200 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77742 (15)
Blaze Wavelength:	350 nm	77250 1/8 m Monochromator equivalent grating (page):	77298 (29)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77233 (42)
Primary Wavelength Region[1]:	200-1600 nm	77400 1/8 m Spectrograph equivalent grating (page):	77411 (57)
Usable Wavelength Region[2]:	180-1600 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

77929 (30 x 30 x 3 mm) and 77930 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	400 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	350 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	200-800 nm	77400 1/8 m Spectrograph equivalent grating (page):	77416 (56)
Usable Wavelength Region[2]:	180-1100 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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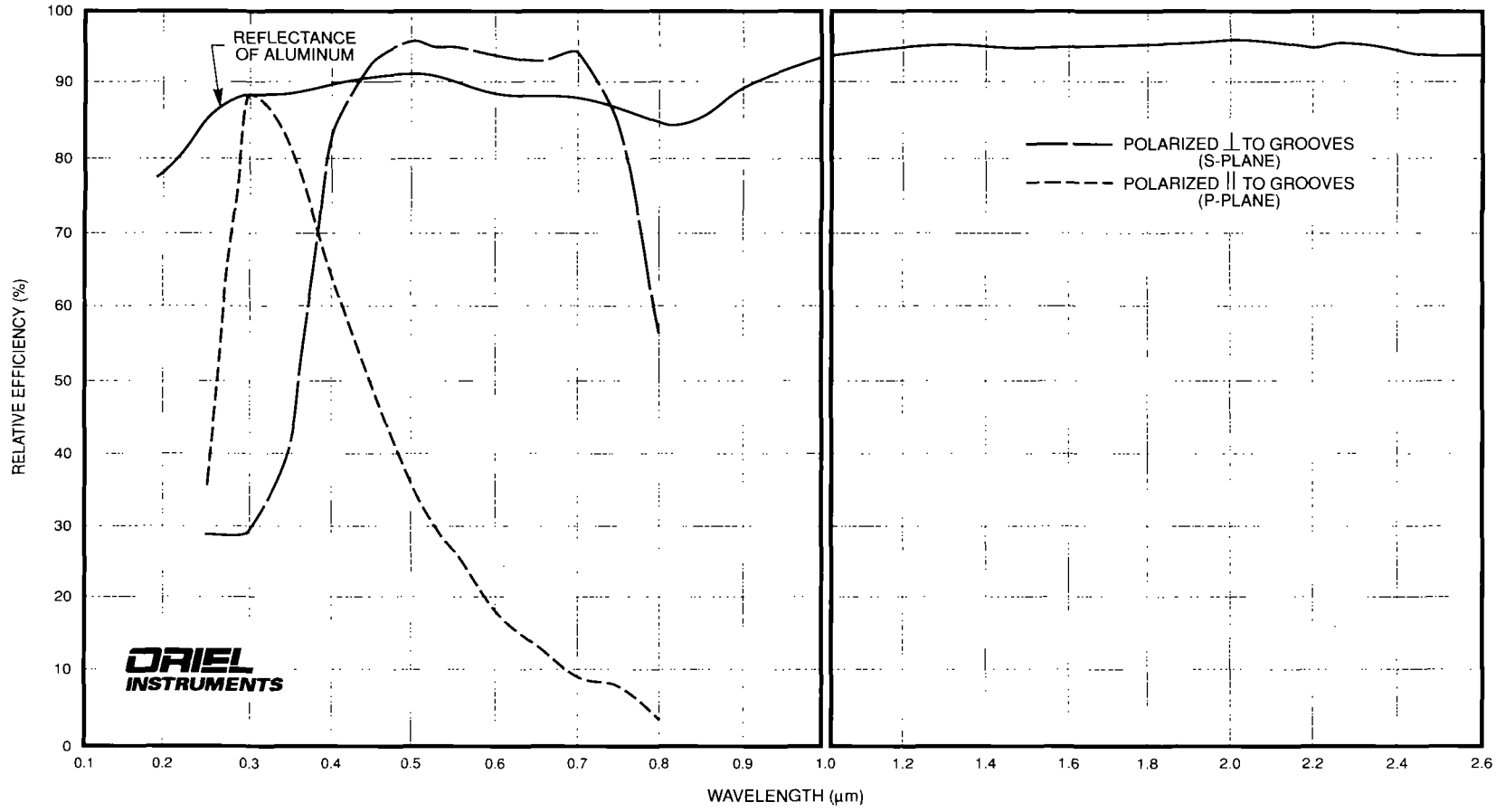
77903 (30 x 30 x 3 mm) and 77904 (50 x 50 x 6 mm) Gratings

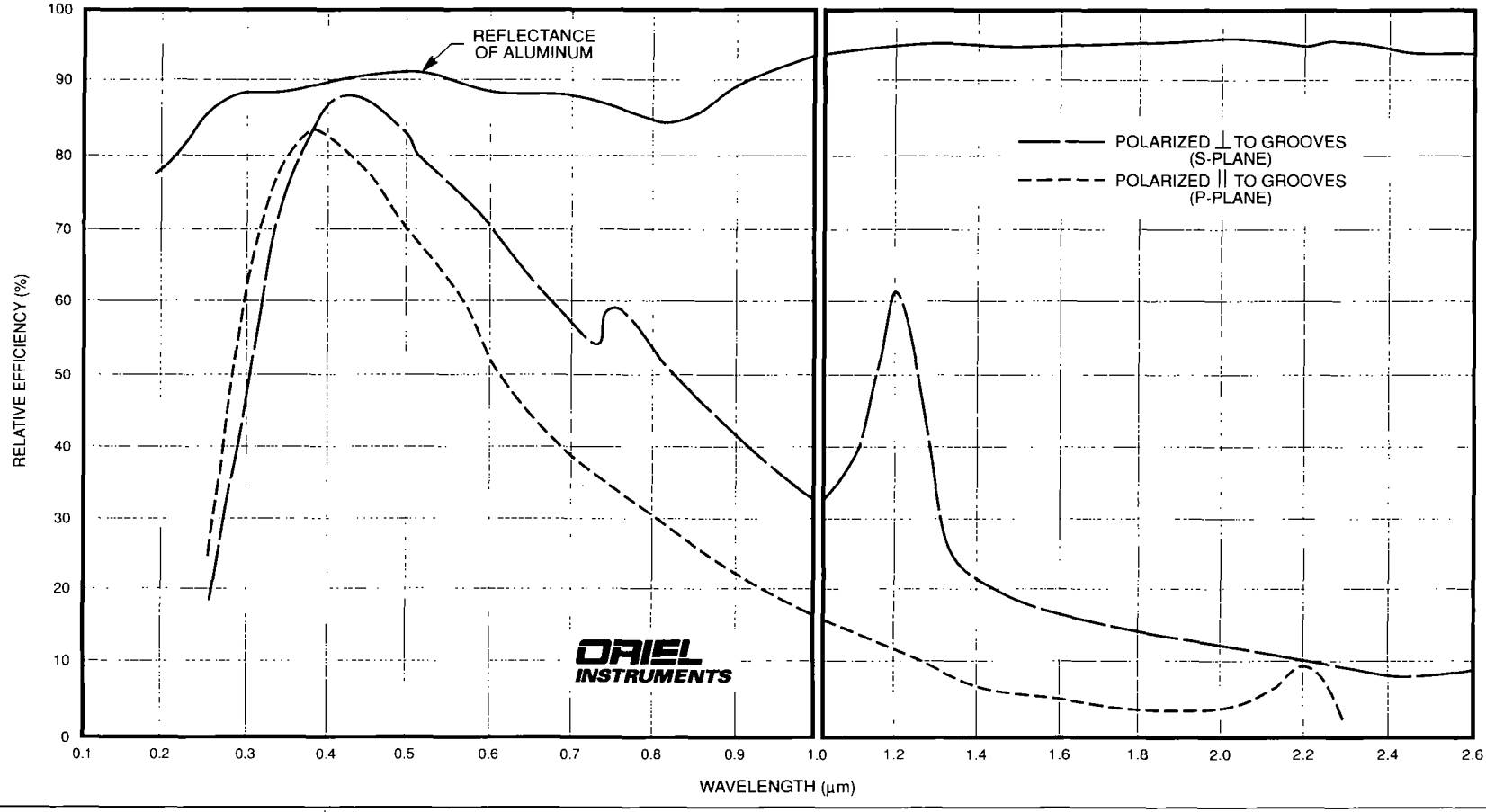


SPECIFICATIONS

Line Density:	2400 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	400 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	230-800 nm	77400 1/8 m Spectrograph equivalent grating (page):	77420 (59)
Usable Wavelength Region[2]:	200-850 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

77921 (30 x 30 x 3 mm) and 77922 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	600 l/mm	*77700 Series Monochromator/Spectrograph equivalent grating (page):*	77744 (16)
Blaze Wavelength:	400 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	250-1300 nm	77400 1/8 m Spectrograph equivalent grating (page):	77414 (58)
Usable Wavelength Region[2]:	250-1600 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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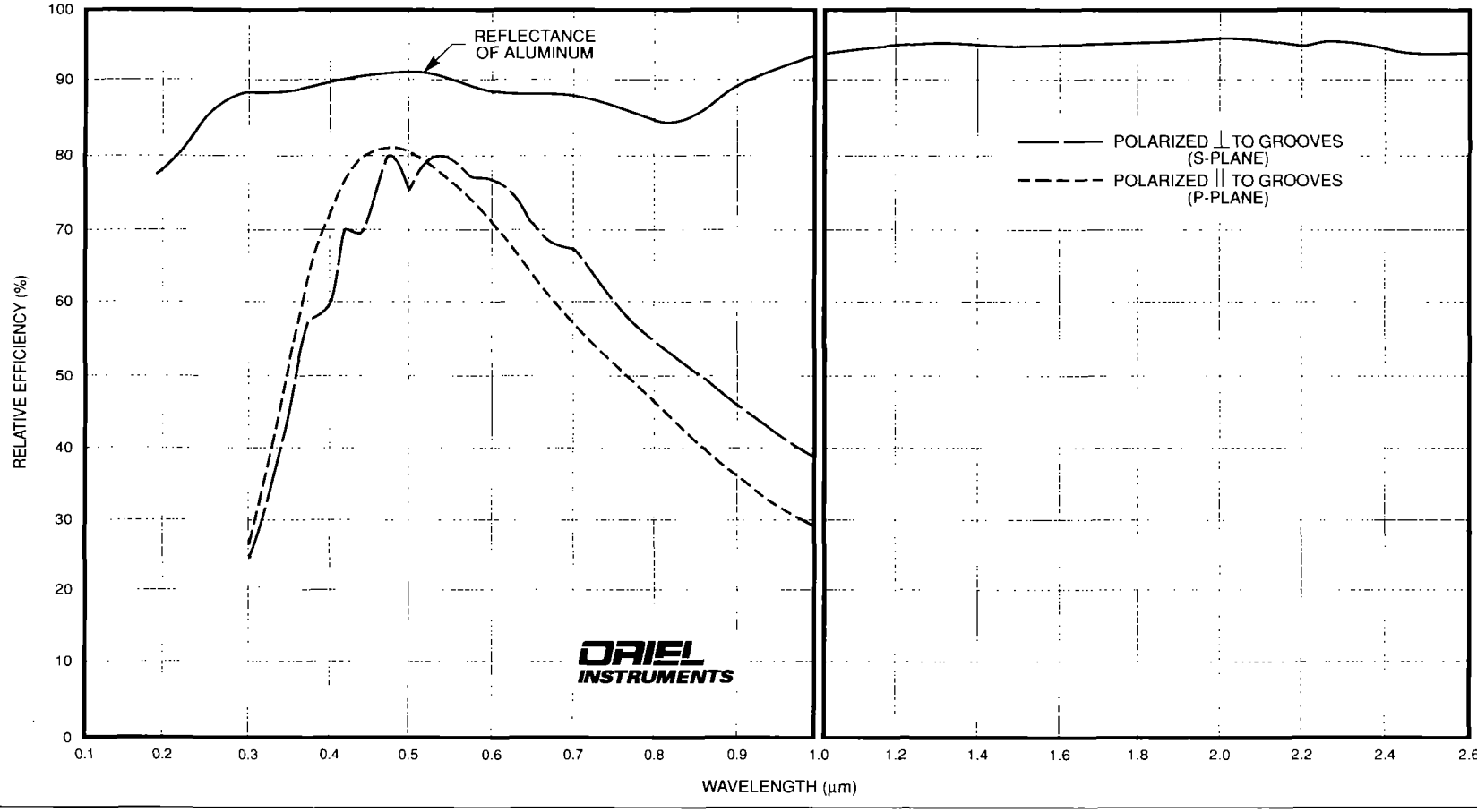
77939 (30 x 30 x 3 mm) and 77940 (50 x 50 x 6 mm) Gratings

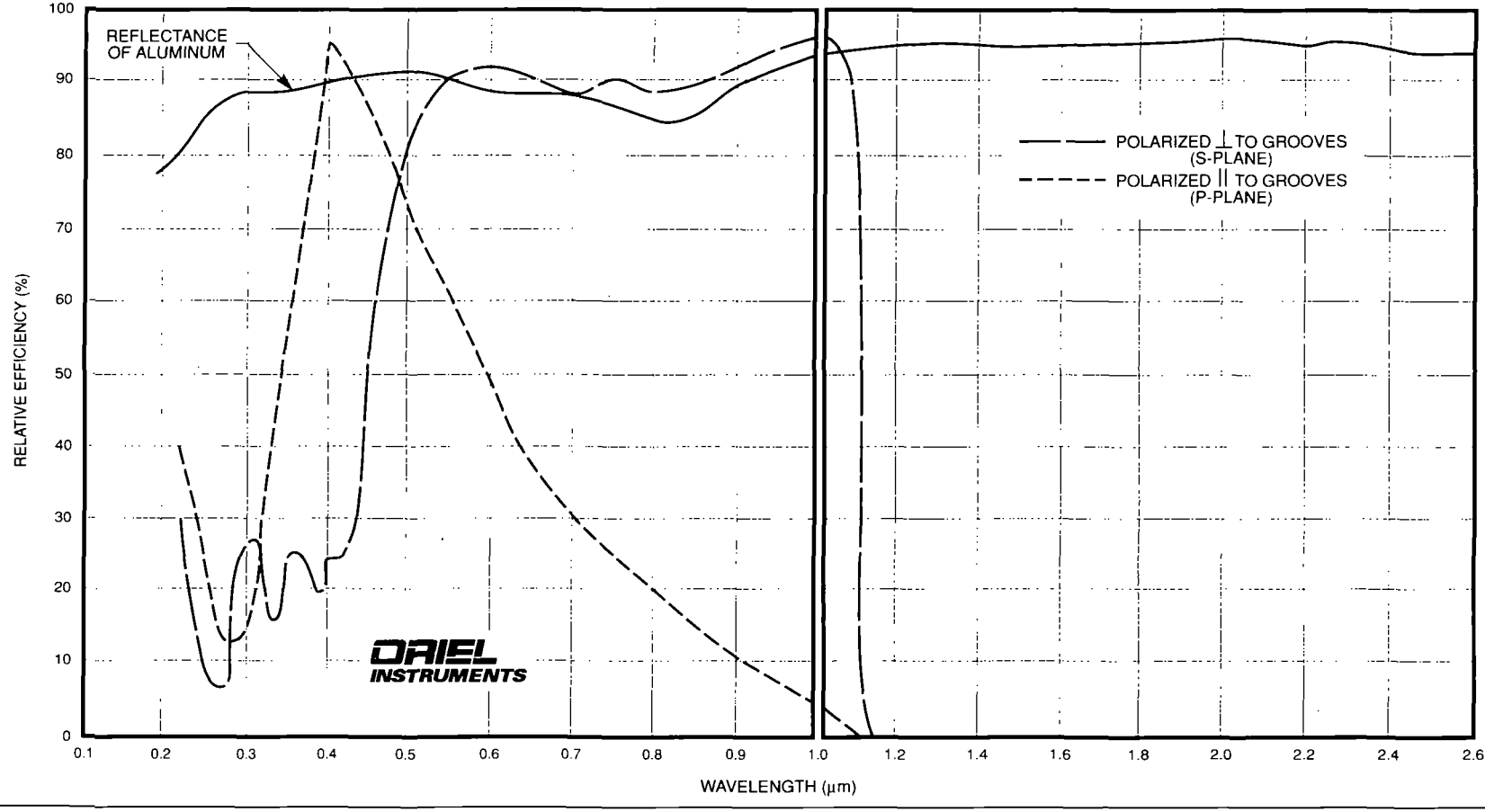


SPECIFICATIONS

Line Density:	*300 l/mm*	*77700 Series Monochromator/Spectrograph equivalent grating (page):*	*77747 (17)*
Blaze Wavelength:	500 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	250-1150 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	245-1500 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

77905 (30 x 30 x 3 mm) and 77906 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	1800 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77753 (18)
Blaze Wavelength:	500 nm	77250 1/8 m Monochromator equivalent grating (page):	77309 (30)
Type:	Holographic	77200 1/4 m Monochromator equivalent grating (page):	77253 (43)
Primary Wavelength Region[1]:	300-1100 nm	77400 1/8 m Spectrograph equivalent grating (page):	77421 (60)
Usable Wavelength Region[2]:	250-1100 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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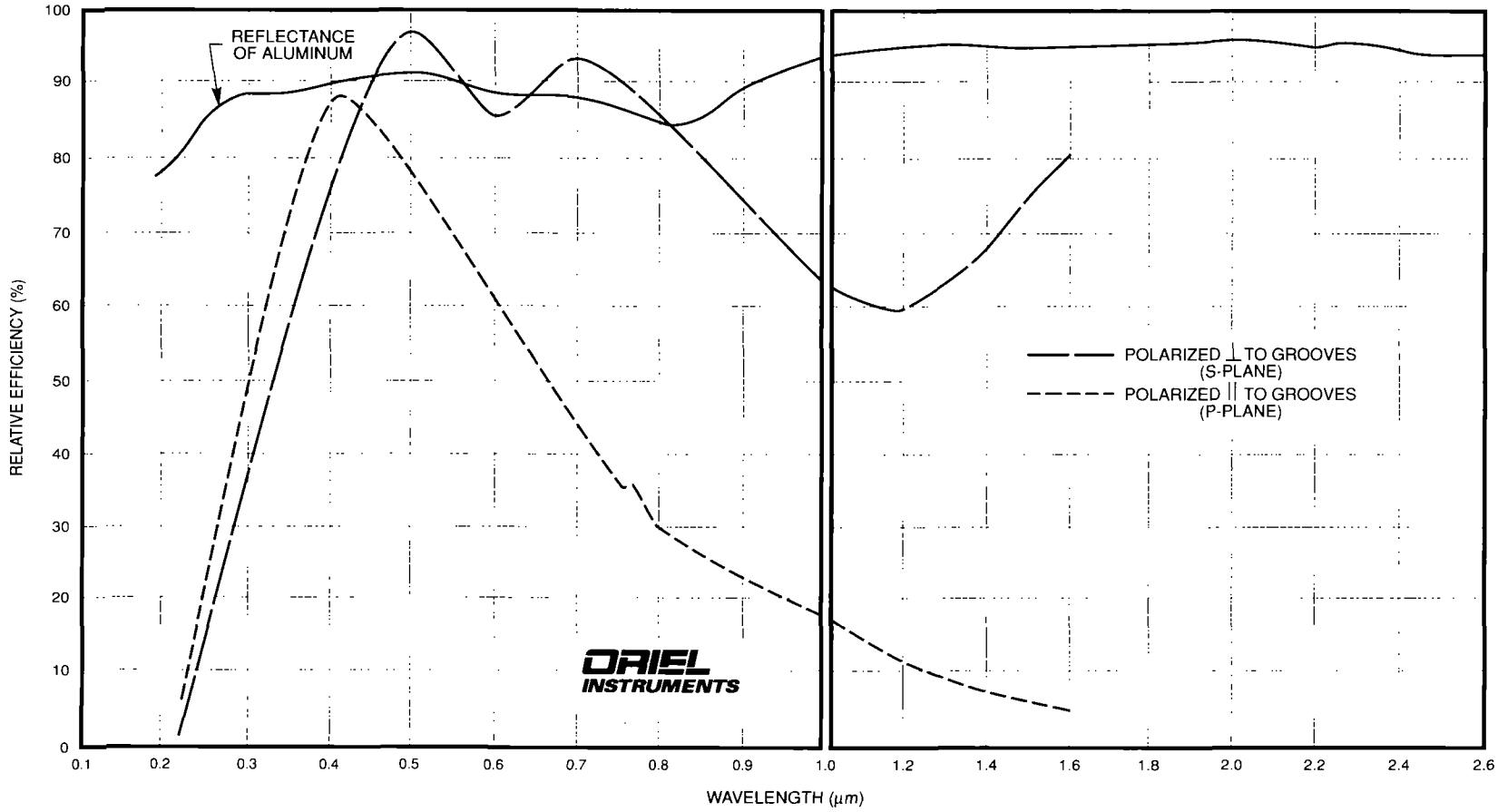
77911 (30 x 30 x 3 mm) and 77912 (50 x 50 x 6 mm) Gratings

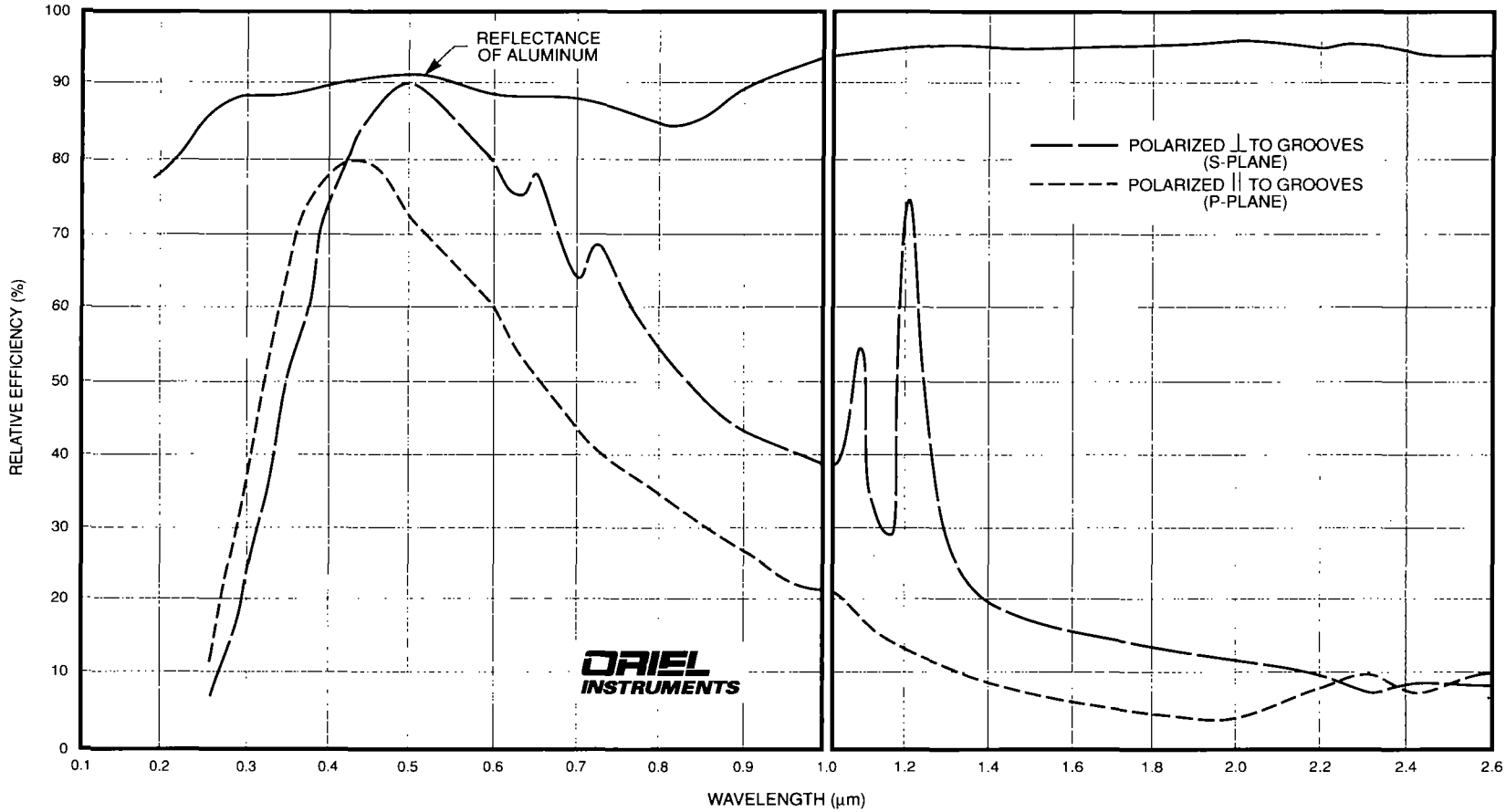


SPECIFICATIONS

Line Density:	1200 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	500 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	280-1600 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	250-1600 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

77923 (30 x 30 x 3 mm) and 77924 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	600 l/mm	*77700 Series Monochromator/Spectrograph equivalent grating (page):*	N/A
Blaze Wavelength:	500 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	280-1200 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	250-1600 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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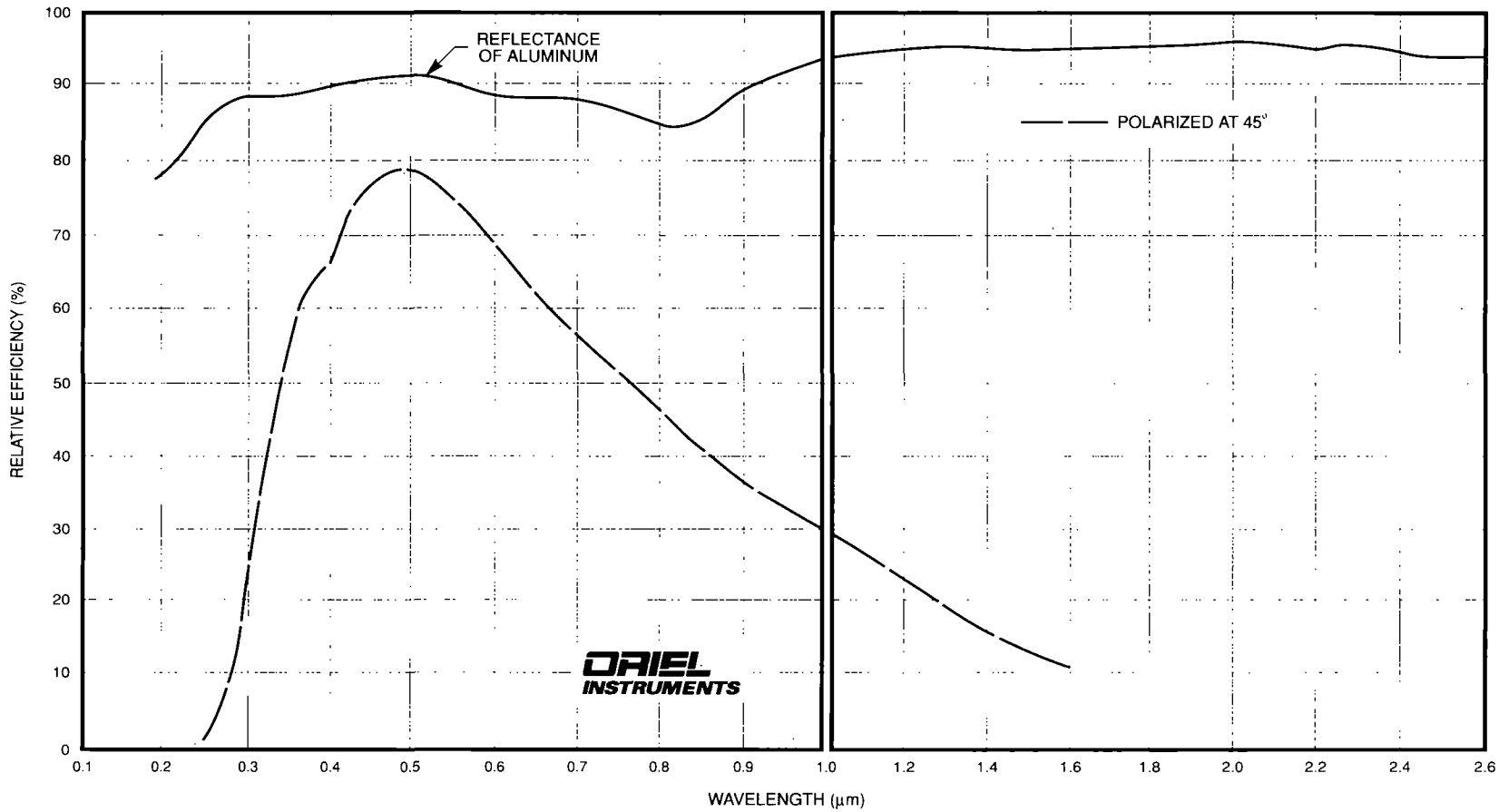
77931 (30 x 30 x 3 mm) and 77932 (50 x 50 x 6 mm) Gratings

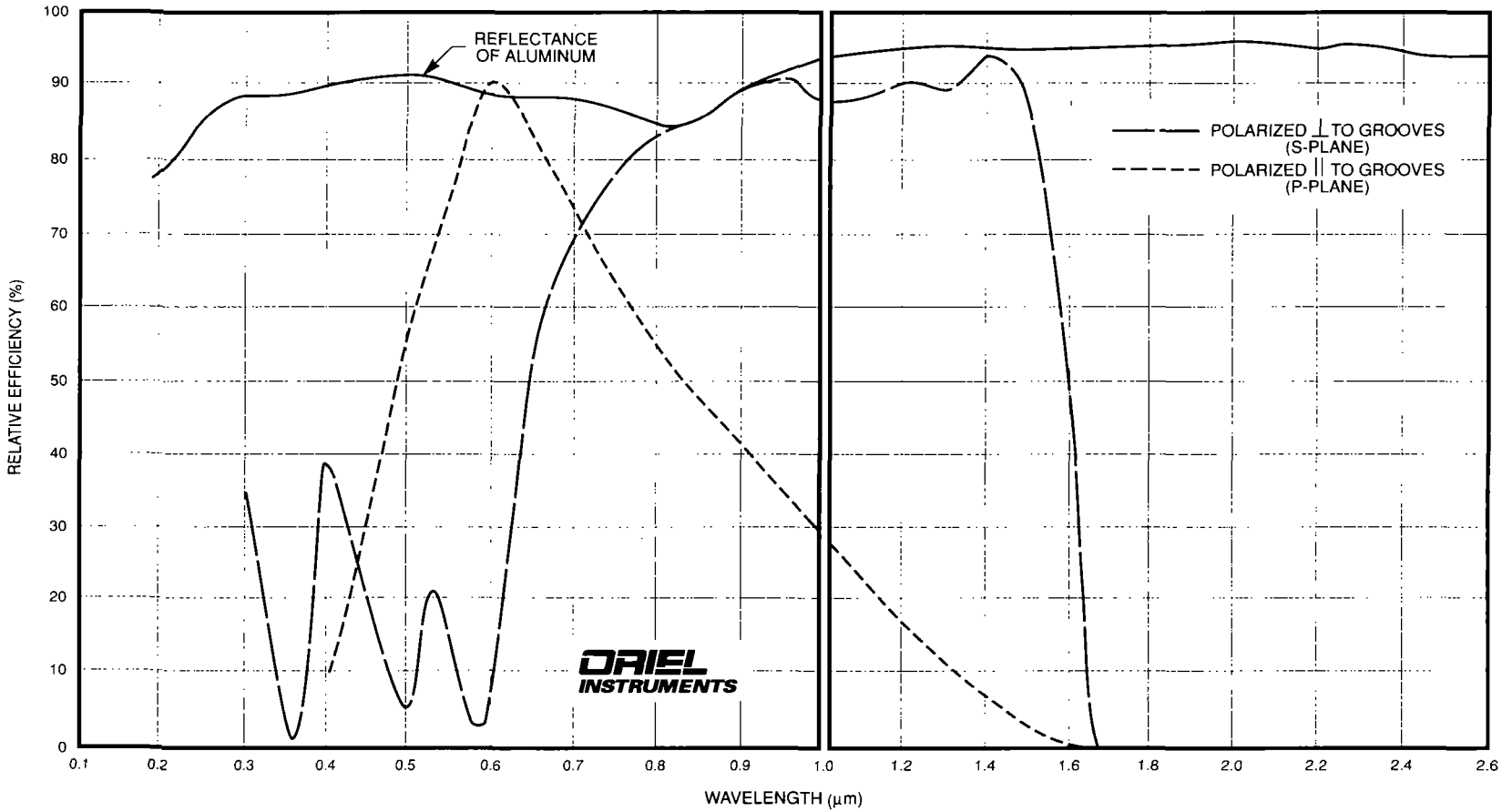


SPECIFICATIONS

Line Density:	400 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	500 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77240 (44)
Primary Wavelength Region[1]:	300-1200 nm	77400 1/8 m Spectrograph equivalent grating (page):	77417 (61)
Usable Wavelength Region[2]:	270-1600 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

77913 (30 x 30 x 3 mm) and 77914 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	1200 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77752 (19)
Blaze Wavelength:	750 nm	77250 1/8 m Monochromator equivalent grating (page):	77306 (31)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77229 (45)
Primary Wavelength Region[1]:	450-1600 nm	77400 1/8 m Spectrograph equivalent grating (page):	77412 (62)
Usable Wavelength Region[2]:	400-1600 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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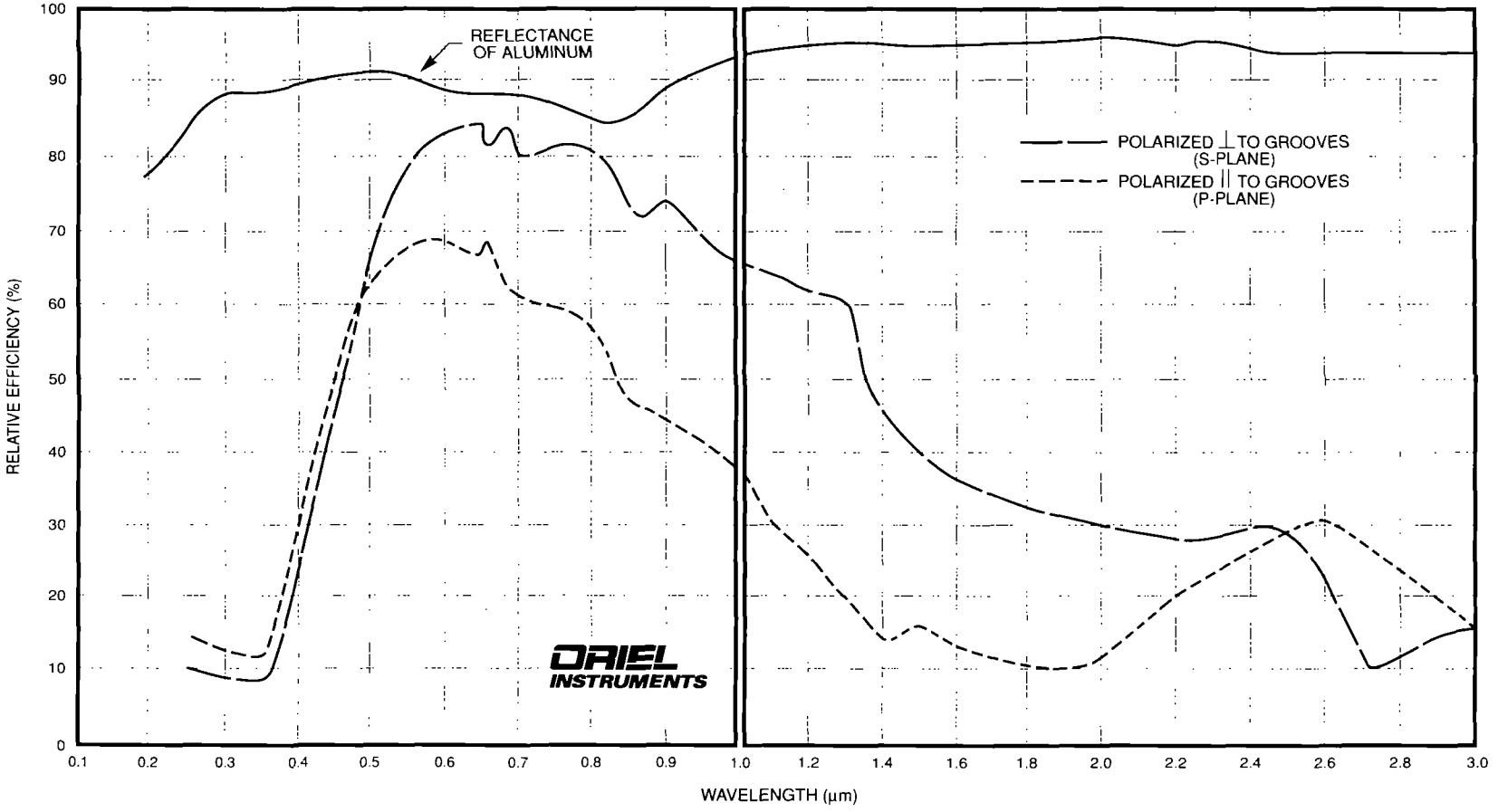
77925 (30 x 30 x 3 mm) and 77926 (50 x 50 x 6 mm) Gratings

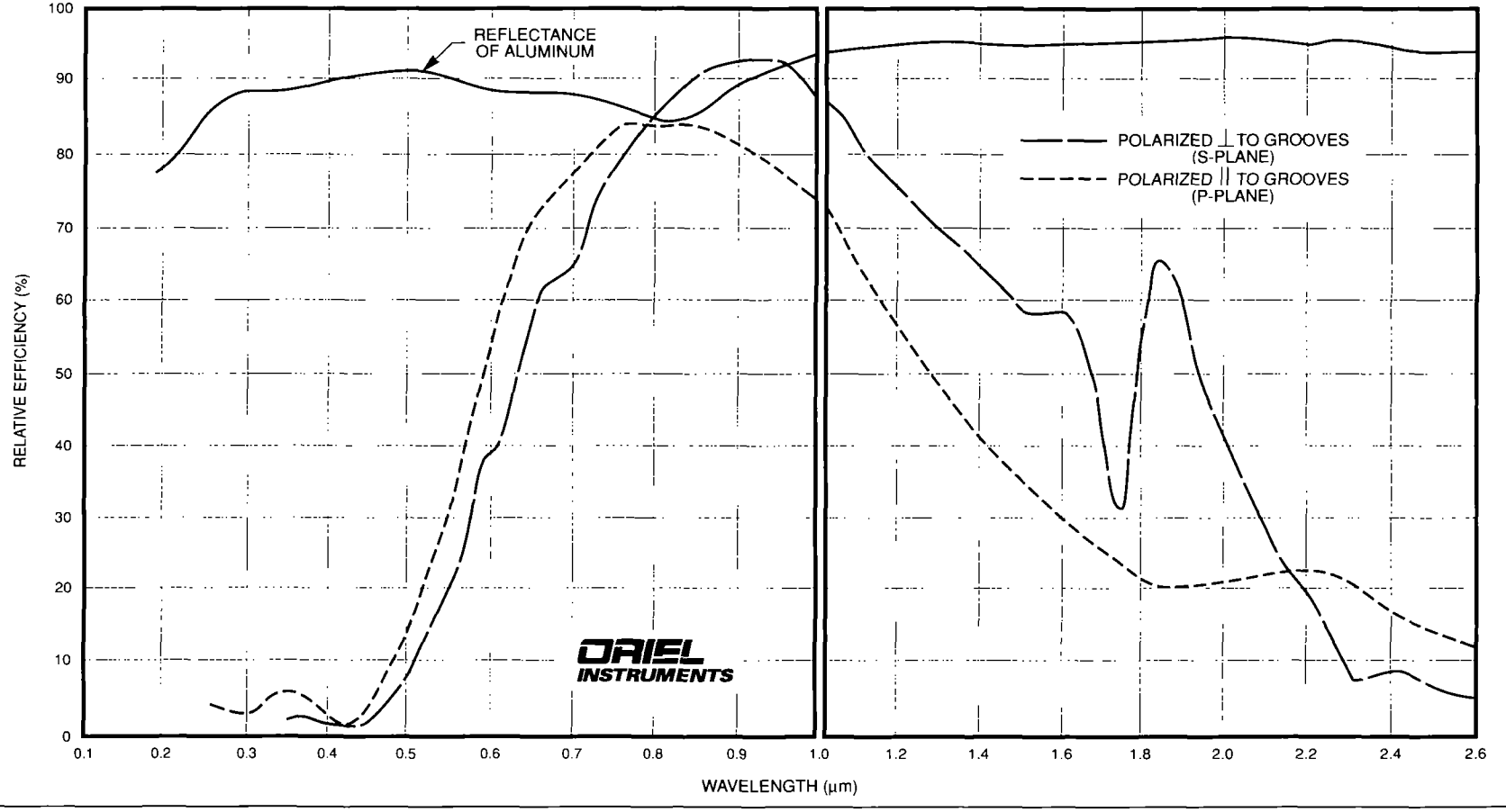


SPECIFICATIONS

Line Density:	600 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	750 nm	77250 1/8 m Monochromator equivalent grating (page):	77305 (32)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77243 (46)
Primary Wavelength Region[1]:	450-2800 nm	77400 1/8 m Spectrograph equivalent grating (page):	77415 (63)
Usable Wavelength Region[2]:	400-3000 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

77933 (30 x 30 x 3 mm) and 77934 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	400 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	850 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	550-2200 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	500-2500 nm		

[1]*Wavelength region where the grating efficiency is ≥20%.*
[2]Wavelength region where the grating efficiency is ≥10%.

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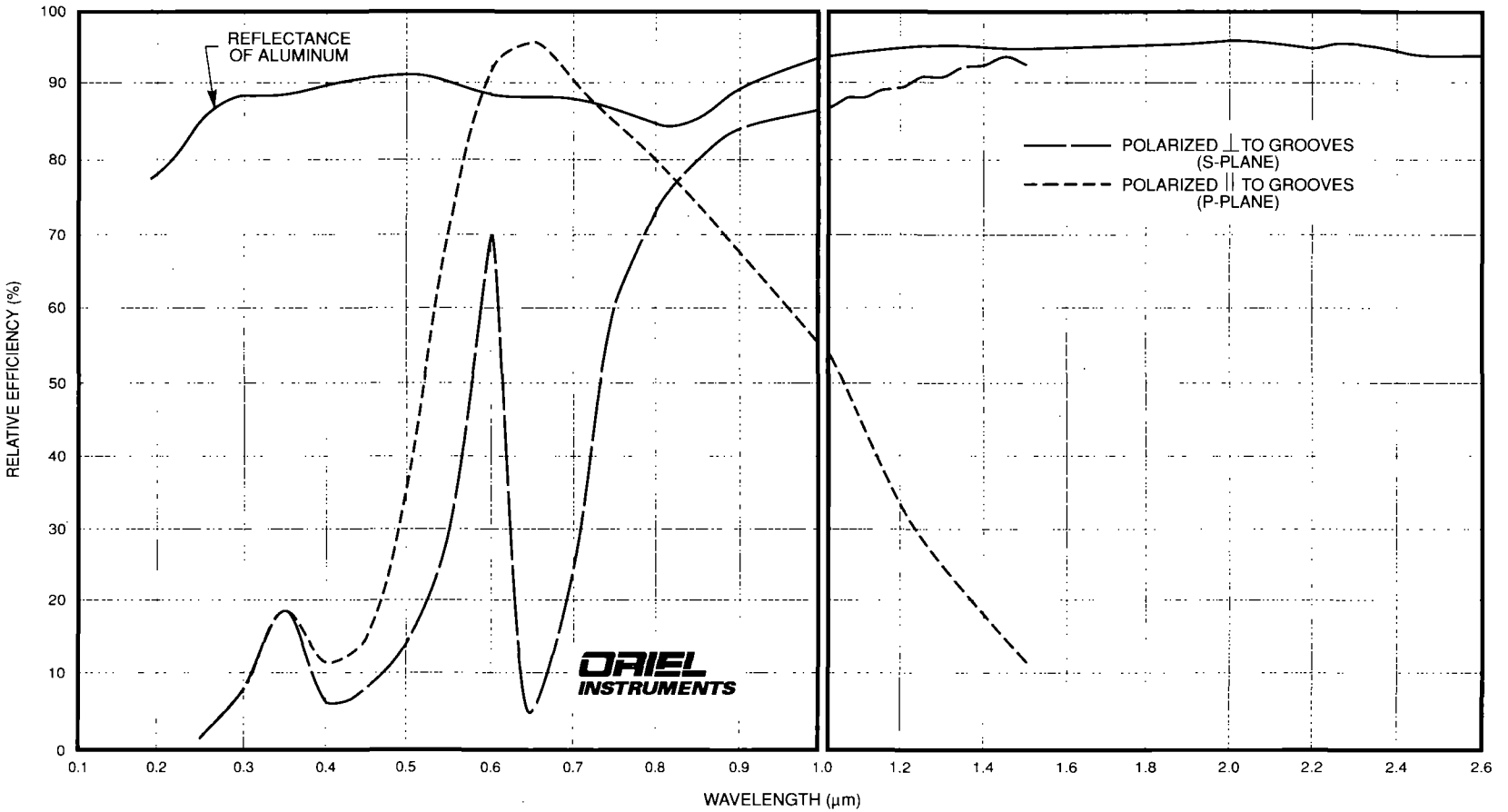
77915 (30 x 30 x 3 mm) and 77916 (50 x 50 x 6 mm) Gratings

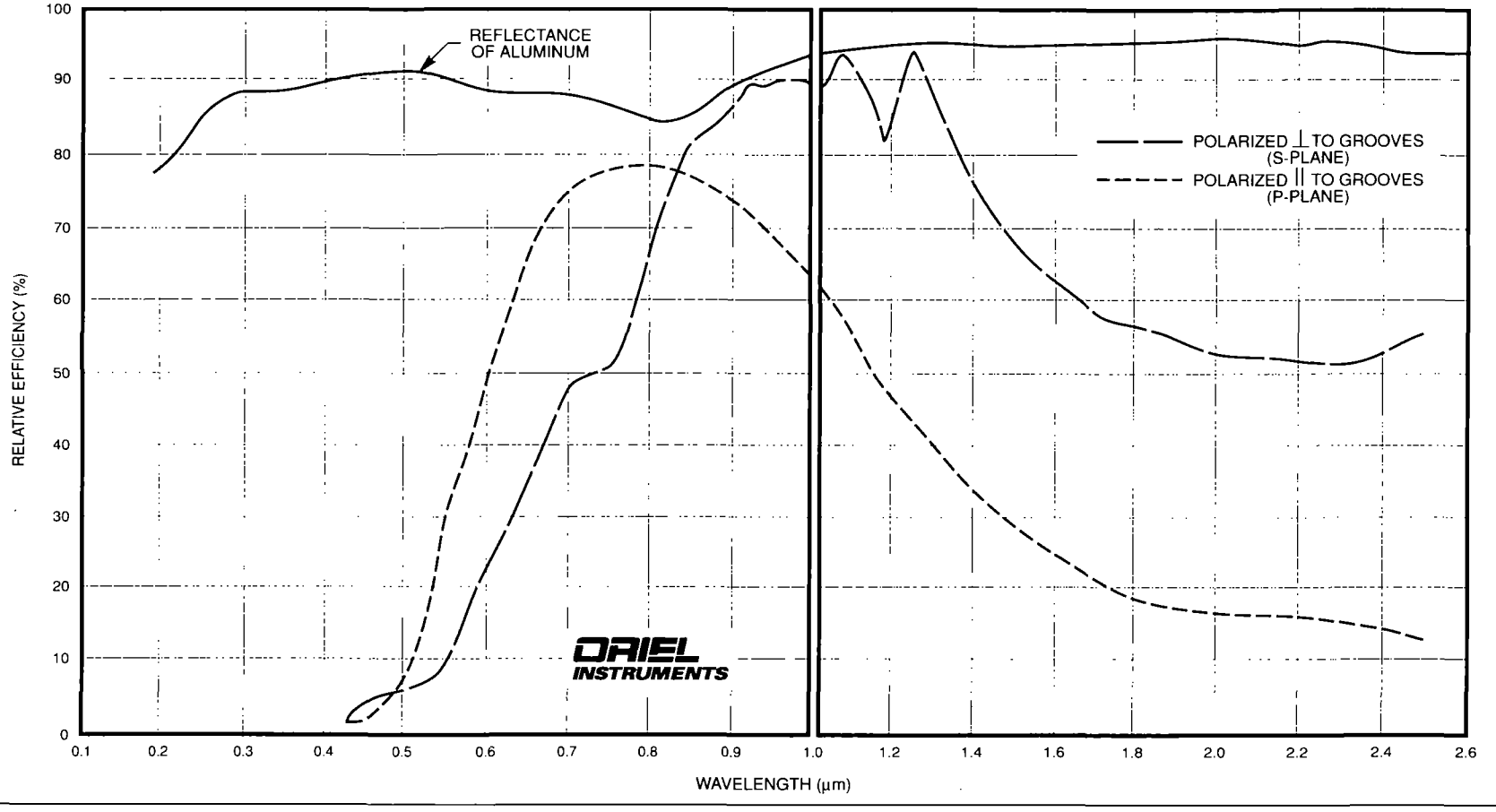


SPECIFICATIONS

Line Density:	1200 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	1000 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	550-1600 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	300-1600 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

77927 (30 x 30 x 3 mm) and 77928 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	600 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77745 (20)
Blaze Wavelength:	1000 nm	77250 1/8 m Monochromator equivalent grating (page):	77299 (33)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77234 (47)
Primary Wavelength Region[1]:	600-2500 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	550-2500 nm		

[1]*Wavelength region where the grating efficiency is ≥20%.*
[2]Wavelength region where the grating efficiency is ≥10%.

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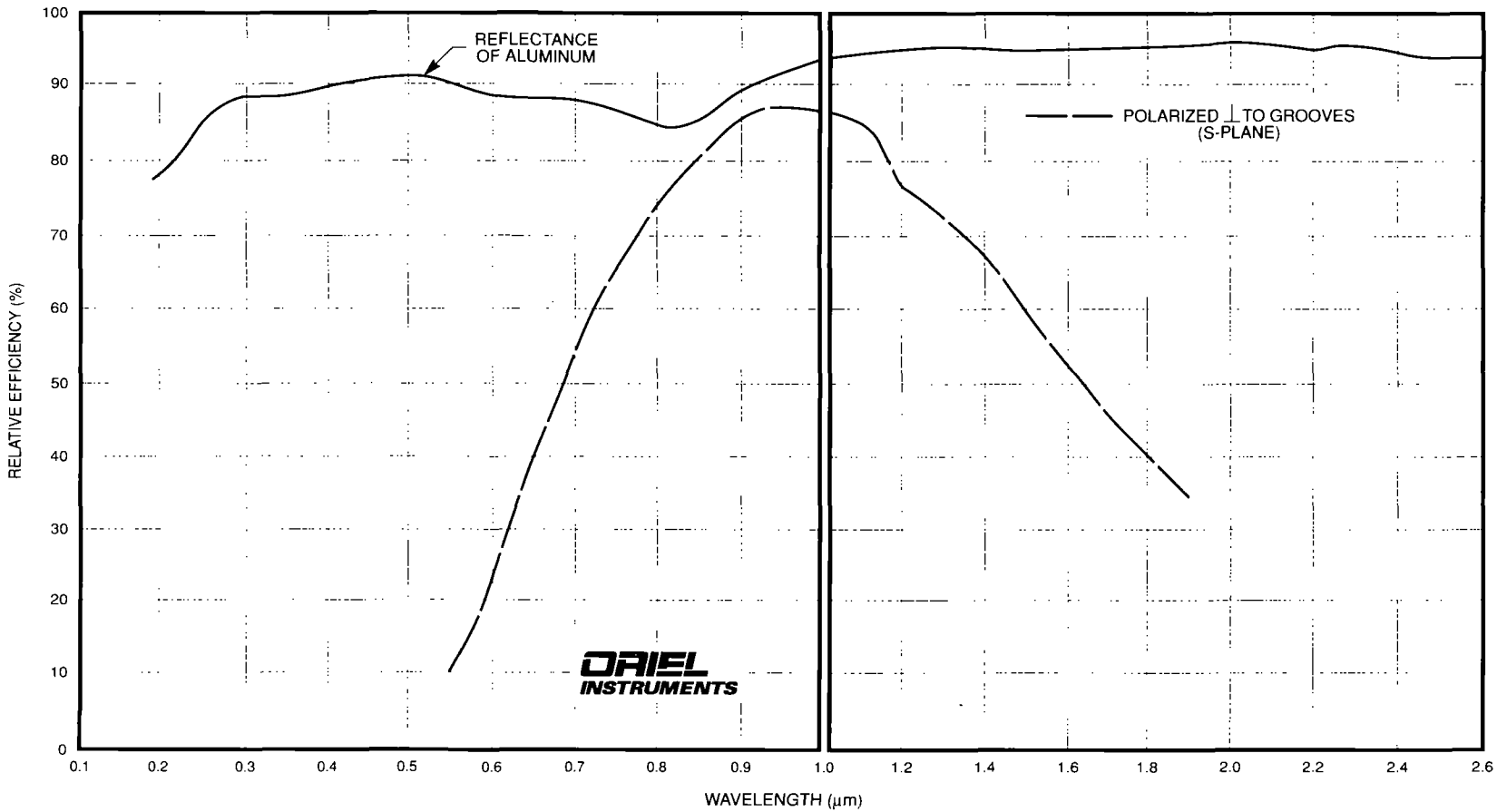
77945 (30 x 30 x 3 mm) and 77946 (50 x 50 x 6 mm) Gratings

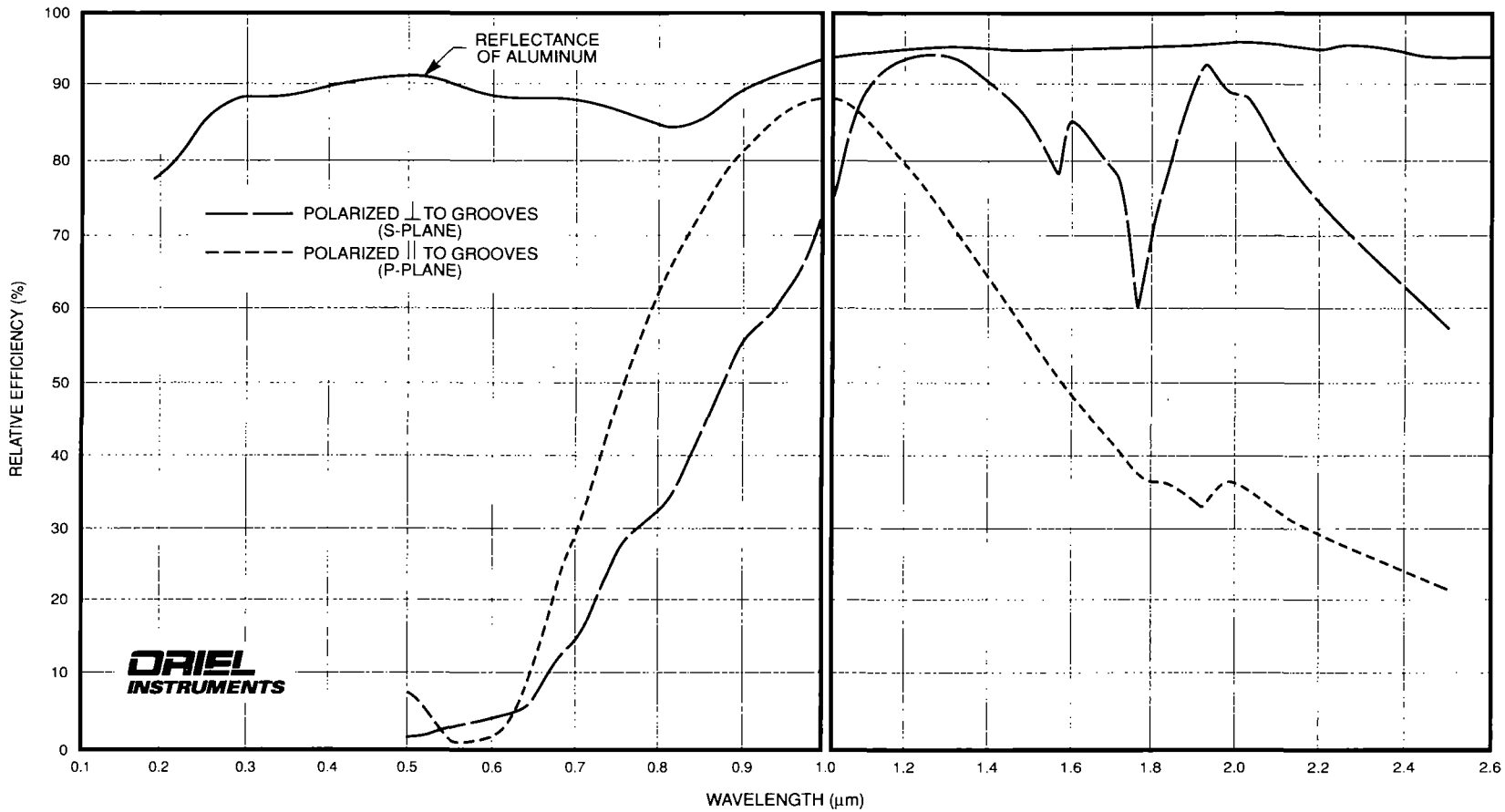


SPECIFICATIONS

Line Density:	200 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77749 (21)
Blaze Wavelength:	1000 nm	77250 1/8 m Monochromator equivalent grating (page):	77307 (34)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77244 (48)
Primary Wavelength Region[1]:	600-2200 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	550-2400 nm		

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

77935 (30 x 30 x 3 mm) and 77936 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	400 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77746 (22)
Blaze Wavelength:	1200 nm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	700-2500 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	650-2500 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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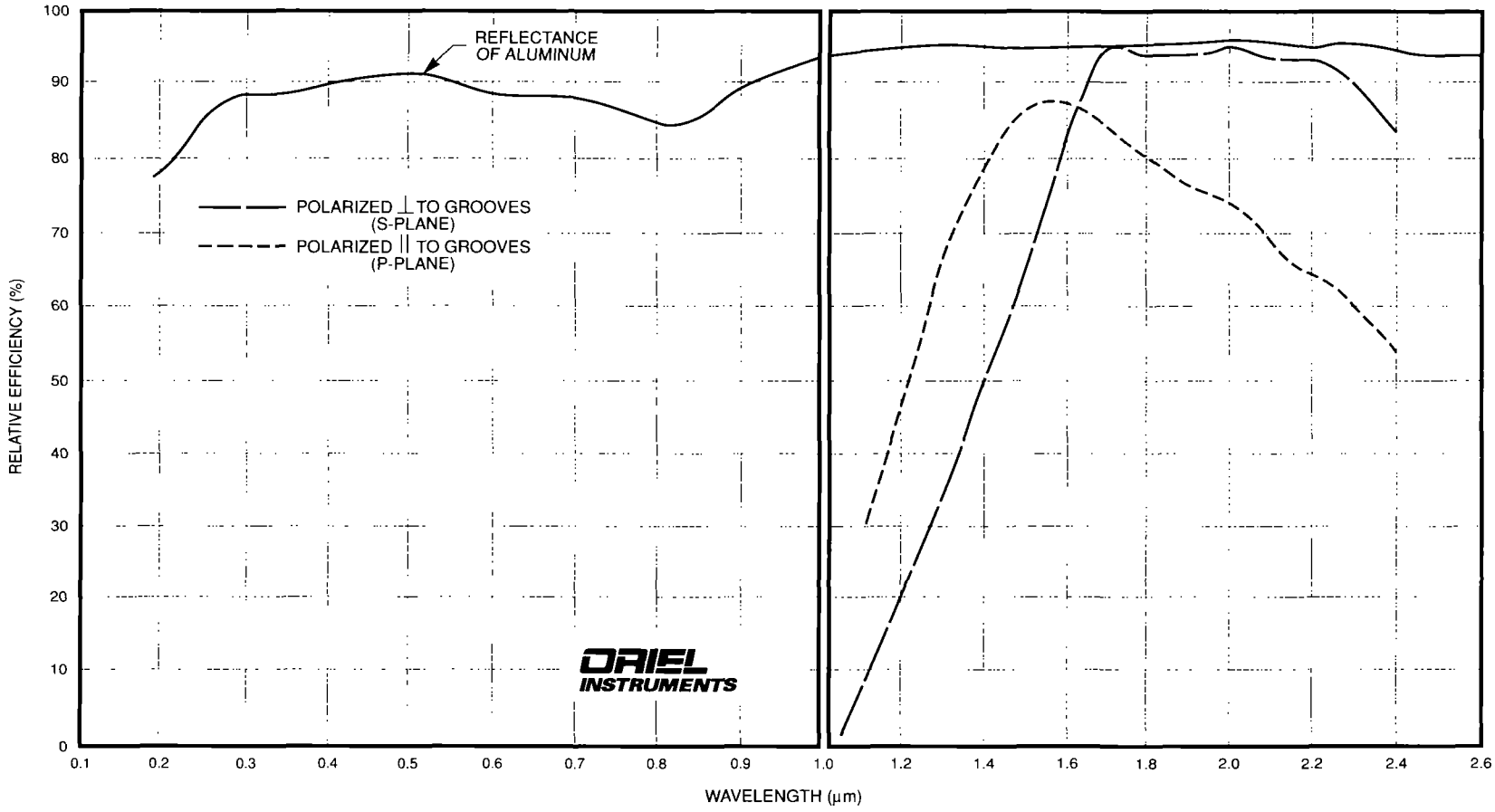
77941 (30 x 30 x 3 mm) and 77942 (50 x 50 x 6 mm) Gratings

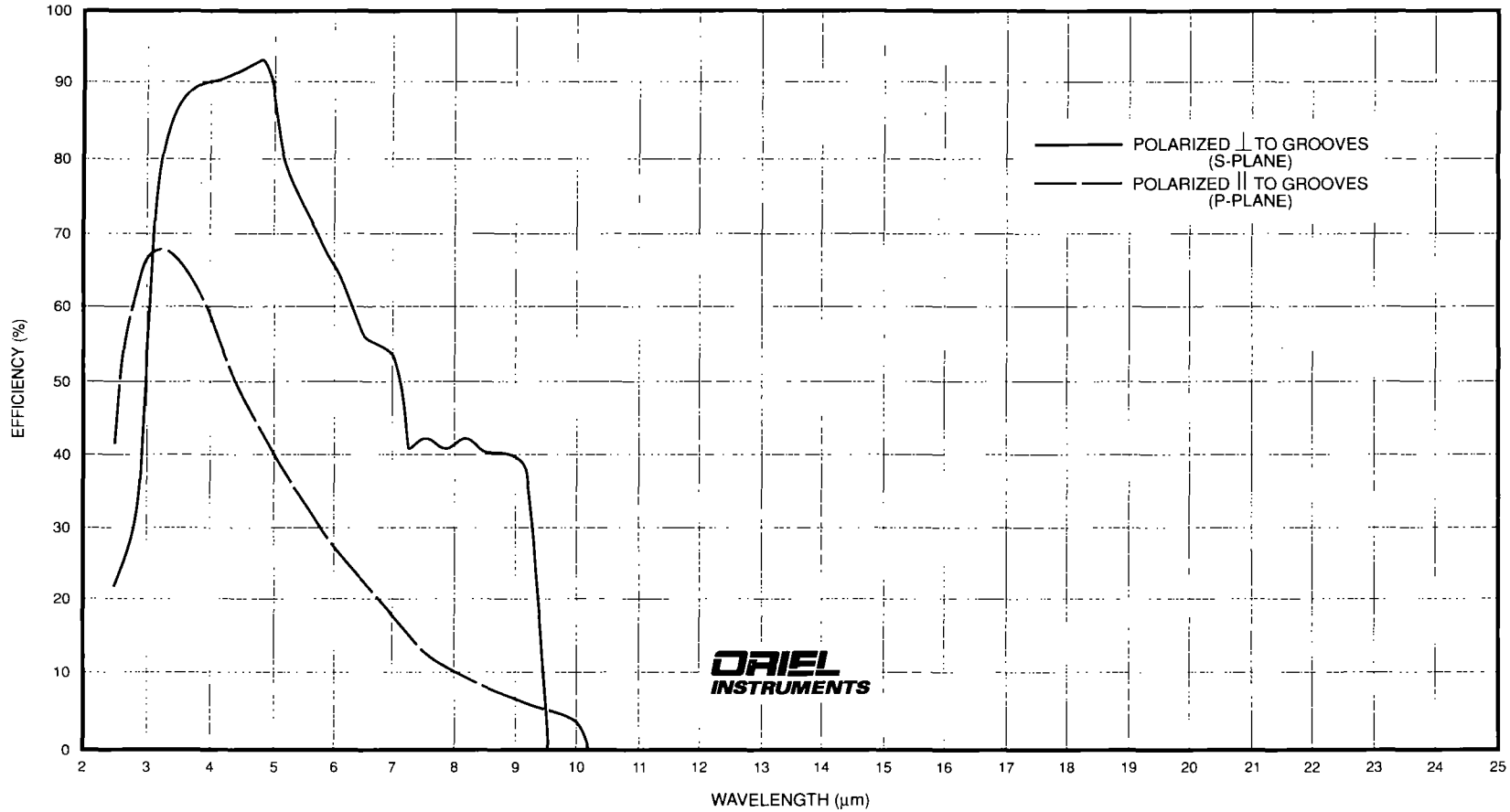


SPECIFICATIONS

Line Density:	300 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	77748 (23)
Blaze Wavelength:	2000 nm	77250 1/8 m Monochromator equivalent grating (page):	77300 (35)
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	77235 (49)
Primary Wavelength Region[1]:	1100-3400 nm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	1000-4000 nm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

77947 (30 x 30 x 3 mm) and 77948 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	150 l/mm
Blaze Wavelength:	4 µm
Type:	Ruled
Primary Wavelength Region[1]:	2.5-9 µm
Usable Wavelength Region[2]:	2.5-9.5 µm

77700 Series Monochromator/Spectrograph equivalent grating (page):	*77750 (24)*
77250 1/8 m Monochromator equivalent grating (page):	77301 (36)
77200 1/4 m Monochromator equivalent grating (page):	77236 (50)
77400 1/8 m Spectrograph equivalent grating (page):	N/A

[1]Wavelength region where the grating efficiency is ≳20%.
[2]Wavelength region where the grating efficiency is ≳10%.

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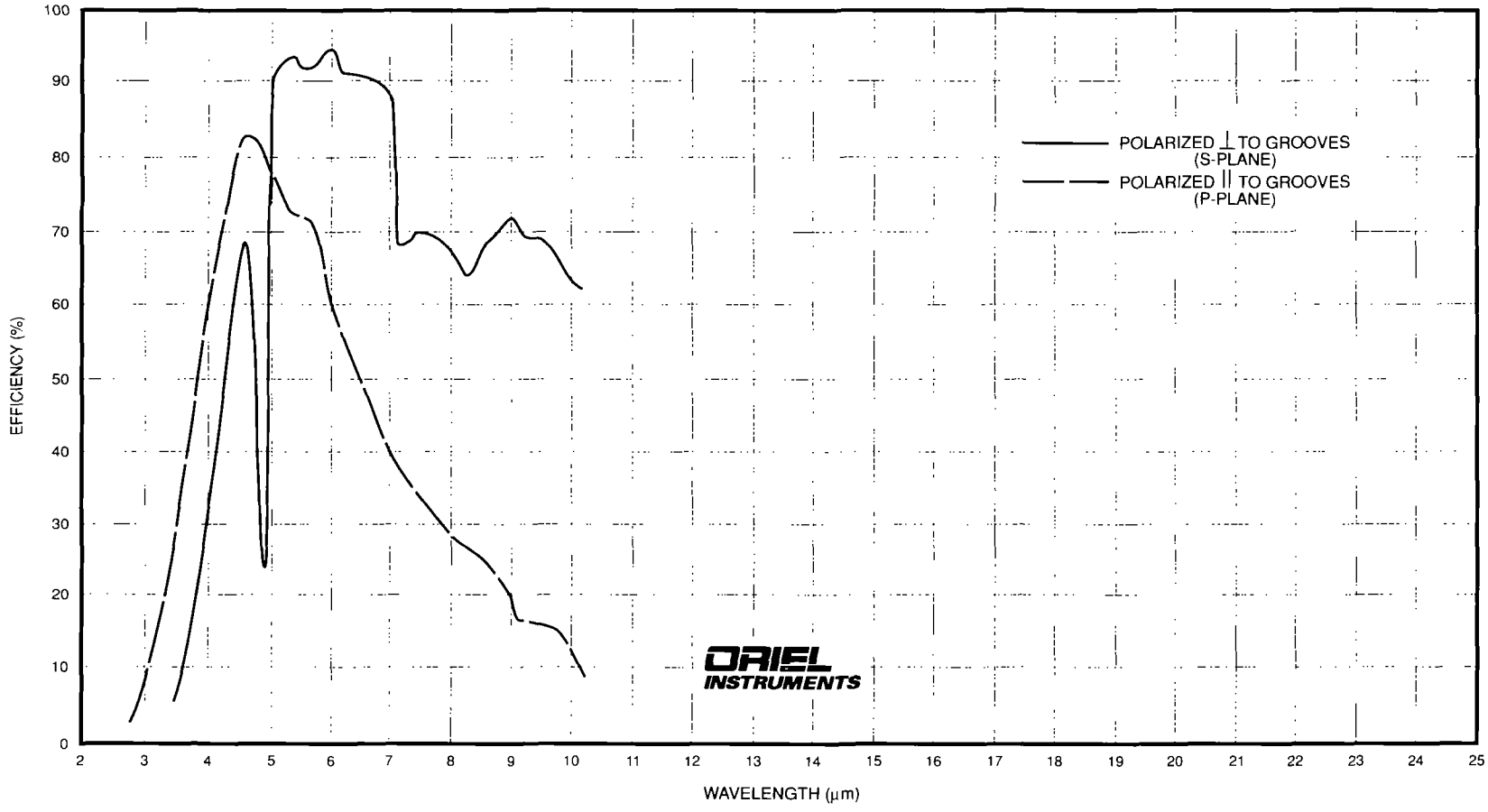
77949 (30 x 30 x 3 mm) and 77950 (50 x 50 x 6 mm) Gratings

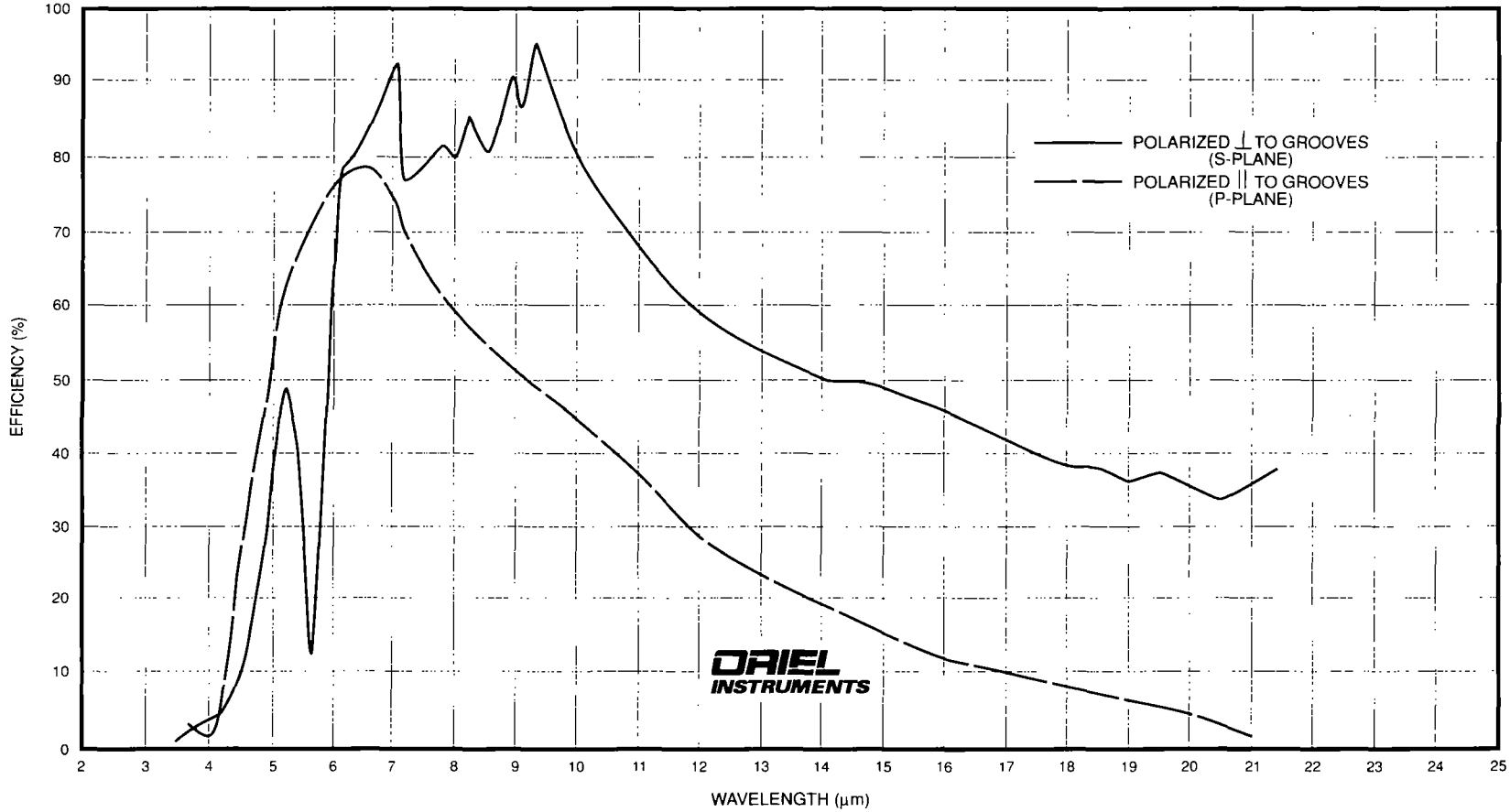


SPECIFICATIONS

Line Density:	150 l/mm	77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
Blaze Wavelength:	6 µm	77250 1/8 m Monochromator equivalent grating (page):	N/A
Type:	Ruled	77200 1/4 m Monochromator equivalent grating (page):	N/A
Primary Wavelength Region[1]:	4-10 µm	77400 1/8 m Spectrograph equivalent grating (page):	N/A
Usable Wavelength Region[2]:	3.5-10.5 µm		

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

77951 (30 x 30 x 3 mm) and 77952 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	75 l/mm
Blaze Wavelength:	7 µm
Type:	Ruled
Primary Wavelength Region[1]:	4.5-20 µm
Usable Wavelength Region[2]:	4.5-21 µm

77700 Series Monochromator/Spectrograph equivalent grating (page):	77751 (25)
77250 1/8 m Monochromator equivalent grating (page):	77302 (37)
77200 1/4 m Monochromator equivalent grating (page):	77237 (51)
77400 1/8 m Spectrograph equivalent grating (page):	N/A

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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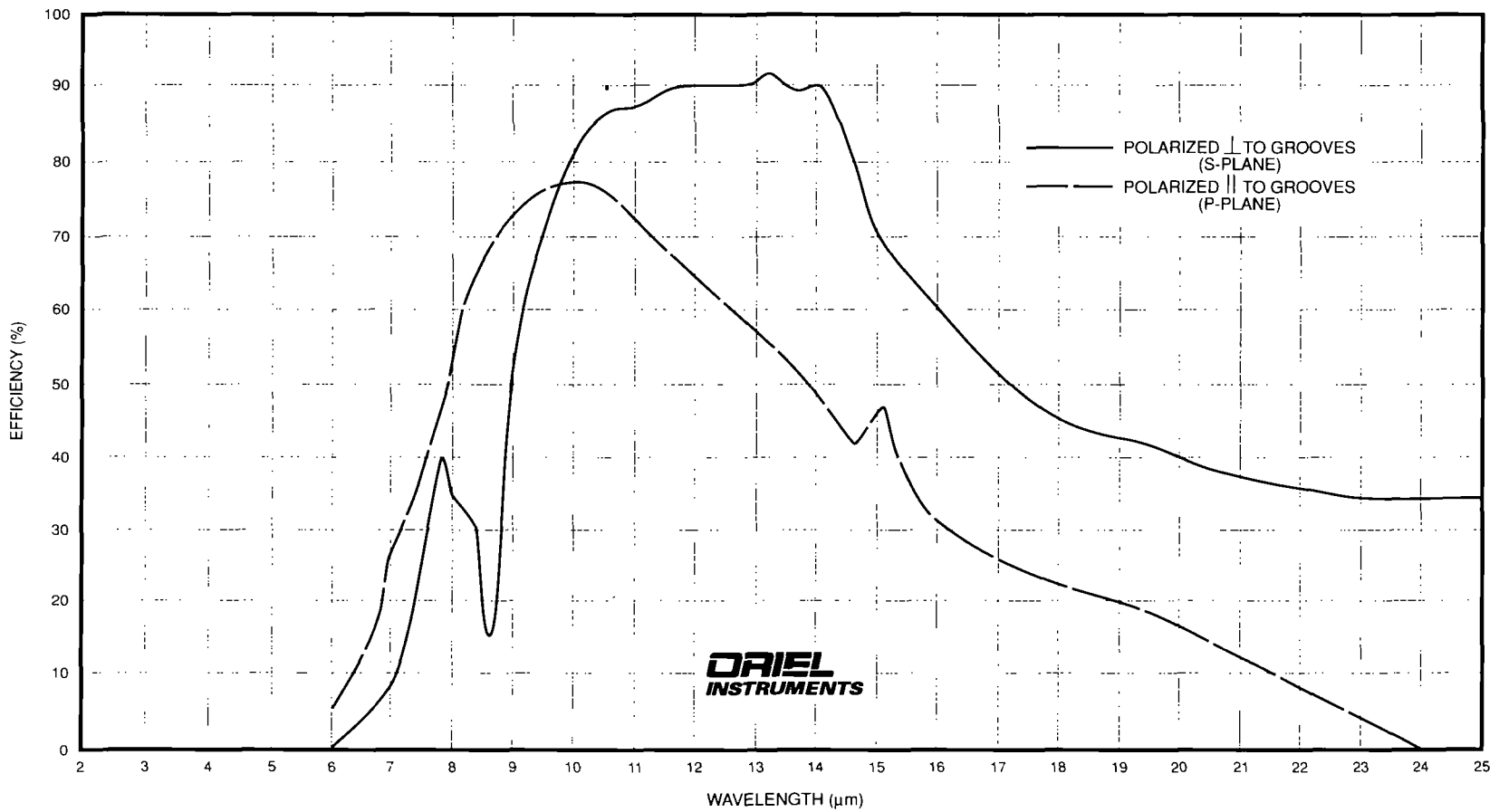
77953 (30 x 30 x 3 mm) and 77954 (50 x 50 x 6 mm) Gratings



SPECIFICATIONS

Line Density:	50 l/mm
Blaze Wavelength:	11 µm
Type:	Ruled
Primary Wavelength Region[1]:	7-23 µm
Usable Wavelength Region[2]:	6.5-24 µm

77700 Series Monochromator/Spectrograph equivalent grating (page):	N/A
77250 1/8 m Monochromator equivalent grating (page):	77303 (38)
77200 1/4 m Monochromator equivalent grating (page):	N/A
77400 1/8 m Spectrograph equivalent grating (page):	N/A

[1]Wavelength region where the grating efficiency is ≥20%.
[2]Wavelength region where the grating efficiency is ≥10%.

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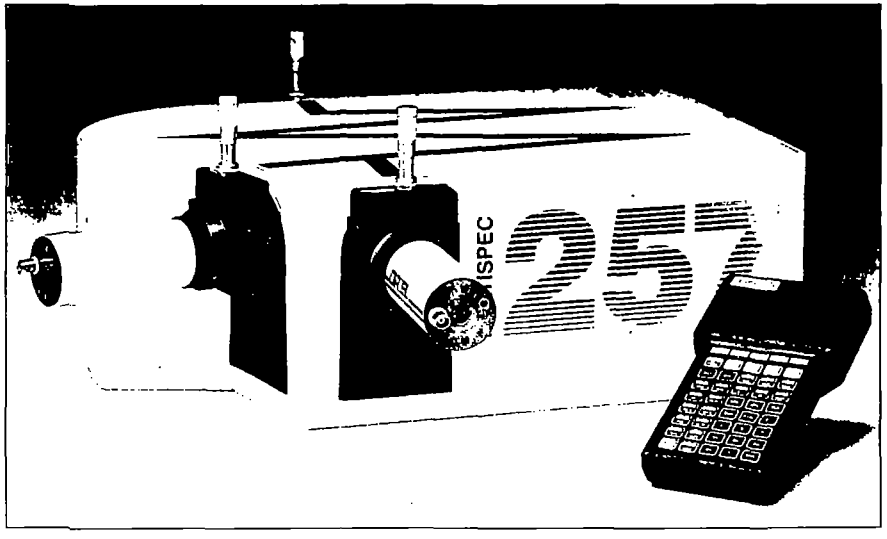


IMAGING MONOCHROMATOR/SPECTROGRAPH

Our new MS 257™ isn't just another 1/4 m monochromator/spectrograph. It's a very smart instrument - it can almost do your work for you!

MS 257™ is available with single, dual, triple or quadruple grating turret: an integrated filter wheel; two input ports and two output ports. A built-in microprocessor allows automatic grating, filter and port selection, at the desired wavelength. An internal shutter is included for dark current measurements and readout of frame transfer CCDs.

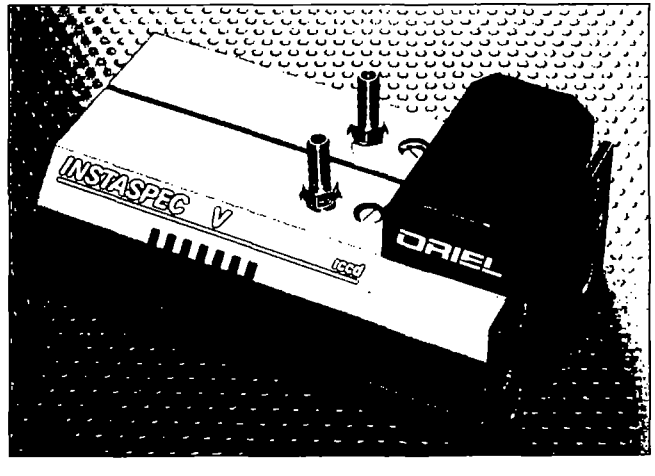
And, you don't have to worry about stray light! Back reflected light from the mirrors and detector have been virtually eliminated.

MULTICHANNEL DETECTORS

Our new multichannel detectors (photodiode arrays, spectroscopic CCDs and imaging CCDs) are fast, powerful, portable and reasonably priced. And when we say portable, we mean portable - our new PC-Spec™ is a spectrograph and photodiode array on a single PC plug-in card!! A fiber optic cable brings the light right into the spectrograph mounted on the card.

Our spectroscopic CCD, InstaSpec™ IV, offers the sensitivity needed for fluorescence, and is the heart of a low cost, compact Raman Spectroscopy system. Combined with our 1/8 m spectrograph and Holographic Notch Filters you can analyze weak Raman scatter in just seconds.

InstaSpec™ V ICCD is our gated intensified system. It measures photon light levels, with ns time resolution. The high sensitivity and detectability make InstaSpec™ V ideal for Raman, Luminescence, Microspectroscopy and Imaging.



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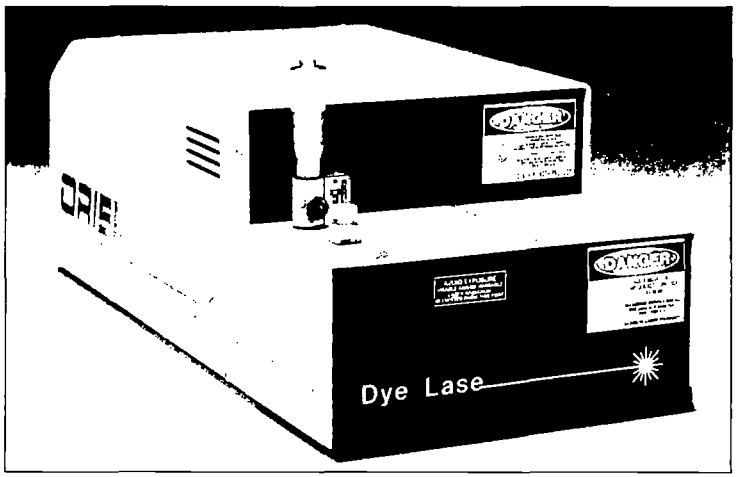
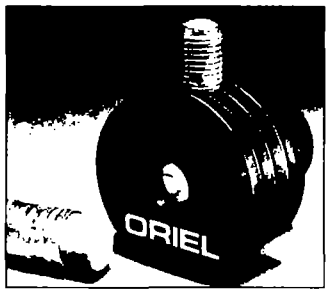
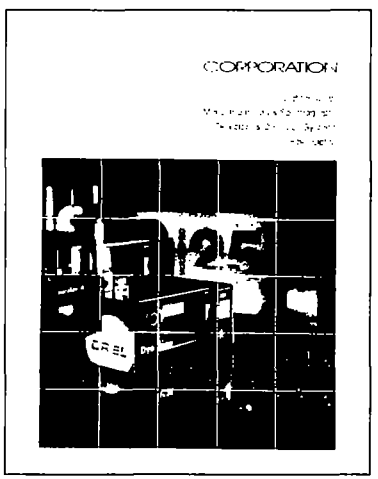
Excellent for time resolved spectroscopy and for gated excitation, they can be quickly adapted to sample illumination or for use with monochromators or spectrographs. Some of these sources are ideal for efficient coupling to fiber optics for remote sensing or microscopy.





IR DETECTORS

If you need to detect low level IR radiation, you'll want to know more about our new line of HgCdZnTe Detectors. They have a broad spectral response, 2 to >12 µm for some models, excellent detectivity, D* is >1 x 10^{11} cm $Hz^{1/2}/W$ for a TE cooled model, are extremely compact (they are offered mounted and unmounted), and reasonably priced.



WHERE DO I FIND THESE PRODUCTS?

You can find these and over 3000 other products in Oriel's new **Light Research** Catalog. This 528 page book covers UV-IR pulsed and continuous light sources, monochromators, spectrographs, spectrophotometers, UV-IR detectors and detection equipment, data acquisition software, and fiber optics.

The technical detail for each product, the tutorials on various technologies and the spectral irradiance data for all light sources make this the most valuable light research catalog you can order. And, it's **FREE!** Write, call, fax or E-Mail your request to the address on the previous page.

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