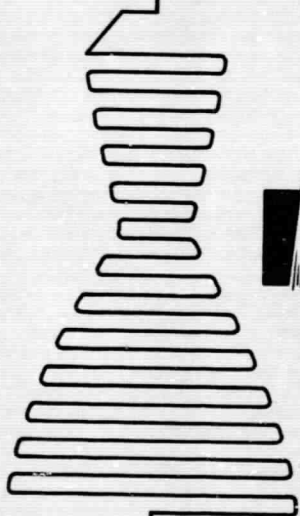


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INFRARED SPECTRAL ⁴
ABSORPTION COEFFICIENT DATA
FOR H₂O

Contract NAS 8-20397

G.O. 08851

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FOREWORD

This work was supported by the George C. Marshall Space Flight Center, NASA, Huntsville, Alabama, under Contracts NAS8-20397 and NAS8-19. The contract monitor was Robert M. Huffaker of the Aero-Astrodynamic Laboratory.

ABSTRACT

A summary of a spectral absorption coefficient measurements program is presented. The data are for H₂O vapor in the 1 to 8 micron region over the temperature range 575 to 1250 degrees Kelvin at pressures up to 1 atmosphere. Foreign gas broadening by H₂, CO, and CO₂ is included. An index to the available spectra is reproduced as an appendix.

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INTRODUCTION AND SUMMARY

Determination of the radiant energy emitted by the exhaust plume of a rocket engine is an important factor in the design of a vehicle engine system. This determination requires an aerothermodynamic plume model which will specify the local pressure, temperature, and composition at any point in the plume. In addition, the radiative characteristics of the exhaust species must be known. NASA has developed a computer program which calculates the radiant energy emanating from an exhaust plume model for single- and multiple-engine configurations. In this calculation, band-model parameters are used in a modified Curtis-Godson approximation to describe the radiative characteristics of the various exhaust species. These band-model parameters are determined from spectral absorptance measurements made over a variety of optical depths and temperatures by methods described in the literature (Refs. 1 and 2).

This report describes spectral absorption coefficient data collected on H_2O over the temperature range 575 to 1250 degrees Kelvin at pressures of 0.1 to 1 atmospheres and path lengths up to 1 meter for the 1.4, 1.8, 2.7, and 6.3 micron bands. Effects of foreign gas broadening by H_2 , CO , and CO_2 have been included. An index to the data, which is available from NASA,* is presented as an appendix.

These data, in addition to those available from other NASA programs, serve as a basis for determination of band model parameters. For this purpose the spectral data have been averaged over 25 cm^{-1} intervals. The complete set of averaged data are also available from NASA.

* For further information on availability, contact R. M. Huffaker, Aero-Astrodynamic Laboratory, MSFC-NASA, Huntsville, Alabama.

EXPERIMENTAL SYSTEM

THE SPECTROMETER

Optical System

Figure 1 is a photograph of the spectrometer taken during assembly and serves to show the general arrangement of the various components. A schematic diagram of the optical system is shown in Figure 2.

The greybody source is an electrically heated graphite rod mounted in an argon-purged, water-cooled housing. The source was operated at a brightness temperature of approximately 1900 K. Figure 2 shows that the instrument can be operated in a double-beam mode. However, for the subject program, the instrument was operated in a single-beam mode entirely. Optical chopping is performed between the greybody and the sample cell so that steady-state emission from the hot cell or its contents does not contribute to the a-c signal output of the detector and is, therefore, not passed by the a-c processing electronics.

The furnaces used to heat the absorption cells can accommodate path lengths up to 30 cm in length. To obtain a one-meter path length, cells were multiple passed as shown in Fig. 3.

Wavelength dispersion was obtained with a McPherson Model 213, one-meter, Czerny-Turner monochromator. This monochromator, which can accommodate gratings with a width up to five inches, has bilateral slits adjustable from zero to two millimeters, and is capable of a spectral resolution on the order of 0.1 cm^{-1} at 4000 cm^{-1} .

Radiation leaving the monochromator exit slit was focused on a PbS detector by an on-axis elliptical mirror providing image reduction of six to one. An off-axis elliptical mirror, also providing six to one

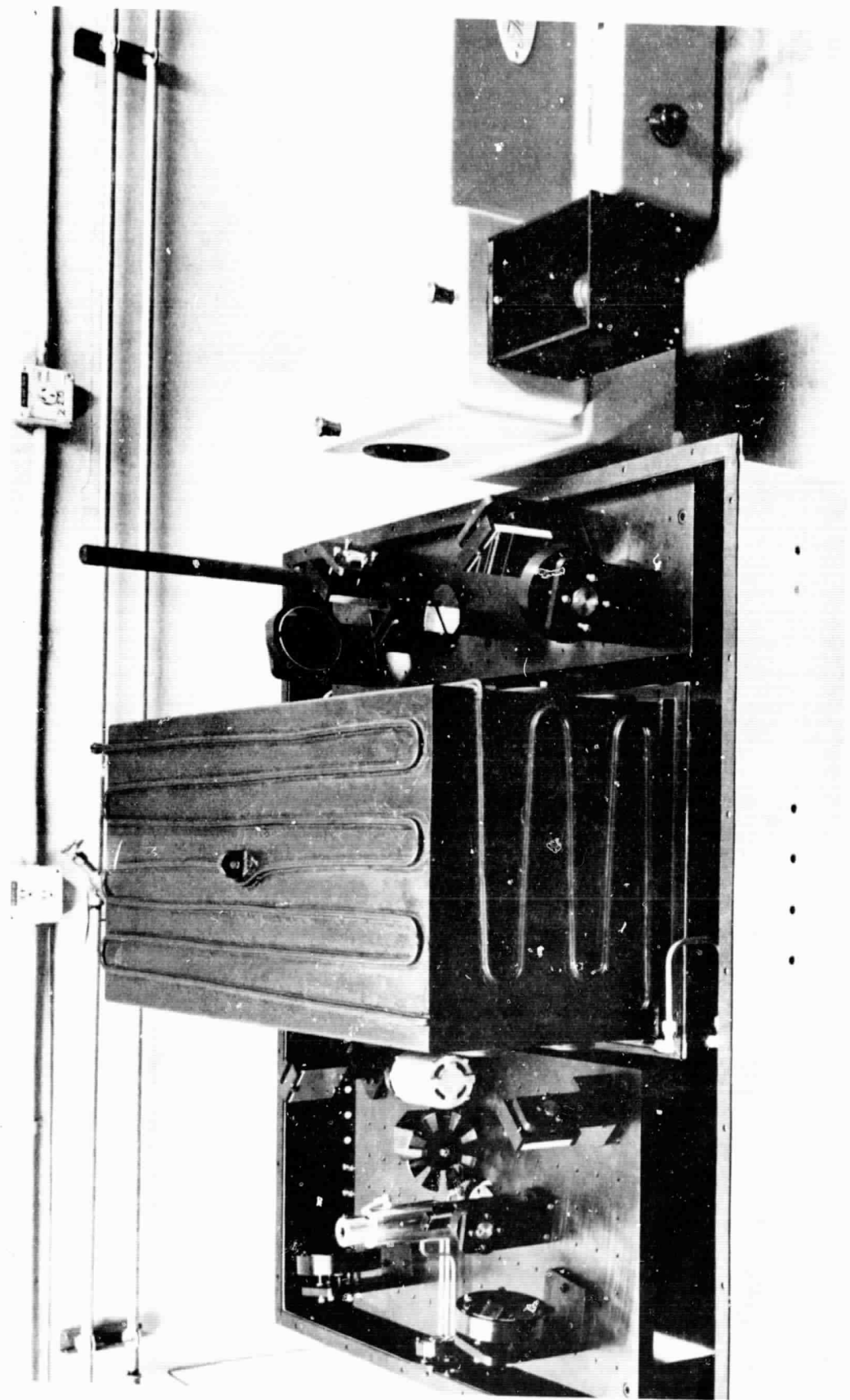


Figure 1. View of High-Resolution Spectrometer

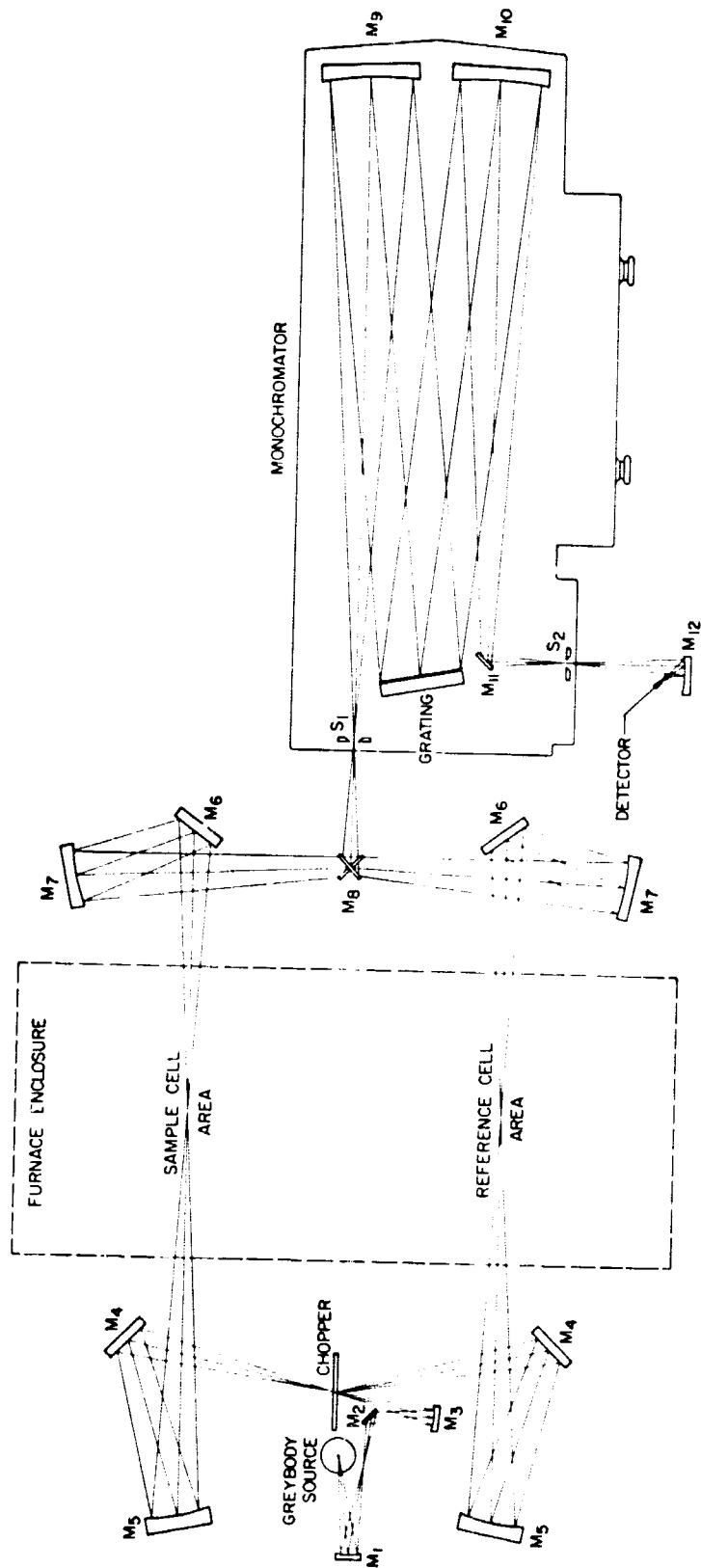


Figure 2. Optical System Schematic

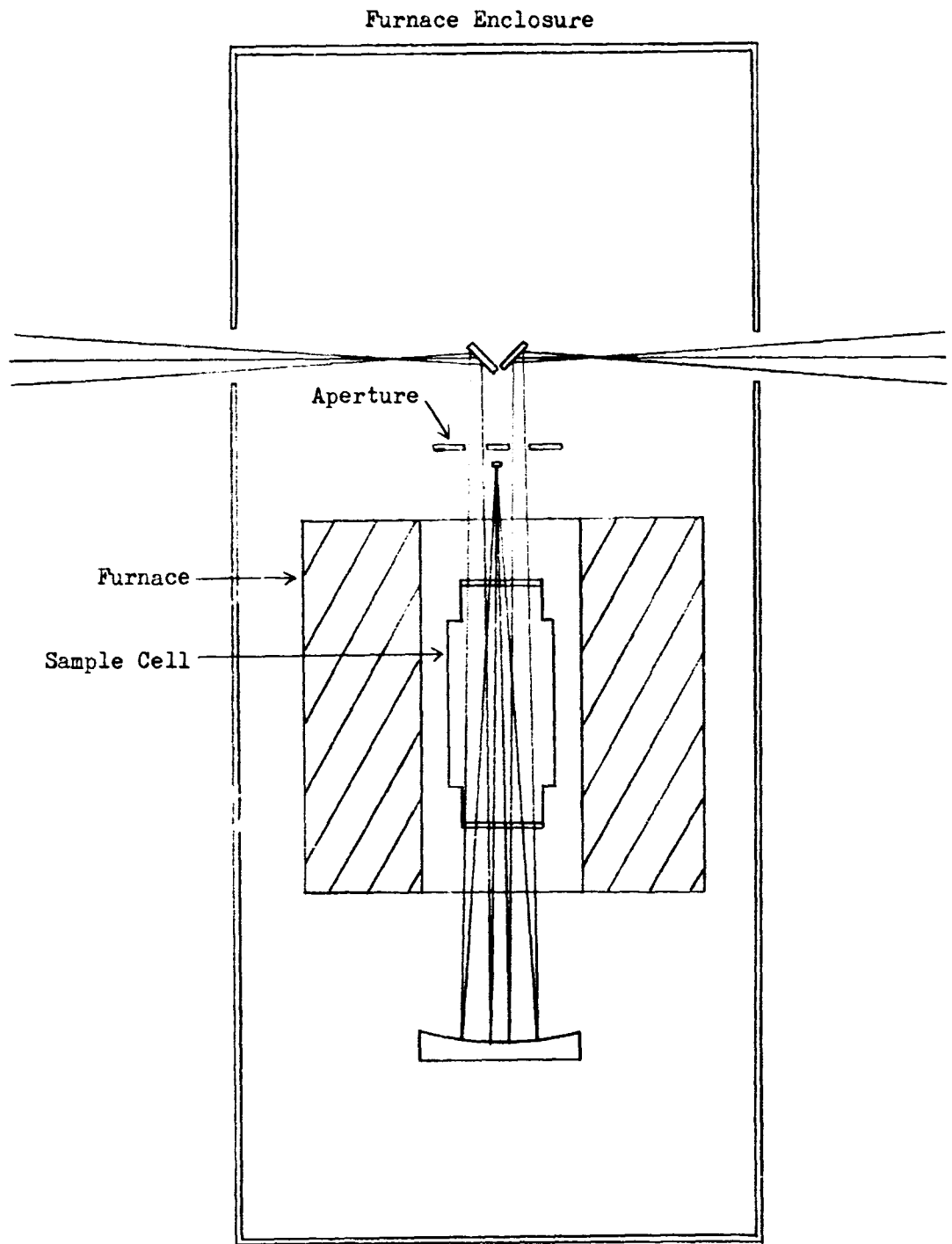


Figure 3. Arrangement for Multiple Passing of Absorption Cell

image reduction, was used to focus radiation on a PbSe detector. The PbSe detector is housed in a dewar and cooled to liquid nitrogen temperatures.

Mechanical Features

The spectrometer was constructed on a four-by-eight foot cast iron surface plate weighing 2000 pounds. Its surface is flat to within 0.002 inch. The massiveness of the surface plate eliminates adverse effects on experimental data which might be caused by vibration or shock. To eliminate effects due to temperature variations, the furnace enclosure is water cooled and the laboratory is air conditioned at a constant temperature. The entire instrument is enclosed and purged with liquid nitrogen boil-off to eliminate CO₂ and minimize H₂O absorption in the optical path.

Grating-Filter-Detector Selection

Two gratings, two detectors, and a number of filters were used in various combinations to isolate various spectral regions in the 1.0 to 8.5 micron range spanned in this program. By experimentation, a grating, grating order, filter and detector combination was selected for each portion of the spectral range to be covered so as to maximize both the signal-to-noise ratio and the spectral resolution. Care was taken in the selection of each combination to insure that it passed only radiation of the desired frequency and eliminated unwanted lower or higher orders of other frequencies. Table I lists the combinations that were used in covering various portions of the 1.0 to 8.5 micron wavelength range. The wavelengths at which silicon, germanium and indium arsenide begin to transmit are approximately 1.1, 1.7, and 3.7 microns, respectively.

TABLE I

GRATING - FILTER - DETECTOR COMBINATIONS USED IN
VARIOUS WAVELENGTH REGIONS

Wavelength (microns)	Grating (Blaze Wavelength)	Grating Order	Filter	Detector
1.2 - 2.1	3 μ	1	Silicon	PbS
2.1 - 3.1	3 μ	1	Germanium	PbS
3.1 - 3.5	12 μ	3	2.8 μ Long Pass	PbS
4.0 - 5.5	12 μ	2	Indium Arsenide	PbSe
5.5 - 7.1	12 μ	1	Indium Arsenide	PbSe
7.0 - 8.4	12 μ	1	6 μ Long Pass	PbSe

Electronics

Conventional electronics were used to amplify and record the data. Greybody radiation was optically chopped at 400 cps to produce an a-c signal at the detector for stable amplification. The amplified signal was synchronously rectified by slaving in both frequency and phase the electro-mechanical chopper in the recorder amplifier to the optical chopper. Spectra were recorded on both a ten inch strip chart and magnetic tape.

GAS HANDLING SYSTEM

Manifold

The gas handling system assembled for this program is shown in block-diagram form in Fig. 4. The system is constructed primarily of copper and stainless steel components. All parts of the system which are exposed to H_2O are maintained at a minimum temperature of 110 C to prevent condensation. A liquid nitrogen cold trap prevents vacuum pump contamination by H_2O , CO_2 , or CO. During foreign gas broadening studies, the subject gases were allowed to remain in the mixing tank for several minutes before being admitted to the absorption cell.

Absorption Cells

Two types of absorption cells were used in the investigation and they are illustrated in Fig. 5.

The "O-Ring" cell, in Fig. 5a, was used with either CaF_2 (long wavelength cut-off approximately 9 microns) or sapphire (long wave-length cutoff approximately 5.5 microns) windows. These windows were two inches in diameter. A vacuum tight seal was achieved with pressure-filled inconel O-Rings plated with gold. Two path lengths (effective cell length) were available: 7.62 and 26.0 centimeters. These two cells leaked when first assembled, but became vacuum tight when heated.

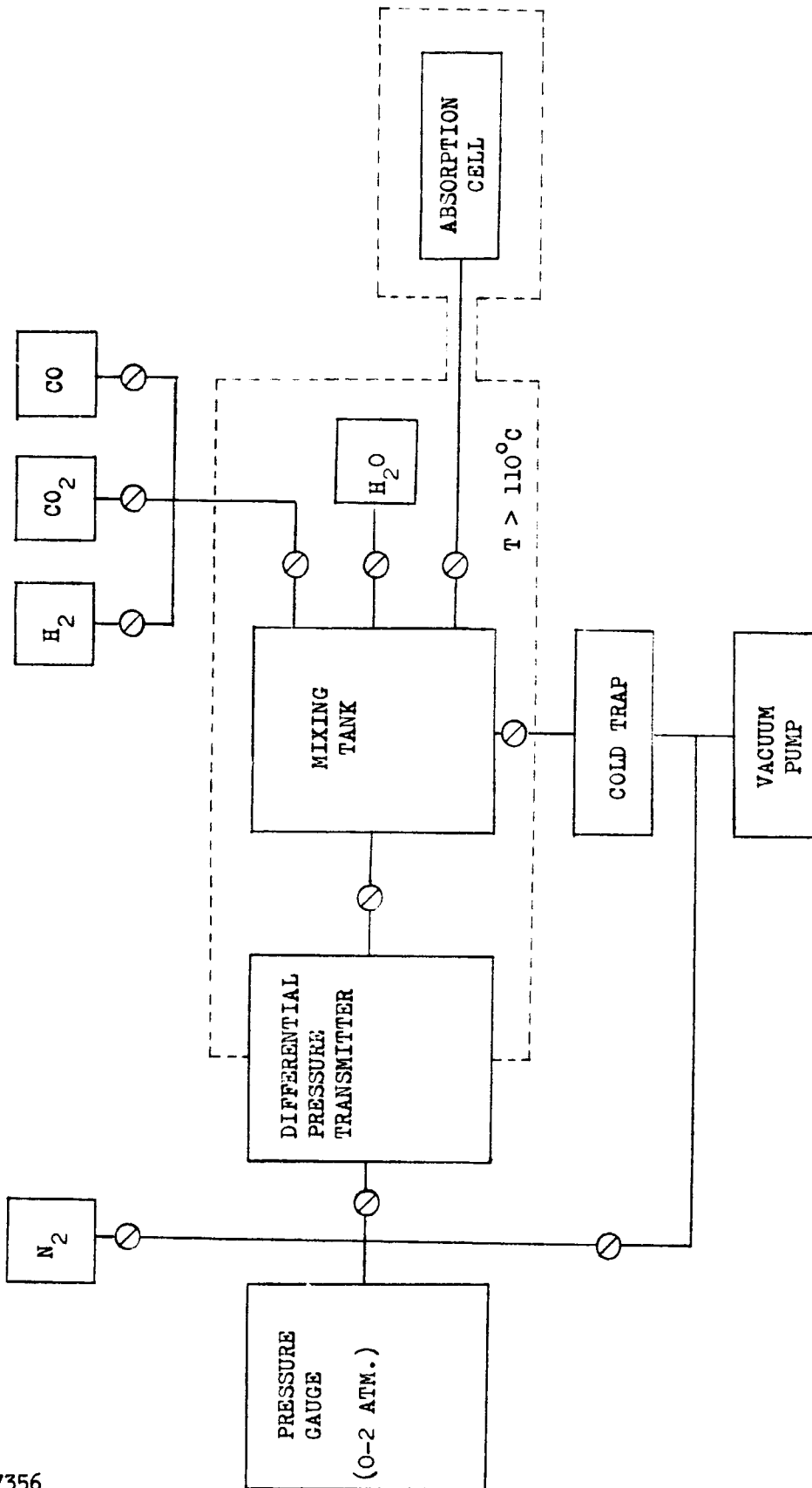


Figure 4. Gas Handling System

The cells suffered from the disadvantage that their temperature could not be recycled, i.e., when cooled they began to leak. In fact, when cooled to room temperature, the windows generally cracked. The 7.62 cm cell operated satisfactorily over the entire temperature range. The 26 cm cell was not usable above 1200 K since its stainless steel center section was oxidized by H₂O at an appreciable rate at this temperature. The inside of this cell has since been plated with nickel in an attempt to eliminate this oxidation.

The "Kovar" cell (Fig. 5b) was constructed using commercially available sapphire-kovar seals which were electron-beam welded to a Kovar ring and inconel center section. Two cells were constructed, one having a 10 cm path length with one inch diameter windows and the other having a 25 cm path length with two-inch diameter windows. These cells could be temperature cycled without developing leaks. However, they were not used above 900 K because of the short predicted lifetime of the sapphire-kovar seal above 1200 K.

Pressure Measurement

Pressure measurements were made with a standard mercury manometer in conjunction with a differential pressure transducer. The bellows section of the transducer was heated to 120 C to prevent condensation of the water sample. The bellows were balanced to an electronically indicated null position by pressurization with nitrogen gas. The nitrogen pressure required to balance the bellows was then determined from the manometer readings.

Temperature Measurement

Temperature measurement was by means of chromel-alumel thermocouples which were spot welded to various points on the absorption cells. Conversion of the voltage readings to temperature was accomplished using the tables supplied by the thermocouple manufacturer. Calibration of the potentiometer was by comparison with a standard cell.

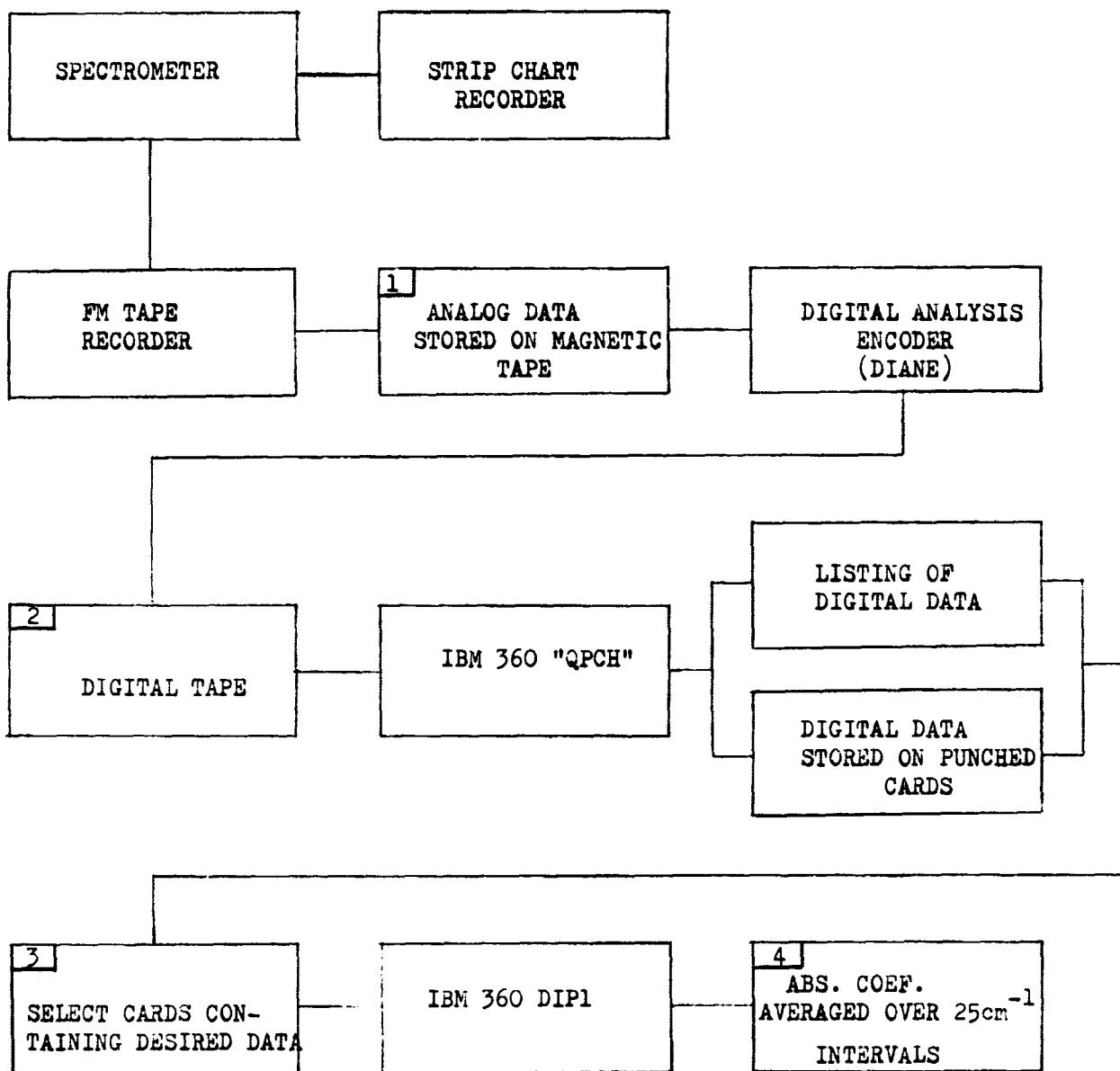


Figure 6. Flow of Data Through Data Processing System.

DATA REDUCTION PROCEDURE

The purpose of the data reduction procedure is to convert the analog signal obtained from the spectrometer to the absorption coefficients for H_2O . The general flow of data during this procedure is outlined in Fig. 6. The numbered boxes indicate intermediate stopping points in the procedure.

The transmission of a particular gas sample in the absorption cell was obtained by taking a point by point ratio of gas spectrum to background spectrum. The necessary data was obtained by scanning the region of interest with the absorption cell evacuated (background spectra) and then repeating the scan with the cell filled to the desired pressure (sample spectra). The information needed to align the two scans in wavelength was incorporated into the analog signal by shorting the input to the recorder at the beginning and end of each scan. The wavelength calibration was obtained by comparing spectra obtained in this program with spectra published in the literature (Ref. 3). Once a particular grating had been calibrated, the wavelengths observed agreed with the tabulated values to $\pm 0.2 \text{ cm}^{-1}$ throughout. The analog tapes were converted to digital tapes suitable for computer input by a digital analysis encoder referred to as DIANE. This instrument is a high speed multi-channel digital voltmeter with digital tape output. Due to the high sampling frequency (10,000/sec) it was necessary to reduce the number of data points by several techniques. A primary reduction by a factor of 32 was accomplished by recording the analog tapes at 1 7/8 ips and playing it into the DIANE at 60 ips. The second reduction was done by a computer program known as QPCH which was written specifically for this problem. QPCH was used to convert the digital tape containing 312 points per second of spectrometer scan into punched cards containing approximately 15 points per wavenumber scanned. The QPCH sample

reduction factor used for a given run was a function of wavelength and scan rate and was varied from run to run to obtain a data rate of approximately 15 points per wavenumber. This rate was selected as a workable compromise between resolution and the bulk of punched cards produced. QPCH also provides a printed listing of the digital values for use in locating the start and end of each run. Each card punched was identified serially and by run number.

After both the spectrum and background had been transferred to punched cards, they were processed by the data integration program, DIP-1. This program computed the point by point transmission and absorption coefficient tables for each spectrum. The absorption coefficient and absorptance were then integrated over 25 cm^{-1} intervals centered about multiples of 25. For example, the integral denoted by 3850 cm^{-1} is the result of integrating from 3837.5 to 3862.5 cm^{-1} . The average absorption coefficient and equivalent width (i.e., integrated absorptance) of each interval was printed and punched on cards for further processing. Cathode ray tube plots of absorption coefficient versus frequency were also produced for each 100 cm^{-1} interval of the spectrum. The averaged absorption coefficients for 25 cm^{-1} intervals are superimposed to demonstrate the results of averaging. Some typical absorption coefficient plots are shown in Figures 7 and 8.

50 CM OF H₂O AT 305 C. L = 7.62
ABSORPTION COEFFICIENT FOR SPECTRUM NO. 24. BACKGROUND NO. 23.

845713
0013 C

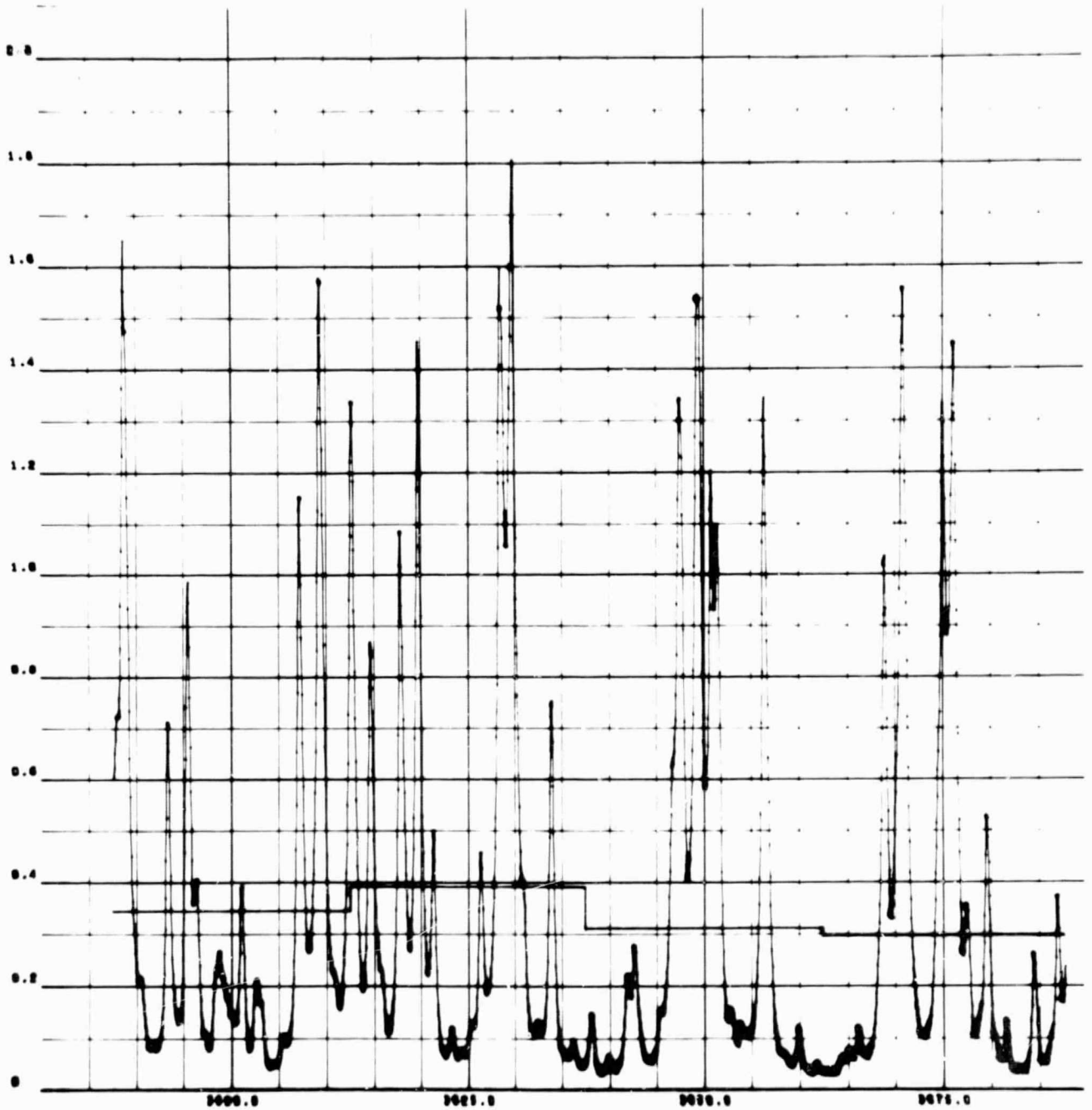


Figure 7. Spectral and Averaged Absorption Coefficients for 50 cm of H₂O at 305 C, 7.62 cm path, 3600 to 3675 cm⁻¹.

50 CM OF H₂O AT 305 C. L = 7.62
ABSORPTION COEFFICIENT FOR SPECTRUM NO. 24. BACKGROUND NO. 23.

MM710
GG16 C

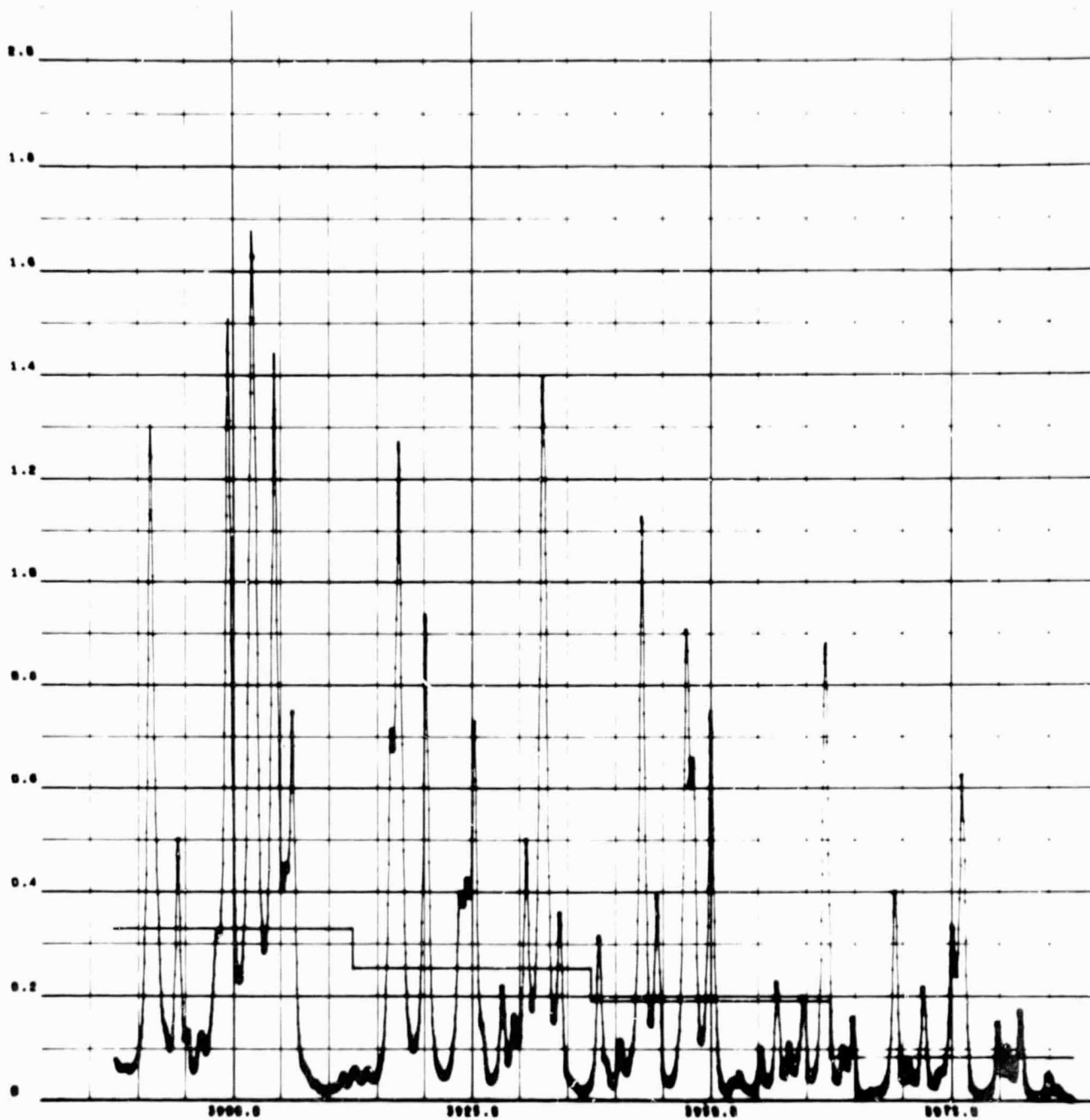


Figure 8. Spectral and Averaged Absorption Coefficients for
50 cm of H₂O at 305 C, 7.62 cm path, 3900 to 3975 cm⁻¹.

RESULTS

The primary objective of this program was to obtain the absorption coefficients of H₂O vapor as a function of pressure, path length, and temperature. A range of values for each of these variables is necessary to allow the determination of the band model parameters. For this purpose a total of 560 spectrometer runs were processed including several pressures for each of the path lengths and temperatures indicated in Fig. 9. A few runs were made at 980 C for comparison with high temperature data obtained at General Dynamics/Convair (Ref. 4). A complete set of data was not obtained at 900 C for the 100 cm path because of reaction between the cell body and the water vapor.

In the form of punched cards the complete set of spectral data occupies 106 boxes of cards. These cards contain the digital values corresponding to the spectral intensities observed when operating the spectrometer in a single-beam mode. To make these spectra available to other investigators the cards have been recorded on magnetic tape. The 9 reels of tape are available from NASA on request.

The choice of recorded intensity data rather than transmissivity data as the permanent storage format was based on both maximum versatility and minimum duplication of stored information. The procedures required to retrieve specific information plus an index which describes the available information are included as Appendix A of this report.

The spectral transmissivity $T(\nu)$ is given by

$$T(\nu) = \frac{I(\nu)}{I_0(\nu)} = \exp \{-K(\nu)u\} \quad (1)$$

$T(^{\circ}C)$ L (cm)	300	600	900
7.62	X	X	X
26	X	X	X
100	X	X	52 cm path

NOTE: For each box containing "X", data at three pressures have been taken for the 1.4, 1.8, 2.7, and 6.3 micron H₂O bands, including various broadening data.

FIGURE 9. MATRIX OF EXPERIMENTAL CONDITIONS

where $I(\nu)$ is the spectral intensity with the sample cell filled to optical depth u and $I_0(\nu)$ is the intensity at the same wavelength with the cell evacuated. $K(\nu)$ is the spectral absorption coefficient. For the purpose of obtaining band model parameters the values of $T(\nu)$ and $K(\nu)$ need to be averaged over a frequency interval, $\Delta\nu$. The average absorption coefficient, \bar{K}_ν , is obtained by integrating the natural logarithm of $T(\nu)$ over an interval $\Delta\nu$ centered at ν ,

$$\bar{K}_\nu = -\frac{1}{u\Delta\nu} \int_{\nu-\frac{\Delta\nu}{2}}^{\nu+\frac{\Delta\nu}{2}} \ln T(\nu) d\nu. \quad (2)$$

The equivalent width, W , or integrated absorptance, is given by

$$W_\nu = \int_{\nu-\frac{\Delta\nu}{2}}^{\nu+\frac{\Delta\nu}{2}} \{1-T(\nu)\} d\nu \quad (3)$$

where the limits on the integration are again $\nu - \frac{\Delta\nu}{2}$ to $\nu + \frac{\Delta\nu}{2}$. Note that the equivalent width integral is not normalized by $\Delta\nu$ as is \bar{K}_ν . Both of these averaged quantities have been computed for all of the spectra recorded using $\Delta\nu = 25 \text{ cm}^{-1}$. These values are available from NASA on punched cards (approximately 8000 cards).

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1. C. C. Ferriso, C. B. Ludwig, and A. L. Thomson: Empirical Infrared Absorption Coefficients of H₂O from 300°K to 3000°K, General Dynamics/ Convair Report DBE-65-028, Dec. 1965.
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3. Tables of Wavenumbers for the Calibration of Infrared Spectrometers, International Union of Pure and Applied Chemistry; Butterworths, Washington (1961).
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APPENDIX A

Index to Available Water Spectra

The following indices contain the experimental conditions used to obtain water spectra under contracts NAS8-20397 and NAS8-19. The first index contains all spectra obtained on water vapor ordered by initial wavelength, temperature region, cell length, and water pressure. When a foreign gas is present the name and pressure are listed. Each entry contains the spectrum run number and location plus the necessary background information.

The second index contains the same information as the first except that the primary sorting is based on temperature region rather than wavelength. The remainder of the subgroups are sorted as before.

The third index is a list of only those spectra containing a gas other than water. These are arranged by identity of the foreign gas and then sorted by wavelength, temperature, path length and water pressure. Spectra containing only CO or CO₂ are indicated by a water pressure of 0.0.

The last index gives the locations of the various runs, with their backgrounds, within the 9 reels of magnetic tape. To locate and use a given run it is not necessary to know its sequence number on that tape since each run can be positively identified. The tape sequence number is provided to allow the ordering of requests so that the tape reading needed to reach all of the desired runs during retrieval of several spectra may be minimized.

Because the taped data has been stored in the format of card images, the following discussion will be in terms of cards rather than the terminology of tape records. On most computers the same statements are used for reading the two types of data.

The identification and calibration information required to process a given spectrum is contained on the first three cards of its data set. A blank card has been recorded after each set to serve as a divider. The first card identifies the run by number, indicates the wavelengths scanned, and lists the sample conditions. Sample conditions are normally omitted on background spectra. Initial and final wavelengths are specified in microns and correspond to the spectrometer dial readings. A slight error in grating adjustment required a correction of 55.2 Angstroms (27.6 in second order) for the first 125 runs. A random check of the remaining spectra indicated no correction was required in order to achieve $\pm 0.2 \text{ cm}^{-1}$ alignment. The appropriate correction, which must be added to the initial and final wavelengths, is supplied for the first 125 runs. A one digit code is used to identify any foreign gas. The code has the following values and meanings:

0	No foreign gas added
1	Added H ₂
2	Added CO
3	Added CO ₂
6	CO is principal absorber
7	CO ₂ is principal absorber

The second card contains the deflection calibration and data card sequence information. Calibration of the deflection data is necessary in order to remove effects due to drift in the graybody source. Also the zero offset

required by the FM tape recorder must be removed. Three deflection values are used to calibrate each run. The initial zero level, IZ, is the digital value which must be subtracted from every deflection value to remove the zero offset. This signal was recorded with the light beam blocked by a shutter. An initial and final deflection, ID and JD, are also recorded at a fixed wavelength with the shutter open and cell evacuated. These values are used to correct for intensity changes between background and spectra. The zero level must be subtracted from these deflections also.

Each card containing spectral intensities is sequenced to provide the required correlation with wavelength. The beginning of a scan is indicated in the data by the sudden increase in deflection values due to opening the shutter. Similarly, the end is signified by the closing of the shutter. Since each data card contains 20 deflection values it is necessary to specify both card sequence number and data point number on that card for the first and last points. These points correspond to the initial and final wavelengths, respectively, after the wavelength correction term has been added. The scan interval is then divided into NPTS - 1 equal steps where the number of data points can be calculated using the card sequence information,

$$\begin{aligned} \text{NPTS} &= (\# \text{ of last card} - \# \text{ of first card}) \times 20 \\ &+ \# \text{ of last point} - \# \text{ of first point} + 1. \quad (\text{A-1}) \end{aligned}$$

A third card is included at the start of each deck to provide an additional verification test. This card contains a 12 digit serial number which is to be found on each data card in that data set. The first three digits of the serial number are the run identification number.

Immediately following the card containing the serial number is the first spectral data card. It has the sequence number given on the calibration

card and contains the first data point of the run. The point corresponding to the initial wavelength is also specified on the calibration card. A blank card follows the card containing the spectral data point corresponding to the final wavelength. This last data card has the sequence number given on the calibration card with the last point specified in the same manner as the first.

The exact card images and Fortran formats suitable for reading them are as follows:

Header Card (I12, 3F12.8, 2F6.2, I6, I1, F5.2)

Col. 1 - 12	Run identification number
13 - 24	Initial wavelength (Microns)
25 - 36	Final wavelength (Microns)
37 - 48	Wavelength correction (Angstroms)
49 - 54	Pathlength (cm)
55 - 60	Water vapor pressure (cm of Hg)
61 - 66	Temperature (°C)
67	Foreign gas code
68 - 72	Foreign gas pressure
73 - 80	Not used

Calibration Card (3I12, 4I6)

Col. 1 - 12	Initial zero value, IZ
13 - 24	Initial deflection value, ID
25 - 36	Final deflection value, JD
37 - 42	Sequence number of first card
43 - 48	First point number
49 - 54	Sequence number of last card
55 - 60	Last point number
61 - 80	Not used

Identification Card (4I3)

1 - 12	Run serial number
13 - 80	Not used

Typical Data Card (4I3, 20I3, 4X, I4)

1 - 12	Run serial number
13 - 72	20 three digit deflection values
73 - 76	Not used
77 - 80	Card sequence number

Blank card signifies end of run - followed by header card for next run.

Calculation of the transmission at a given point in the spectrum requires the use of the run of interest and its background. The correction, C, for graybody drift between the two scans is given by

$$C = \frac{(ID^B + JD^B)/2 - IZ^B}{(ID^S + JD^S)/2 - IZ^S}$$

where the superscripts B and S refer to background and spectrum respectively. The transmission is then

$$T_{\lambda} = \frac{(\text{Deflection at } \lambda)^S - IZ^S}{(\text{Deflection at } \lambda)^B - IZ^B} \times C$$

where λ is the wavelength determined by interpolation using the corrected initial and final wavelengths.

To retrieve a given run (or background) from the set of tapes it is necessary to search the tape using the first card after each blank card as the key. The tapes are arranged with the background spectra immediately preceding the set of spectra to be compared against it. Since several runs were normally made using each background, it is advisable to search first for the background, copy it to the desired location (either into memory, or onto cards or another tape), and then continue searching for the desired spectrum. Due to the relatively long time required to search the tape a secondary means of storage is recommended when repeated use of a particular spectrum is anticipated. The following indices can be used to locate spectra of particular regions run under the desired conditions.

For example, if one wished to investigate the temperature dependence of the absorption coefficient in the vicinity of 3.3 microns, the runs of interest could be located in the first index. There are 35 runs which include this wavelength at a variety of temperatures, pathlengths, and pressures. Data are available at 4 temperatures for this wavelength and since the data are grouped on the tapes by temperature the runs of interest are located on 4 tapes (tapes 3, 4, 7, and 9). It should be noted that if, for example, runs 127 and 384 are selected from tape 3, the optimum retrieval order is 383, 384, 126 and then 127 to prevent rewinding the tape unnecessarily (see Run Location Index). Runs 126 and 383 are the pertinent background spectra.

INDEX TO AVAILABLE WATER SPECTRA

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	DEPENDENT GAS PRESSURE		RUN LOCATION		BACKGROUND	
INITIAL	FINAL						SPECTRUM IDCONT. TAPE SEQ.		IDCONT. TAPE SEQ.	
1.250	1.450	300	26.0	33.00			641 1 2	640	1	1
1.250	1.450	300	26.0	58.91			642 1 3	640	1	1
1.250	1.450	300	52.0	14.91			579 1 7	575	1	4
1.250	1.450	310	52.0	35.00			576 1 5	575	1	4
1.250	1.450	310	52.0	68.00			578 1 6	575	1	4
1.250	1.600	300	100.0	28.95			511 1 9	510	1	8
1.250	1.600	300	100.0	59.65			512 1 10	510	1	8
1.250	1.450	600	26.0	60.00			661 5 2	660	5	1
1.250	1.450	610	52.0	15.60			597 5 4	595	5	3
1.250	1.450	610	52.0	30.81			598 5 5	595	5	3
1.250	1.450	610	52.0	60.80			599 5 6	595	5	3
1.250	1.610	600	100.0	4.91			563 5 10	560	5	7
1.250	1.610	600	100.0	5.40	H2	40.25	564 5 11	560	5	7
1.250	1.610	600	100.0	29.10			562 5 9	560	5	7
1.250	1.610	600	100.0	59.20			561 5 8	560	5	7
1.250	1.450	898	26.0	29.61			664 8 2	662	8	1
1.250	1.450	898	26.0	60.50			665 8 3	662	8	1
1.250	1.450	848	52.0	15.21			601 8 5	600	8	4
1.250	1.450	848	52.0	30.40			602 8 6	600	8	4
1.250	1.450	848	52.0	61.40			603 8 7	600	8	4
1.300	1.450	300	100.0	4.91			519 1 12	518	1	11
1.300	1.450	300	100.0	5.00	H2	40.06	521 1 13	518	1	11
1.310	1.510	590	26.0	10.00			433 5 13	432	5	12
1.310	1.510	600	26.0	10.60	H2	32.37	436 5 16	432	5	12
1.310	1.510	592	26.0	20.00			434 5 14	432	5	12
1.310	1.510	595	26.0	40.00			435 5 15	432	5	12
1.310	1.510	900	26.0	20.20			514 5 9	513	5	8
1.310	1.510	900	26.0	40.00			509 8 10	508	8	8
1.310	1.370	302	26.0	9.65			369 1 15	368	1	14
1.310	1.370	302	26.0	10.20	H2	31.06	372 1 14	368	1	14
1.310	1.370	302	26.0	19.90			370 1 16	368	1	14
1.320	1.370	302	26.0	40.00			371 1 17	368	1	14
1.320	1.370	901	7.6	51.00	H2	51.06	253 4 65	250	4	62
1.320	1.370	901	7.6	49.70			251 4 63	250	4	62
1.320	1.370	901	7.6	70.30			252 4 64	250	4	62
1.325	1.375	307	7.6	50.35			55 1 20	54	1	19
1.325	1.375	297	7.6	50.50	H2	52.56	63 1 23	62	1	22
1.325	1.375	307	7.6	69.95			56 1 21	54	1	19
1.325	1.375	606	7.6	50.10			100 5 14	99	5	17
1.325	1.375	606	7.6	69.90			101 5 19	99	5	17
1.360	1.510	303	26.0	10.00			377 1 24	373	1	24
1.360	1.510	303	26.0	10.10			374 1 25	373	1	24
1.360	1.510	303	26.0	20.00			375 1 26	373	1	24
1.360	1.510	303	26.0	40.05			376 1 27	373	1	24
1.360	1.505	591	7.6	51.00	H2	52.69	125 5 21	121	5	20
1.360	1.510	899	7.6	50.15			292 8 12	291	8	11
1.360	1.510	900	7.6	70.30			293 8 13	291	8	11
1.366	1.525	307	7.6	50.40			58 1 30	57	1	29
1.366	1.525	307	7.6	69.90			59 1 31	57	1	29
1.366	1.525	602	7.6	50.00			104 5 23	103	5	22
1.366	1.525	602	7.6	70.00			105 5 24	103	5	22
1.371	1.530	297	7.6	49.40	H2	52.75	61 1 33	60	1	32
1.430	1.750	600	26.0	60.00			659 5 26	658	5	25
1.430	1.750	900	26.0	30.60			667 8 15	666	8	14
1.430	1.750	900	26.0	60.90			668 8 16	666	8	14
1.430	1.750	300	26.0	57.80			644 1 35	643	1	34
1.440	1.700	610	52.0	30.00			594 5 24	592	5	27
1.440	1.700	610	52.0	61.60			595 5 29	592	5	27
1.440	1.700	844	52.0	15.50			605 8 18	604	8	17
1.440	1.700	844	52.0	30.00			606 8 19	604	8	17
1.440	1.700	844	52.0	63.40			607 8 20	604	8	17
1.450	1.700	306	52.0	14.80			541 1 37	540	1	36
1.450	1.700	306	52.0	29.90			542 1 38	540	1	36
1.450	1.700	306	52.0	57.00			543 1 39	540	1	36
1.600	2.100	306	100.0	14.95			517 2 5	513	2	1
1.600	2.100	306	100.0	30.10			514 2 2	513	2	1
1.600	2.100	306	100.0	59.30			515 2 3	513	2	1
1.600	2.100	306	100.0	59.35			516 2 4	513	2	1
1.600	2.110	600	100.0	5.00			564 5 33	565	5	30
1.600	2.110	600	100.0	29.90			567 5 32	565	5	30
1.600	2.110	600	100.0	59.35			566 5 31	565	5	30
1.700	2.100	306	52.0	7.40			545 2 7	544	2	6
1.700	2.100	306	52.0	14.20			547 2 9	544	2	6
1.700	2.100	306	52.0	30.20			546 2 8	544	2	6
1.700	2.100	600	26.0	5.00	H2	29.37	444 6 7	437	6	1
1.700	2.100	600	26.0	5.05	H2	14.75	442 6 6	437	6	1
1.700	2.100	600	26.0	5.15			438 6 2	437	6	1
1.700	2.100	600	26.0	10.00			439 6 3	437	6	1
1.700	2.100	600	26.0	20.00			441 6 5	437	6	1
1.700	2.100	600	26.0	39.65			440 6 4	437	6	1
1.700	2.100	610	52.0	6.40			589 6 9	588	6	8
1.700	2.100	610	52.0	15.40			590 6 10	588	6	8
1.700	2.100	610	52.0	30.60			591 6 11	588	6	8

INDEX TO AVAILABLE WATER SPECTRA (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	BROADENER		SPECTRUM			RUN LOCATION		
INITIAL	FINAL				GAS	PRESSURE	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
1.700	2.100	884	52.0	7.50			610	8	22	60A	8	21
1.700	2.100	886	52.0	15.40			610	8	23	60A	8	21
1.700	2.100	895	52.0	31.50			611	8	24	60A	8	21
1.700	2.100	895	52.0	61.20			612	8	25	60A	8	21
1.700	2.100	980	26.0	23.30			604	4	94	607	4	93
1.700	2.100	980	26.0	60.00			605	4	95	607	4	93
1.700	2.100	990	52.0	30.10			635	4	97	634	4	96
1.730	2.100	300	26.0	30.10			646	2	11	645	2	10
1.730	2.100	300	26.0	59.60			647	2	12	645	2	10
1.730	2.100	910	26.0	14.70			670	8	27	669	8	26
1.730	2.100	910	26.0	31.10			671	8	28	669	8	26
1.730	2.100	910	26.0	55.00			672	8	29	669	8	26
1.750	1.870	302	7.6	30.30	H2	71.19	46	2	17	45	2	16
1.750	1.810	298	7.6	50.00			37	2	14	36	2	13
1.750	1.810	298	7.6	60.60			38	2	15	36	2	13
1.750	1.820	296	26.0	4.90			349	2	19	34A	2	18
1.750	1.820	296	26.0	10.15			350	2	20	34A	2	18
1.750	1.820	296	26.0	19.95			351	2	21	34A	2	18
1.750	1.820	295	26.0	40.00			352	2	22	34A	2	16
1.750	2.000	300	100.0	4.90			522	2	24	521	2	23
1.750	2.000	300	100.0	5.10	H2	40.37	523	2	25	521	2	23
1.750	1.820	600	7.6	30.00			84	6	13	87	6	12
1.750	1.850	607	7.6	30.20	H2	70.44	119	6	17	11A	6	16
1.750	1.820	600	7.6	50.70			89	6	14	87	6	12
1.750	1.820	600	7.6	70.20			91	6	15	87	6	12
1.750	1.820	900	7.6	29.50			295	8	31	294	8	30
1.750	1.820	900	7.6	50.25			296	8	32	294	8	30
1.750	1.820	900	7.6	70.65			297	8	33	294	8	30
1.750	1.860	310	7.6	30.55			35	2	27	34	2	26
1.750	1.860	298	7.6	50.40			40	2	29	39	2	28
1.800	1.880	298	7.6	69.40			41	2	30	39	2	28
1.800	1.880	296	26.0	5.10			354	2	32	353	2	31
1.800	1.880	296	26.0	10.20			355	2	33	353	2	31
1.800	1.880	295	26.0	20.00			356	2	34	353	2	31
1.800	1.880	295	26.0	38.95			357	2	35	353	2	31
1.800	1.880	602	7.6	30.40			92	6	19	91	6	18
1.800	1.880	602	7.6	50.60			93	6	20	91	6	18
1.800	1.880	602	7.6	70.40			94	6	21	91	6	18
1.800	1.880	905	7.6	29.60			299	8	35	298	8	34
1.800	1.880	900	7.6	50.20			300	8	36	298	8	34
1.800	1.880	898	7.6	69.95			301	8	37	298	8	34
1.830	2.000	607	7.6	30.20	H2	69.75	121	5	23	120	6	22
1.850	2.000	312	7.6	30.30	H2	72.00	48	2	30	47	2	38
1.850	2.000	310	7.6	30.35			33	2	37	32	2	36
1.860	2.100	295	26.0	5.15			362	2	41	361	2	40
1.860	2.100	300	26.0	5.15	H2	15.19	366	2	45	361	2	40
1.860	2.100	301	26.0	5.18	H2	30.37	367	2	46	361	2	40
1.860	2.100	296	26.0	10.05			363	2	42	361	2	40
1.860	2.100	300	26.0	20.10			364	2	43	361	2	40
1.860	2.100	301	26.0	39.70			365	2	44	361	2	40
1.860	2.000	602	7.6	30.10			96	6	25	95	6	24
1.860	2.000	602	7.6	49.90			97	6	26	95	6	24
1.860	2.000	612	7.6	70.10			98	6	27	95	6	24
1.860	2.100	898	7.6	29.90			303	9	2	302	9	1
1.860	2.100	900	7.6	50.00			304	9	3	302	9	1
1.860	2.100	900	7.6	70.90			305	9	4	302	9	1
1.870	2.000	300	7.6	50.40			43	2	48	42	2	47
1.870	2.000	300	7.6	71.10			44	2	49	42	2	47
2.000	2.370	900	26.0	60.50			642	9	6	641	9	5
2.000	2.370	980	26.0	60.30			606	4	99	695	4	98
2.100	2.550	300	100.0	9.95			527	2	56	524	2	53
2.100	2.550	300	100.0	30.20			528	2	55	524	2	53
2.100	2.550	300	100.0	60.35			525	2	54	524	2	53
2.100	2.550	600	100.0	29.60			570	6	32	569	6	31
2.100	2.550	600	100.0	60.10			571	6	33	569	6	31
2.200	2.430	900	52.0	30.60			614	9	8	613	9	7
2.200	2.430	900	52.0	62.00			615	9	9	613	9	7
2.300	2.600	305	7.6	50.00			24	2	58	23	2	57
2.300	2.600	305	7.6	70.00			25	2	59	23	2	57
2.300	2.600	990	52.0	12.20			637	4	101	636	4	100
2.300	2.600	990	52.0	30.90			638	4	102	636	4	100
2.300	2.600	990	52.0	61.80			639	4	103	636	4	100
2.350	2.600	294	26.0	1.05			326	3	2	325	3	1
2.350	2.600	294	26.0	1.15			331	3	6	325	3	1
2.350	2.600	293	26.0	5.10	H2	29.25	327	3	3	325	3	1
2.350	2.600	294	26.0	10.00			328	3	4	325	3	1
2.350	2.600	294	26.0	20.00			329	3	5	325	3	1
2.350	2.600	300	26.0	60.00			649	3	8	648	3	7
2.350	2.600	596	26.0	1.00			460	6	35	459	6	34
2.350	2.600	596	26.0	4.05			461	6	36	459	6	34
2.350	2.600	596	26.0	10.15			462	6	37	459	6	34
2.350	2.600	596	26.0	20.00			463	6	38	459	6	34
2.350	2.600	600	26.0	60.00			655	6	40	654	6	39

INDEX TO AVAILABLE WATER SPECTRA (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	DETAILED GAS PRESSURE	SPECTRUM			RUN LOCATION			BACKGROUND		
INITIAL	FINAL					IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
2.350	2.800	910	26.0	15.31		674	9	11	677	9	10			
2.350	2.800	910	26.0	30.11		675	9	12	677	9	10			
2.350	2.800	905	26.0	61.71		680	9	13	677	9	10			
2.350	2.800	980	26.0	23.27		683	4	105	692	4	104			
2.350	2.800	980	26.0	60.31		674	4	106	692	4	104			
2.400	2.800	303	7.6	10.00		19	3	12	18	3	11			
2.400	2.800	312	7.6	30.00		11	3	10	10	3	9			
2.400	2.800	310	7.6	30.81	H2	72.37	31	3	14	30	3	13		
2.400	2.800	607	7.6	10.00	H2	71.69	115	6	47	114	6	46		
2.400	2.800	602	7.6	10.25		72	6	42	71	6	41			
2.400	2.800	602	7.6	30.31		73	6	43	71	6	41			
2.400	2.800	602	7.6	50.11		74	6	44	71	6	41			
2.400	2.800	600	7.6	69.95		75	6	45	71	6	41			
2.400	2.800	903	7.6	29.81	H2	34.75	310	9	18	306	9	14		
2.400	2.800	903	7.6	30.05		307	9	15	306	9	14			
2.400	2.800	913	7.6	50.00		308	9	16	306	9	14			
2.400	2.800	913	7.6	69.85		310	9	17	306	9	14			
2.410	2.800	900	52.0	2.71		622	9	20	621	9	19			
2.410	2.800	900	52.0	4.91		623	9	21	621	9	19			
2.410	2.800	900	52.0	9.01		624	9	22	621	9	19			
2.500	2.600	300	7.6	9.01	CO	31.00	67	3	21	66	3	20		
2.500	2.600	300	7.6	9.05	CO	30.16	69	3	23	66	3	20		
2.500	2.600	300	7.6	9.05	CO	61.31	70	3	24	66	3	20		
2.500	2.600	300	7.6	10.01	CO	61.31	68	3	22	66	3	20		
2.500	2.600	303	26.0	5.01	CO	15.11	379	3	26	378	3	25		
2.500	2.600	303	26.0	5.01	CO	15.11	381	3	28	378	3	25		
2.500	2.600	303	26.0	5.05	CO	31.13	383	3	27	378	3	25		
2.500	2.600	303	26.0	5.11	CO	31.25	382	3	29	378	3	25		
2.500	2.600	602	7.6	10.00	CO	31.25	383	6	49	107	6	48		
2.500	2.600	602	7.6	10.00	CO	61.25	384	6	50	107	6	48		
2.500	2.600	602	7.6	10.21	CO	61.37	381	6	52	107	6	48		
2.500	2.600	602	7.6	10.31	CO	31.50	385	6	51	107	6	48		
2.500	2.600	596	26.0	5.01	CO	15.00	387	6	54	466	6	53		
2.500	2.600	596	26.0	5.01	CO	31.19	388	6	55	466	6	53		
2.500	2.600	905	7.6	10.11	CO	29.94	323	9	24	322	9	23		
2.500	2.600	905	7.6	10.11	CO	61.06	324	9	25	322	9	23		
2.600	2.700	300	7.6	9.01		65	3	31	64	3	30			
2.600	2.700	607	7.6	9.01		113	6	57	112	6	56			
2.600	2.700	906	7.6	49.85		321	9	27	320	9	26			
2.700	3.000	307	7.6	10.31	H2	70.25	53	3	35	52	3	34		
2.700	3.000	307	7.6	30.01		13	3	33	12	3	32			
2.700	3.000	607	7.6	10.01	H2	71.69	117	6	59	116	6	58		
2.700	3.000	305	7.6	70.01		27	3	37	26	3	36			
2.700	3.000	305	7.6	10.00		21	3	39	20	3	38			
2.700	3.000	305	7.6	10.00		22	3	40	20	3	38			
2.700	3.000	302	26.0	5.01		334	3	42	336	3	41			
2.700	3.000	302	26.0	10.70		330	3	43	336	3	41			
2.700	3.000	302	26.0	20.20		310	3	44	336	3	41			
2.700	3.020	300	26.0	59.60		651	3	46	650	3	45			
2.700	3.000	602	7.6	9.91		77	7	2	76	7	1			
2.700	3.000	602	7.6	30.00		78	7	3	76	7	1			
2.700	3.000	602	7.6	50.10		79	7	4	76	7	1			
2.700	3.000	602	7.6	69.95		80	7	5	76	7	1			
2.700	3.020	600	26.0	1.00		447	7	7	446	7	6			
2.700	3.000	596	26.0	5.00		448	7	8	446	7	6			
2.700	3.000	596	26.0	10.20		449	7	9	446	7	6			
2.700	3.000	594	26.0	20.25		450	7	10	446	7	6			
2.700	3.000	594	26.0	40.45		451	7	11	446	7	6			
2.700	3.020	596	26.0	50.60		653	7	13	652	7	12			
2.700	3.000	905	7.6	29.80	H2	39.06	315	9	32	311	9	28		
2.700	3.000	903	7.6	30.10		312	9	29	311	9	28			
2.700	3.000	903	7.6	50.10		313	9	30	311	9	28			
2.700	3.000	903	7.6	69.80		314	9	31	311	9	28			
2.700	3.020	910	26.0	14.70		674	9	34	673	9	33			
2.700	3.020	905	26.0	30.60		675	9	35	673	9	33			
2.700	3.020	905	26.0	58.70		676	9	36	673	9	33			
2.700	3.020	980	26.0	22.70		693	4	108	689	4	107			
2.700	3.020	980	26.0	60.10		691	4	109	689	4	107			
2.700	3.000	900	52.0	2.70		620	9	40	617	9	37			
2.700	3.000	900	52.0	5.10		619	9	39	617	9	37			
2.700	3.000	900	52.0	10.00		618	9	38	617	9	37			
2.700	3.010	990	52.0	12.30		632	4	112	630	4	110			
2.700	3.010	990	52.0	30.50		631	4	111	630	4	110			
2.700	3.010	990	52.0	60.60		633	4	113	630	4	110			
2.900	3.200	307	7.6	30.00		15	3	48	14	3	47			
2.900	3.200	305	7.6	70.00		29	3	50	28	3	49			
2.900	3.250	303	26.0	9.95		345	3	52	343	3	51			
2.900	3.250	303	26.0	20.05		346	3	53	343	3	51			
2.900	3.250	302	26.0	40.60		347	3	54	343	3	51			
2.900	3.200	602	7.6	30.00		42	7	15	81	7	14			
2.900	3.200	593	7.6	50.60		83	7	17	84	7	16			
2.900	3.200	593	7.6	70.10		86	7	18	84	7	16			
2.900	3.250	598	26.0	10.10		456	7	20	454	7	19			

INDEX TO AVAILABLE WATER SPECTRA (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	BROADENER		RUN LOCATION					
INITIAL	FINAL				GAS	PRESSURE	SPECTRUM IDENT.	TAPE	SEQ.	BACKGROUND IDENT.	TAPE	SEQ.
2.980	3.250	596	26.0	20.30			457	7	21	454	7	19
2.980	3.250	596	26.0	40.60			45A	7	22	454	7	19
2.980	3.200	905	7.6	30.00			317	9	42	316	9	41
2.980	3.200	906	7.6	49.90			318	9	43	316	9	41
2.980	3.200	906	7.6	70.20			319	9	44	316	9	41
2.980	3.200	906	7.6	90.50			534	3	58	531	3	55
3.000	3.470	300	100.0	9.90	H2	50.37	535	3	59	531	3	55
3.000	3.470	300	100.0	10.40			532	3	56	531	3	55
3.000	3.470	300	100.0	30.20			533	3	57	531	3	55
3.000	3.470	300	100.0	60.25			573	7	24	572	7	23
3.000	3.470	600	100.0	29.90			574	7	25	572	7	23
3.000	3.470	600	100.0	59.40			503	9	46	502	9	45
3.000	3.470	900	26.0	10.10			504	9	47	502	9	45
3.000	3.470	900	26.0	19.80			685	9	51	683	9	49
3.000	3.470	900	26.0	40.45			505	9	48	502	9	45
3.000	3.470	900	26.0	60.50			684	9	50	683	9	49
3.000	3.470	900	52.0	30.50			626	9	53	625	9	52
3.000	3.470	900	52.0	62.40			627	9	54	625	9	52
3.000	3.470	978	26.0	22.50			687	4	115	686	4	114
3.000	3.470	978	26.0	60.10			688	4	116	686	4	114
3.000	3.470	980	52.0	59.10			629	4	118	628	4	117
3.140	3.470	600	7.6	30.10			271	7	27	270	7	26
3.140	3.470	600	7.6	51.00			272	7	28	270	7	26
3.140	3.470	600	7.6	51.40	H2	52.31	274	7	30	270	7	26
3.140	3.470	600	7.6	70.70			273	7	29	270	7	26
3.147	3.467	290	7.6	29.95			127	3	61	126	3	60
3.147	3.467	290	7.6	40.70			128	3	62	126	3	60
3.147	3.467	293	7.6	51.30	H2	50.50	130	3	64	126	3	60
3.147	3.467	293	7.6	69.85			129	3	63	126	3	60
3.147	3.467	902	7.6	30.05			216	4	67	215	4	66
3.147	3.467	901	7.6	40.90	H2	51.00	210	4	70	215	4	66
3.147	3.467	903	7.6	50.00			217	4	68	215	4	66
3.147	3.467	903	7.6	70.40			218	4	69	215	4	66
3.200	3.470	303	26.0	10.00			364	3	16	363	3	15
3.200	3.470	304	26.0	10.40	H2	30.69	367	3	19	363	3	15
3.200	3.470	304	26.0	19.80			365	3	17	363	3	15
3.200	3.470	298	26.0	39.80			366	3	18	363	3	15
3.200	3.470	606	26.0	10.00			470	7	32	469	7	31
3.200	3.470	604	26.0	20.00			471	7	33	469	7	31
3.200	3.470	604	26.0	39.85			472	7	34	469	7	31
4.000	5.000	600	100.0	30.10			549	7	39	544	7	35
4.000	5.000	600	100.0	59.80			550	7	40	544	7	35
4.100	4.600	294	26.0	5.10	CO2	1.00	404	3	69	399	3	65
4.100	4.600	299	26.0	10.15	CO2	1.00	405	3	70	399	3	65
4.100	5.000	300	100.0	10.10			530	3	74	536	3	71
4.100	5.000	300	100.0	10.30	H2	42.25	540	3	75	536	3	71
4.100	5.000	300	100.0	30.30			538	3	73	536	3	71
4.100	5.000	300	100.0	59.20			537	3	72	536	3	71
4.100	4.600	597	7.6	7.50	CO2	3.06	279	7	45	275	7	41
4.100	4.600	597	7.6	14.90	CO2	3.00	280	7	46	275	7	41
4.100	4.600	605	26.0	10.40	CO2	1.06	485	7	59	482	7	56
4.200	5.000	605	26.0	40.40			484	7	48	480	7	47
4.400	5.500	308	26.0	0.95			390	4	2	388	4	1
4.400	5.500	302	26.0	4.05	H2	30.69	395	4	8	388	4	1
4.400	5.500	307	26.0	5.00			394	4	3	388	4	1
4.400	5.500	300	26.0	5.08	CO	20.25	396	4	9	388	4	1
4.400	5.500	299	26.0	5.11	CO2	10.19	397	4	10	388	4	1
4.400	5.500	302	26.0	5.20	H2	15.00	394	4	7	388	4	1
4.400	5.500	307	26.0	10.20			391	4	4	388	4	1
4.400	5.500	305	26.0	20.15			392	4	5	388	4	1
4.400	5.500	304	26.0	40.50			393	4	6	388	4	1
4.400	5.500	605	26.0	5.30			476	7	54	473	7	52
4.400	5.500	605	27.0	11.00			475	7	53	473	7	52
4.400	5.500	605	26.0	19.90			478	7	55	473	7	52
4.400	4.520	894	7.6	50.10			189	4	71	190	4	72
4.400	4.520	903	7.6	70.25			191	4	73	190	4	72
4.500	5.040	290	7.6	10.00			132	4	12	131	4	11
4.500	5.040	290	7.6	30.40			133	4	13	131	4	11
4.500	5.040	290	7.6	50.00			134	4	14	131	4	11
4.500	5.040	290	7.6	69.95			135	4	15	131	4	11
4.500	5.040	605	7.6	9.95			155	4	43	154	4	42
4.500	5.040	605	7.6	29.85			156	4	44	154	4	42
4.500	5.040	603	7.6	49.85			157	4	45	154	4	42
4.500	5.040	603	7.6	69.60			158	4	46	154	4	42
4.500	5.040	896	7.6	10.20			188	4	78	183	4	74
4.500	5.040	903	7.6	30.30			185	4	75	183	4	74
4.500	5.040	901	7.6	50.50			186	4	76	183	4	74
4.500	5.040	901	7.6	70.50			187	4	77	183	4	74
5.000	5.500	305	7.6	10.10			137	4	17	136	4	35
5.000	5.500	305	7.6	30.10	CO2	50.06	142	4	39	141	4	36
5.000	5.500	305	7.6	30.20			138	4	18	136	4	35
5.000	5.500	304	7.6	30.50	H2	61.25	144	4	41	141	4	36
5.000	5.500	304	7.6	30.60	CO	61.75	143	4	40	141	4	36

INDEX TO AVAILABLE WATER SPECTRA (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	GRADIENT GAS PRESSURE	SPECTRUM			RUN LOCATION			BACKGROUND		
INITIAL	FINAL					IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
5.000	5.500	300	7.6	49.85		139	4	36	136	4	35			
5.000	5.500	300	7.6	69.91		140	4	37	136	4	35			
5.000	5.500	605	7.6	10.10		160	4	48	159	4	47			
5.000	5.500	605	7.6	29.91		161	4	49	159	4	47			
5.000	5.300	607	7.6	30.01	CO2	60.25	181	4	55	180	4	54		
5.000	5.300	607	7.6	30.31	H2	60.44	182	4	56	180	4	54		
5.000	5.300	607	7.6	31.31	CO	63.00	175	4	53	169	4	52		
5.000	5.500	605	7.6	50.00		162	4	50	159	4	47			
5.000	5.500	605	7.6	69.85		163	4	51	159	4	47			
5.000	5.240	903	7.6	9.95		193	4	A4	192	4	A3			
5.000	5.240	903	7.6	30.25		194	4	A5	192	4	A3			
5.000	5.300	900	7.6	30.31	CO	59.50	204	4	81	202	4	79		
5.000	5.300	900	7.6	30.31	CO2	59.75	208	4	82	202	4	79		
5.000	5.300	901	7.6	30.50	H2	59.94	203	4	80	202	4	79		
5.000	5.240	903	7.6	50.11		195	4	66	192	4	A3			
5.000	5.240	903	7.6	70.91		196	4	67	192	4	A3			
5.220	5.500	903	7.6	9.90		198	4	89	197	4	88			
5.220	5.500	903	7.6	30.00		199	4	90	197	4	88			
5.220	5.500	903	7.6	50.45		200	4	91	197	4	88			
5.220	5.500	903	7.6	70.81		201	4	92	197	4	88			
5.300	5.500	605	7.6	10.10		165	4	58	164	4	57			
5.300	5.500	605	7.6	29.85		166	4	59	164	4	57			
5.300	5.500	605	7.6	50.05		167	4	60	164	4	57			
5.300	5.500	605	7.6	70.00		168	4	61	164	4	57			
5.400	7.200	300	26.0	1.00		410	4	20	409	4	19			
5.400	7.200	301	26.0	5.00		411	4	21	409	4	19			
5.400	7.200	300	26.0	5.10	H2	15.12	416	4	26	409	4	19		
5.400	7.200	300	26.0	5.10	H2	30.25	417	4	27	409	4	19		
5.400	7.200	300	26.0	5.20	CO2	10.56	414	4	24	409	4	19		
5.400	7.200	300	26.0	5.25	CO	10.19	415	4	25	409	4	19		
5.400	7.200	300	26.0	10.15		412	4	22	409	4	19			
5.400	7.200	300	26.0	19.90		413	4	23	409	4	19			
5.400	7.200	604	26.0	5.00	CO2	10.12	490	7	64	486	7	60		
5.400	7.200	605	26.0	5.05		487	7	61	486	7	60			
5.400	7.200	605	26.0	10.00		488	7	62	486	7	60			
5.400	7.200	604	26.0	20.05		489	7	63	486	7	60			
7.000	7.840	300	26.0	1.00		419	4	29	418	4	28			
7.000	7.840	300	26.0	5.05		420	4	30	418	4	28			
7.000	7.840	298	26.0	5.14	H2	30.44	420	4	34	418	4	28		
7.000	7.840	299	26.0	5.15	H2	15.25	423	4	33	418	4	28		
7.000	7.840	300	26.0	10.05		421	4	31	418	4	28			
7.000	7.840	299	26.0	20.10		422	4	32	418	4	28			
7.000	7.840	602	26.0	5.00		492	7	66	491	7	65			
7.000	7.840	602	26.0	5.00	CO2	9.94	495	7	69	491	7	65		
7.000	7.840	602	26.0	10.00		493	7	67	491	7	65			
7.000	7.840	602	26.0	20.15		494	7	68	491	7	65			
7.800	8.100	603	26.0	5.00		497	7	71	496	7	70			
7.800	8.100	600	26.0	5.00	CO2	9.94	501	7	75	496	7	70		
7.800	8.100	600	26.0	10.00		498	7	72	496	7	70			
7.800	8.100	600	26.0	20.00		499	7	73	496	7	70			
7.800	8.100	600	26.0	40.05		500	7	74	496	7	70			

WATER SPECTRA GROUPED BY TEMPERATURE

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	BROADENER		SPECTRUM			RUN LOCATION		
INITIAL	FINAL				GAS	PRESSURE	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
1.250	1.450	300	26.0	33.00			641	1	2	640	1	1
1.250	1.450	300	26.0	54.90			642	1	3	640	1	1
1.250	1.450	300	52.0	14.90			579	1	7	575	1	4
1.250	1.450	310	52.0	35.00			576	1	5	575	1	4
1.250	1.450	310	52.0	64.00			578	1	6	575	1	4
1.250	1.600	300	100.0	29.95			511	1	9	510	1	8
1.250	1.600	300	100.0	59.65			512	1	10	510	1	8
1.300	1.450	300	100.0	4.90			519	1	12	518	1	11
1.300	1.450	300	100.0	5.00	H2	40.06	520	1	13	518	1	11
1.320	1.370	302	26.0	9.85			369	1	15	36A	1	14
1.320	1.370	302	26.0	10.20	H2	31.06	372	1	18	36A	1	14
1.320	1.370	302	26.0	19.90			370	1	16	36A	1	14
1.320	1.370	302	26.0	40.00			371	1	17	36A	1	14
1.325	1.375	307	7.6	50.35			55	1	20	54	1	19
1.325	1.385	297	7.6	50.50	H2	52.56	63	1	23	62	1	22
1.325	1.375	307	7.6	69.95			56	1	21	54	1	19
1.360	1.510	303	26.0	10.00	H2	30.87	377	1	24	373	1	24
1.360	1.510	303	26.0	10.10			374	1	25	373	1	24
1.360	1.510	303	26.0	20.00			375	1	26	373	1	24
1.360	1.510	303	26.0	40.05			376	1	27	373	1	24
1.366	1.525	307	7.6	50.40			54	1	30	57	1	29
1.366	1.525	307	7.6	69.90			59	1	31	57	1	29
1.371	1.530	297	7.6	49.40	H2	52.75	61	1	33	60	1	32
1.430	1.750	300	26.0	57.80			644	1	35	643	1	34
1.450	1.700	300	52.0	14.80			541	1	37	540	1	36
1.450	1.700	300	52.0	29.90			542	1	38	540	1	36
1.450	1.700	300	52.0	57.00			543	1	39	540	1	36
1.600	2.100	300	100.0	14.95			517	2	5	513	2	1
1.600	2.100	300	100.0	30.10			514	2	2	513	2	1
1.600	2.100	300	100.0	59.30			515	2	3	513	2	1
1.600	2.100	300	100.0	59.30			516	2	4	513	2	1
1.700	2.100	306	52.0	7.40			585	2	7	584	2	6
1.700	2.100	306	52.0	14.20			547	2	9	544	2	6
1.700	2.100	306	52.0	30.20			546	2	8	544	2	6
1.730	2.100	300	26.0	30.10			646	2	11	645	2	10
1.730	2.100	300	26.0	59.60			647	2	12	645	2	10
1.750	1.870	302	7.6	30.30	H2	71.19	46	2	17	45	2	16
1.750	1.810	294	7.6	50.00			37	2	14	36	2	13
1.750	1.810	294	7.6	69.80			34	2	15	36	2	13
1.750	1.820	296	26.0	4.90			349	2	19	348	2	18
1.750	1.820	296	26.0	10.15			350	2	20	348	2	18
1.750	1.820	296	26.0	19.95			351	2	21	348	2	18
1.750	1.820	295	26.0	40.00			352	2	22	348	2	18
1.750	2.000	300	100.0	4.90			522	2	24	521	2	23
1.750	2.000	300	100.0	5.10	H2	40.37	523	2	25	521	2	23
1.750	1.860	300	7.6	30.55			35	2	27	34	2	26
1.800	1.880	294	7.6	50.40			40	2	29	39	2	28
1.800	1.880	294	7.6	69.40			41	2	30	39	2	28
1.800	1.880	296	26.0	5.10			354	2	32	353	2	31
1.800	1.880	295	26.0	10.20			355	2	33	353	2	31
1.800	1.880	295	26.0	20.00			356	2	34	353	2	31
1.850	1.880	295	26.0	34.05			357	2	35	353	2	31
1.850	2.000	302	7.6	30.30	H2	72.00	44	2	39	47	2	36
1.850	2.000	310	7.6	30.35			33	2	37	32	2	36
1.860	2.100	295	26.0	5.15			352	2	41	361	2	40
1.860	2.100	300	26.0	5.15	H2	15.10	356	2	45	361	2	40
1.860	2.100	301	26.0	5.18	H2	30.37	357	2	46	361	2	40
1.860	2.100	296	26.0	10.05			353	2	42	361	2	40
1.860	2.100	300	26.0	20.10			354	2	43	361	2	40
1.860	2.100	301	26.0	30.70			365	2	44	361	2	40
1.870	2.000	300	7.6	50.40			43	2	48	42	2	47
1.870	2.000	300	7.6	71.10			44	2	49	42	2	47
2.100	2.550	300	100.0	9.95			527	2	56	524	2	53
2.100	2.550	300	100.0	30.20			526	2	55	524	2	53
2.100	2.550	300	100.0	60.35			525	2	54	524	2	53
2.300	2.800	305	7.6	50.00			24	2	58	23	2	57
2.300	2.800	305	7.6	70.00			25	2	59	23	2	57
2.350	2.800	294	26.0	1.05			326	3	2	325	3	1
2.350	2.800	294	26.0	1.15	H2	29.25	331	3	6	325	3	1
2.350	2.800	293	26.0	5.10			327	3	3	325	3	1
2.350	2.800	294	26.0	10.00			324	3	4	325	3	1
2.350	2.800	294	26.0	20.00			329	3	5	325	3	1
2.350	2.800	300	26.0	60.00			649	3	8	64A	3	7
2.400	2.800	302	7.6	10.00			19	3	12	18	3	11
2.400	2.800	310	7.6	30.00			11	3	10	10	3	9
2.400	2.800	300	7.6	30.80	H2	72.37	31	3	14	30	3	13
2.500	2.600	300	7.6	9.90	CO2	30.00	67	3	21	66	3	20
2.500	2.600	300	7.6	9.95	CO	30.06	69	3	23	66	3	20
2.500	2.600	300	7.6	9.95	CO	61.31	70	3	24	66	3	20
2.500	2.600	300	7.6	10.00	CO2	61.31	68	3	22	66	3	20
2.500	2.600	303	26.0	5.00	CO2	15.00	379	3	26	378	3	25
2.500	2.600	303	26.0	5.00	CO	15.00	381	3	28	378	3	25
2.500	2.600	303	26.0	5.05	CO2	30.19	380	3	27	378	3	25

WATER SPECTRA GROUPED BY TEMPERATURE (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	BROADENER GAS	PRESSURE	SPECTRUM			RUN LOCATION		
INITIAL	FINAL						IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
2.500	2.600	303	26.0	5.10	CO	31.25	342	3	29	37A	3	25
2.600	2.700	303	7.6	9.90			65	3	31	64	3	30
2.700	3.000	307	7.6	10.30	H2	70.25	53	3	35	52	3	34
2.700	3.000	307	7.6	30.00			13	3	33	12	3	32
2.770	3.000	305	7.6	70.00			27	3	37	26	3	36
2.700	3.000	305	7.6	10.00			21	3	39	20	3	38
2.700	3.000	305	7.6	50.00			22	3	40	20	3	38
2.700	3.000	302	26.0	5.00			33A	3	42	336	3	41
2.700	3.000	302	26.0	10.75			339	3	43	336	3	41
2.700	3.000	302	26.0	20.25			340	3	44	336	3	41
2.700	3.020	300	26.0	59.60			651	3	46	650	3	45
2.900	3.200	307	7.6	30.00			15	3	48	14	3	47
2.900	3.200	305	7.6	70.00			29	3	50	2A	3	49
2.900	3.250	303	26.0	9.95			345	3	52	343	3	51
2.900	3.250	303	26.0	20.05			346	3	53	343	3	51
2.900	3.250	302	26.0	40.60			347	3	54	343	3	51
3.000	3.470	300	100.0	9.90			534	3	58	531	3	55
3.000	3.470	300	100.0	10.40	H2	50.37	535	3	59	531	3	55
3.000	3.470	300	100.0	30.20			532	3	56	531	3	55
3.000	3.470	300	100.0	60.75			533	3	57	531	3	55
3.147	3.467	293	7.6	20.05			127	3	61	126	3	60
3.147	3.467	290	7.6	49.70			128	3	62	126	3	60
3.147	3.467	293	7.6	51.30	H2	50.50	130	3	64	126	3	60
3.147	3.467	293	7.6	69.85			129	3	63	126	3	60
3.200	3.470	303	26.0	10.00			342	3	16	343	3	15
3.200	3.470	304	26.0	10.40	H2	30.69	347	3	19	343	3	15
3.200	3.470	304	26.0	19.60			345	3	17	343	3	15
3.200	3.470	298	26.0	39.60			346	3	18	343	3	15
4.100	4.600	298	26.0	5.10	CO2	1.00	404	3	69	309	3	65
4.100	4.600	299	26.0	10.15	CO2	1.00	405	3	70	309	3	65
4.100	5.000	300	100.0	10.00			539	3	74	536	3	71
4.100	5.000	300	100.0	10.50	H2	42.25	540	3	75	536	3	71
4.100	5.000	300	100.0	30.20			538	3	73	536	3	71
4.100	5.000	300	100.0	50.20			537	3	72	536	3	71
4.400	5.500	308	26.0	0.05			349	4	2	348	4	1
4.400	5.500	302	26.0	4.05	H2	30.69	305	4	8	348	4	1
4.400	5.500	307	26.0	5.00			300	4	3	348	4	1
4.400	5.500	300	26.0	5.00	CO	20.25	305	4	9	348	4	1
4.400	5.500	299	26.0	5.11	CO2	10.19	307	4	10	348	4	1
4.400	5.500	302	26.0	5.20	H2	15.00	304	4	7	348	4	1
4.400	5.500	307	26.0	10.20			301	4	4	348	4	1
4.400	5.500	305	26.0	20.15			302	4	5	348	4	1
4.400	5.500	304	26.0	40.50			303	4	6	348	4	1
4.500	5.040	290	7.6	10.00			132	4	12	131	4	11
4.500	5.040	290	7.6	30.40			133	4	13	131	4	11
4.500	5.040	290	7.6	50.00			134	4	14	131	4	11
4.500	5.040	290	7.6	69.05			135	4	15	131	4	11
5.000	5.500	305	7.6	10.10			137	4	17	136	4	35
5.000	5.500	305	7.6	30.10	CO2	56.06	142	4	39	141	4	38
5.000	5.500	305	7.6	30.20			138	4	18	136	4	35
5.000	5.500	304	7.6	30.50	H2	61.25	144	4	41	141	4	38
5.000	5.500	304	7.6	30.60	CO	61.75	143	4	40	141	4	38
5.000	5.500	300	7.6	49.85			139	4	36	136	4	35
5.000	5.500	300	7.6	69.00			140	4	37	136	4	35
5.400	7.200	300	26.0	1.00			410	4	20	409	4	19
5.400	7.200	301	26.0	5.00			411	4	21	409	4	19
5.400	7.200	300	26.0	5.10	H2	15.12	416	4	26	409	4	19
5.400	7.200	300	26.0	5.10	H2	30.25	417	4	27	409	4	19
5.400	7.200	300	26.0	5.20	CO2	10.56	414	4	24	409	4	19
5.400	7.200	300	26.0	5.25	CO	10.19	415	4	25	409	4	19
5.400	7.200	300	26.0	10.10			412	4	22	409	4	19
5.400	7.200	300	26.0	19.00			413	4	23	409	4	19
7.000	7.440	300	26.0	1.00			419	4	29	41A	4	28
7.000	7.440	300	26.0	5.00			420	4	30	41A	4	28
7.000	7.440	294	26.0	5.10	H2	30.44	424	4	31	41A	4	28
7.000	7.440	299	26.0	5.15	H2	15.25	423	4	33	41A	4	28
7.000	7.440	300	26.0	10.05			421	4	31	41A	4	28
7.000	7.440	299	26.0	20.10			422	4	32	41A	4	28
1.250	1.450	600	26.0	60.00			661	5	2	660	5	1
1.250	1.450	610	52.0	15.60			507	5	4	596	5	3
1.250	1.450	610	52.0	30.80			598	5	5	596	5	3
1.250	1.450	610	52.0	60.80			599	5	6	596	5	3
1.250	1.610	600	100.0	4.90			563	5	10	560	5	7
1.250	1.610	600	100.0	5.40	H2	40.25	564	5	11	560	5	7
1.250	1.610	600	100.0	29.10			562	5	9	560	5	7
1.250	1.610	600	100.0	59.20			561	5	8	560	5	7
1.310	1.510	590	26.0	10.00			433	5	13	432	5	12
1.310	1.510	600	26.0	10.60	H2	32.37	436	5	16	432	5	12
1.310	1.510	592	26.0	20.00			434	5	14	432	5	12
1.310	1.510	595	26.0	40.00			435	5	15	432	5	12
1.325	1.375	606	7.6	50.10			100	5	18	99	5	17
1.325	1.375	606	7.6	69.90			101	5	19	99	5	17
1.360	1.505	590	7.6	51.00	H2	52.69	125	5	21	124	5	20

WATER SPECTRA GROUPED BY TEMPERATURE (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	BROADENER GAS PRESSURE		SPECTRUM			RUN LOCATION BACKGROUND		
INITIAL	FINAL				IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.		
1.366	1.525	602	7.6	50.00			104	5	23	103	5	22
1.366	1.525	602	7.6	70.00			105	5	24	103	5	22
1.430	1.750	600	26.0	60.00			650	5	26	65A	5	25
1.440	1.700	610	52.0	30.00			504	5	28	592	5	27
1.440	1.700	610	52.0	61.60			595	5	29	592	5	27
1.600	2.110	600	100.0	5.00			56A	5	33	565	5	30
1.600	2.110	600	100.0	29.00			567	5	32	565	5	30
1.600	2.110	600	100.0	59.35			566	5	31	565	5	30
1.700	2.100	600	26.0	5.00	H2	29.37	444	6	7	437	6	1
1.700	2.100	600	26.0	5.05	H2	14.75	442	6	6	437	6	1
1.700	2.100	600	26.0	5.15			43A	6	2	437	6	1
1.700	2.100	600	26.0	10.00			439	6	3	437	6	1
1.700	2.100	600	26.0	20.00			441	6	5	437	6	1
1.700	2.100	600	26.0	39.85			443	6	4	437	6	1
1.700	2.100	610	52.0	6.40			5A9	6	9	5A8	6	8
1.700	2.100	610	52.0	15.40			590	6	10	5A8	6	8
1.700	2.100	610	52.0	30.60			591	6	11	5A8	6	8
1.750	1.820	600	7.6	30.00			89	6	13	87	6	12
1.750	1.850	607	7.6	30.20	H2	70.44	119	6	17	118	6	16
1.750	1.820	600	7.6	50.70			89	6	14	87	6	12
1.750	1.820	600	7.6	70.20			90	6	15	87	6	12
1.800	1.880	602	7.6	30.40			92	6	19	91	6	1A
1.800	1.880	602	7.6	50.60			93	6	20	91	6	1A
1.800	1.880	602	7.6	70.40			94	6	21	91	6	1A
1.830	2.000	607	7.6	30.20	H2	69.75	121	6	23	120	6	22
1.860	2.000	602	7.6	30.10			96	6	25	95	6	24
1.860	2.000	602	7.6	49.90			97	6	26	95	6	24
1.860	2.000	612	7.6	70.10			9A	6	27	95	6	24
2.100	2.550	600	100.0	29.60			570	6	32	569	6	31
2.100	2.550	600	100.0	60.10			571	6	33	569	6	31
2.350	2.800	596	26.0	1.00			460	6	35	459	6	34
2.350	2.800	596	26.0	4.95			461	6	35	459	6	34
2.350	2.800	596	26.0	10.15			462	6	37	459	6	34
2.350	2.800	596	26.0	20.00			463	6	38	459	6	34
2.350	2.800	600	26.0	60.00			655	6	40	654	6	39
2.400	2.800	607	7.6	10.00	H2	71.69	115	6	47	114	6	46
2.400	2.800	602	7.6	10.25			72	6	42	71	6	41
2.400	2.800	602	7.6	30.30			73	6	43	71	6	41
2.400	2.800	602	7.6	50.10			74	6	44	71	6	41
2.400	2.800	600	7.6	69.90			75	6	45	71	6	41
2.500	2.600	602	7.6	10.00	CO	32.06	108	6	49	107	6	4A
2.500	2.600	602	7.6	10.00	CO	60.25	109	6	50	107	6	4A
2.500	2.600	602	7.6	10.20	CO2	60.37	111	6	52	107	6	4A
2.500	2.600	602	7.6	10.30	CO2	30.50	110	6	51	107	6	4A
2.500	2.600	596	26.0	5.00	CO2	15.00	467	6	54	466	6	53
2.500	2.600	596	26.0	5.00	CO2	30.19	46A	6	55	466	6	53
2.600	2.700	607	7.6	9.00			113	6	57	112	6	56
2.760	3.000	607	7.6	10.00	H2	71.69	117	6	59	116	6	5A
2.780	3.000	602	7.6	9.90			77	7	2	76	7	1
2.780	3.000	602	7.6	30.00			78	7	3	76	7	1
2.780	3.000	602	7.6	50.10			79	7	4	76	7	1
2.780	3.000	602	7.6	69.90			80	7	5	76	7	1
2.780	3.000	600	26.0	1.00			447	7	7	446	7	6
2.780	3.000	596	26.0	5.00			448	7	8	446	7	6
2.780	3.000	596	26.0	10.20			449	7	9	446	7	6
2.780	3.000	594	26.0	20.25			450	7	10	446	7	6
2.780	3.000	594	26.0	40.45			451	7	11	446	7	6
2.780	3.000	596	26.0	59.60			653	7	13	652	7	12
2.980	3.200	602	7.6	30.00			82	7	15	81	7	14
2.980	3.200	590	7.6	50.60			85	7	17	84	7	16
2.980	3.200	593	7.6	70.10			86	7	1A	84	7	16
2.980	3.250	596	26.0	10.10			456	7	20	454	7	19
2.980	3.250	596	26.0	20.30			457	7	21	454	7	19
2.980	3.250	596	26.0	40.60			458	7	22	454	7	19
3.000	3.470	600	100.0	29.90			573	7	24	572	7	23
3.000	3.470	600	100.0	59.40			574	7	25	572	7	23
3.140	3.470	600	7.6	30.10			271	7	27	270	7	26
3.140	3.470	600	7.6	51.00			272	7	2A	270	7	26
3.140	3.470	600	7.6	51.40	H2	52.31	274	7	30	270	7	26
3.140	3.470	600	7.6	70.70			273	7	29	270	7	26
3.200	3.470	606	26.0	10.00			470	7	32	469	7	31
3.200	3.470	604	26.0	20.00			471	7	33	469	7	31
3.200	3.470	604	26.0	39.85			472	7	34	469	7	31
4.000	5.000	600	100.0	30.10			549	7	39	544	7	35
4.000	5.000	600	100.0	59.80			550	7	40	544	7	35
4.100	4.600	597	7.6	7.50	CO2	3.06	279	7	45	275	7	41
4.100	4.600	597	7.6	14.90	CO2	3.00	280	7	46	275	7	41
4.100	4.600	605	26.0	10.40	CO2	1.06	485	7	59	482	7	56
4.200	5.000	605	26.0	40.40			481	7	48	480	7	47
4.400	5.500	605	26.0	5.30			476	7	54	473	7	52
4.400	5.500	605	26.0	11.00			475	7	53	473	7	52
4.400	5.500	605	26.0	19.90			478	7	55	473	7	52
4.500	5.040	605	7.6	9.95			155	4	43	154	4	42

WATER SPECTRA GROUPED BY TEMPERATURE (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	BROADENER GAS PRESSURE		RUN LOCATION					
INITIAL	FINAL						SPECTRUM IDENT.	TAPE	SEQ.	BACKGROUND IDENT.	TAPE	SEQ.
4.500	5.040	605	7.6	29.45			156	4	44	154	4	42
4.500	5.040	603	7.6	49.45			157	4	45	154	4	42
4.500	5.040	603	7.6	69.90			154	4	46	154	4	42
5.000	5.500	605	7.6	10.10			160	4	48	159	4	47
5.000	5.500	605	7.6	29.90			161	4	49	159	4	47
5.000	5.500	607	7.6	30.00	CO2	60.25	181	4	55	180	4	54
5.000	5.500	607	7.6	30.30	H2	60.44	182	4	56	180	4	54
5.000	5.500	607	7.6	31.30	CO	63.00	170	4	53	169	4	52
5.000	5.500	605	7.6	50.00			162	4	50	159	4	47
5.000	5.500	605	7.6	69.45			163	4	51	159	4	47
5.000	5.500	605	7.6	10.10			165	4	58	164	4	57
5.000	5.500	605	7.6	29.45			166	4	59	164	4	57
5.000	5.500	605	7.6	50.15			167	4	60	164	4	57
5.000	5.500	605	7.6	70.00			168	4	61	164	4	57
5.400	7.200	604	26.0	5.00	CO2	10.12	490	7	64	486	7	60
5.400	7.200	605	26.0	5.05			487	7	61	486	7	60
5.400	7.200	605	26.0	10.00			488	7	62	486	7	60
5.400	7.200	604	26.0	20.15			489	7	63	486	7	60
7.000	7.840	602	26.0	5.00			492	7	66	491	7	65
7.000	7.840	602	26.0	5.00	CO2	9.94	495	7	69	491	7	65
7.000	7.840	602	26.0	10.00			493	7	67	491	7	65
7.000	7.840	602	26.0	20.15			494	7	68	491	7	65
7.000	8.100	603	26.0	5.00			497	7	71	496	7	70
7.000	8.100	603	26.0	5.00	CO2	9.94	501	7	75	496	7	70
7.000	8.100	600	26.0	10.00			498	7	72	496	7	70
7.000	8.100	600	26.0	20.00			499	7	73	496	7	70
7.000	8.100	600	26.0	40.00			500	7	74	496	7	70
1.250	1.450	898	26.0	29.00			664	8	2	662	8	1
1.250	1.450	898	26.0	60.00			665	8	3	662	8	1
1.250	1.450	888	52.0	15.00			601	8	5	600	8	4
1.250	1.450	888	52.0	30.00			602	8	6	600	8	4
1.250	1.450	888	52.0	61.00			603	8	7	600	8	4
1.310	1.510	900	26.0	21.00			504	8	9	506	8	8
1.310	1.510	900	26.0	40.00			505	8	10	506	8	8
1.320	1.370	901	7.6	51.00	H2	51.06	253	4	65	250	4	62
1.320	1.370	901	7.6	49.00			251	4	63	250	4	62
1.320	1.370	901	7.6	70.00			252	4	61	250	4	62
1.360	1.510	899	7.6	50.15			202	8	12	201	8	11
1.360	1.510	900	7.6	70.00			203	8	13	201	8	11
1.430	1.750	900	26.0	30.00			667	8	15	666	8	14
1.430	1.750	900	26.0	60.00			668	8	16	666	8	14
1.440	1.700	884	52.0	15.00			605	8	18	604	8	17
1.440	1.700	884	52.0	30.00			606	8	19	604	8	17
1.440	1.700	884	52.0	63.00			607	8	20	604	8	17
1.700	2.100	884	52.0	7.00			609	8	22	608	8	21
1.700	2.100	886	52.0	15.00			610	8	23	608	8	21
1.700	2.100	895	52.0	31.00			611	8	24	608	8	21
1.700	2.100	895	52.0	61.00			612	8	25	608	8	21
1.730	2.100	910	26.0	14.00			670	8	27	669	8	26
1.730	2.100	910	26.0	31.00			671	8	28	669	8	26
1.730	2.100	910	26.0	55.00			672	8	29	669	8	26
1.750	1.820	900	7.6	29.50			295	8	31	294	8	30
1.750	1.820	900	7.6	50.25			296	8	32	294	8	30
1.750	1.820	900	7.6	70.05			297	8	33	294	8	30
1.800	1.880	905	7.6	29.60			299	8	35	298	8	34
1.800	1.880	900	7.6	50.20			300	8	36	298	8	34
1.800	1.880	894	7.6	69.95			301	8	37	298	8	34
1.850	2.100	898	7.6	29.00			313	9	2	302	9	1
1.850	2.100	900	7.6	50.00			314	9	3	302	9	1
1.850	2.100	900	7.6	70.00			305	9	4	302	9	1
2.000	2.370	900	26.0	60.00			602	9	6	601	9	5
2.200	2.430	900	52.0	30.60			614	9	8	613	9	7
2.200	2.430	900	52.0	62.00			615	9	9	613	9	7
2.350	2.800	910	26.0	15.00			674	9	11	677	9	10
2.350	2.800	910	26.0	30.00			675	9	12	677	9	10
2.350	2.800	905	26.0	60.00			676	9	13	677	9	10
2.400	2.800	903	7.6	29.80	H2	38.75	310	9	18	306	9	14
2.400	2.800	903	7.6	30.05			307	9	15	306	9	14
2.400	2.800	903	7.6	50.00			308	9	16	306	9	14
2.400	2.800	903	7.6	69.85			309	9	17	306	9	14
2.410	2.800	900	52.0	2.00			622	9	20	621	9	19
2.410	2.800	900	52.0	4.90			623	9	21	621	9	19
2.410	2.800	900	52.0	9.90			624	9	22	621	9	19
2.500	2.600	905	7.6	10.10	CO2	29.94	323	9	24	322	9	23
2.500	2.600	905	7.6	10.10	CO2	61.06	324	9	25	322	9	23
2.600	2.700	906	7.6	49.85			321	9	27	320	9	26
2.780	3.000	905	7.6	29.80	H2	39.06	315	9	32	311	9	28
2.780	3.000	903	7.6	30.10			312	9	29	311	9	28
2.780	3.000	903	7.6	50.10			313	9	30	311	9	28
2.780	3.000	903	7.6	69.80			314	9	31	311	9	28
2.780	3.020	910	26.0	14.00			674	9	34	673	9	33
2.780	3.020	905	26.0	30.60			675	9	35	673	9	33
2.780	3.020	905	26.0	58.00			676	9	36	673	9	33

WATER SPECTRA GROUPED BY TEMPERATURE (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	DROPCENER GAS PRESSURE		RUN LOCATION			
INITIAL	FINAL				SPECTRUM IDENT.	TAPE	SEQ.	BACKGROUND IDENT.	TAPE	SEQ.
2.790	3.000	900	52.0	2.70				617	9	37
2.790	3.000	900	52.0	5.10				617	9	37
2.790	3.000	900	52.0	10.00				617	9	37
2.980	3.200	905	7.6	30.00				316	9	41
2.980	3.200	906	7.6	49.00				316	9	41
2.980	3.200	906	7.6	70.00				316	9	41
3.000	3.470	900	26.0	10.10				502	9	45
3.000	3.470	900	26.0	19.00				502	9	45
3.000	3.470	900	26.0	30.00				643	9	49
3.000	3.470	900	26.0	40.45				643	9	49
3.000	3.470	900	26.0	60.00				625	9	52
3.000	3.470	900	52.0	30.00				625	9	52
3.000	3.470	900	52.0	62.00				215	4	65
3.147	3.467	902	7.6	30.00				215	4	66
3.147	3.467	901	7.6	49.00	H2	51.00		215	4	66
3.147	3.467	903	7.6	50.00				215	4	66
3.147	3.467	903	7.6	70.00				215	4	66
4.400	4.520	898	7.6	50.00				100	4	72
4.400	4.520	903	7.6	70.00				100	4	72
4.500	5.040	896	7.6	10.00				183	4	74
4.500	5.040	903	7.6	30.00				183	4	74
4.500	5.040	901	7.6	50.00				183	4	74
4.500	5.040	901	7.6	70.00				183	4	74
4.900	5.040	901	7.6	9.00				102	4	83
5.000	5.240	903	7.6	30.00				192	4	83
5.000	5.240	903	7.6	30.00				192	4	83
5.000	5.240	903	7.6	30.00	O2	59.50		202	4	79
5.000	5.240	903	7.6	30.00	O2	59.75		202	4	79
5.000	5.240	903	7.6	30.00	H2	59.94		202	4	79
5.000	5.240	903	7.6	50.00				102	4	83
5.000	5.240	903	7.6	70.00				102	4	83
5.220	5.500	903	7.6	9.00				107	4	88
5.220	5.500	903	7.6	30.00				107	4	88
5.220	5.500	903	7.6	50.00				107	4	88
5.220	5.500	903	7.6	70.00				107	4	88
5.220	5.500	903	7.6	50.00				197	4	88
5.220	5.500	903	7.6	70.00				197	4	88
1.700	2.100	980	26.0	23.00				697	4	93
1.700	2.100	980	26.0	60.00				697	4	93
1.700	2.100	990	52.0	30.00				634	4	96
2.000	2.370	980	26.0	60.00				695	4	94
2.300	2.800	990	52.0	12.00				636	4	100
2.300	2.800	990	52.0	30.00				636	4	100
2.300	2.800	990	52.0	61.00				636	4	100
2.300	2.800	980	26.0	23.00				692	4	104
2.300	2.800	980	26.0	60.00				692	4	104
2.700	3.020	980	26.0	22.00				689	4	107
2.700	3.020	980	26.0	60.00				689	4	107
2.790	3.010	990	52.0	12.00				630	4	110
2.790	3.010	990	52.0	30.00				630	4	110
2.790	3.010	990	52.0	60.00				630	4	110
3.000	3.470	978	26.0	22.00				686	4	114
3.000	3.470	978	26.0	60.00				686	4	114
3.000	3.470	980	52.0	50.00				628	4	117

SPECTRA CONTAINING FOREIGN GASES

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	DROPOUNDER		RUN LOCATION					
INITIAL	FINAL				GAS	PRESSURE	SPECTRUM IDENT.	TAPE	SEQ.	BACKGROUND IDENT.	TAPE	SEQ.
1.250	1.610	600	100.0	5.40	H2	40.25	564	5	11	560	5	7
1.300	1.450	300	100.0	5.00	H2	40.06	501	1	13	518	1	11
1.310	1.510	600	26.0	10.00	H2	32.37	436	5	16	432	5	12
1.320	1.370	302	26.0	10.20	H2	31.06	372	1	1A	368	1	14
1.320	1.370	901	7.6	51.00	H2	51.06	253	4	65	250	4	62
1.325	1.365	297	7.6	50.50	H2	50.56	63	1	23	62	1	22
1.360	1.510	303	26.0	10.00	H2	30.87	377	1	2A	373	1	24
1.360	1.505	590	7.6	51.00	H2	52.69	125	5	21	124	5	20
1.371	1.530	297	7.6	49.40	H2	52.75	61	1	33	60	1	32
1.700	2.100	600	26.0	5.05	H2	14.75	442	6	6	437	6	1
1.700	2.100	600	26.0	5.00	H2	29.37	444	6	7	437	6	1
1.750	1.870	302	7.6	30.30	H2	71.19	46	2	17	45	2	16
1.750	2.000	300	100.0	5.10	H2	40.37	523	2	25	521	2	23
1.750	1.850	607	7.6	30.00	H2	70.44	119	6	17	118	6	16
1.830	2.000	607	7.6	30.00	H2	60.75	121	6	23	120	6	22
1.850	2.000	302	7.6	30.30	H2	72.00	4A	2	39	47	2	38
1.860	2.100	300	26.0	5.15	H2	15.19	366	2	45	361	2	40
1.860	2.100	301	26.0	5.14	H2	30.37	367	2	46	361	2	40
2.350	2.800	294	26.0	1.15	H2	29.25	331	3	6	325	3	1
2.400	2.800	310	7.6	30.00	H2	72.37	31	3	14	30	3	13
2.400	2.800	607	7.6	10.00	H2	71.69	115	6	47	114	6	46
2.400	2.800	903	7.6	29.00	H2	34.75	310	9	1A	306	9	14
2.760	3.000	607	7.6	10.00	H2	70.25	53	3	35	52	3	34
2.760	3.000	607	7.6	10.00	H2	71.69	117	6	59	116	6	58
2.780	3.000	905	7.6	29.00	H2	30.06	315	9	32	311	9	28
3.000	3.470	300	100.0	10.40	H2	50.37	535	3	59	531	3	55
3.140	3.470	600	7.6	51.00	H2	52.31	274	7	30	270	7	26
3.147	3.467	293	7.6	51.00	H2	50.50	130	3	64	126	3	60
3.147	3.467	901	7.6	49.00	H2	51.00	219	4	70	215	4	66
3.200	3.470	304	26.0	10.40	H2	30.69	347	3	19	343	3	15
4.100	5.000	300	100.0	10.30	H2	42.25	540	3	75	536	3	71
4.400	5.500	302	26.0	5.20	H2	15.00	304	4	7	300	4	1
4.400	5.500	302	26.0	4.05	H2	30.69	305	4	8	300	4	1
5.000	5.300	304	7.6	30.50	H2	61.25	144	4	41	141	4	38
5.000	5.300	607	7.6	30.30	H2	60.44	182	4	56	180	4	54
5.000	5.300	901	7.6	30.30	H2	50.04	203	4	80	202	4	79
5.400	7.200	300	26.0	5.10	H2	15.12	416	4	26	409	4	19
5.400	7.200	300	26.0	5.10	H2	30.25	417	4	27	409	4	19
7.000	7.640	299	26.0	5.15	H2	15.25	423	4	33	418	4	28
7.000	7.640	298	26.0	5.14	H2	30.44	424	4	34	418	4	28
2.500	2.600	300	7.6	9.95	CO	30.06	69	3	23	66	3	20
2.500	2.600	300	7.6	9.95	CO	61.31	70	3	24	66	3	20
2.500	2.600	303	26.0	5.00	CO	15.00	381	3	28	378	3	25
2.500	2.600	303	26.0	5.10	CO	30.05	382	3	29	378	3	25
2.500	2.600	602	7.6	10.00	CO	32.06	108	6	49	107	6	48
2.500	2.600	602	7.6	10.00	CO	60.25	109	6	50	107	6	48
4.300	5.100	299	26.0	0.0	CO	5.00	407	3	80	406	3	79
4.300	5.100	299	26.0	0.0	CO	10.00	408	3	81	406	3	79
4.300	5.100	602	7.6	0.0	CO	0.84	282	7	50	281	7	49
4.300	5.100	603	7.6	0.0	CO	20.00	283	7	51	281	7	49
4.300	5.100	901	7.6	0.0	CO	10.00	285	9	59	284	9	58
4.300	5.100	899	7.6	0.0	CO	20.19	286	9	60	284	9	58
4.400	5.500	300	26.0	5.00	CO	20.25	306	4	9	300	4	1
5.000	5.300	304	7.6	30.60	CO	61.75	143	4	40	141	4	38
5.000	5.300	607	7.6	31.30	CO	60.00	107	4	53	169	4	52
5.000	5.300	900	7.6	30.30	CO	50.50	284	4	81	282	4	79
5.400	7.200	300	26.0	5.20	CO	10.19	415	4	25	409	4	19
1.900	2.160	300	100.0	0.0	CO2	70.50	555	2	51	554	2	50
1.900	2.160	300	100.0	0.0	CO2	142.25	556	2	52	554	2	50
1.900	2.200	600	100.0	0.0	CO2	70.00	55A	6	29	557	6	28
1.900	2.200	600	100.0	0.0	CO2	140.00	550	6	30	557	6	28
2.500	2.600	300	7.6	9.90	CO2	30.00	67	3	21	66	3	20
2.500	2.600	300	7.6	10.00	CO2	61.31	64	3	22	66	3	20
2.500	2.600	303	26.0	5.00	CO2	15.00	379	3	26	378	3	25
2.500	2.600	303	26.0	5.00	CO2	30.19	380	3	27	378	3	25
2.500	2.600	602	7.6	10.30	CO2	30.50	110	6	51	107	6	48
2.500	2.600	602	7.6	10.20	CO2	60.37	111	6	52	107	6	48
2.500	2.600	596	26.0	5.00	CO2	15.00	467	6	54	466	6	53
2.500	2.600	596	26.0	5.00	CO2	30.19	468	6	55	466	6	53
2.500	2.600	905	7.6	10.10	CO2	29.04	323	9	24	322	9	23
2.500	2.600	905	7.6	10.10	CO2	61.06	324	9	25	322	9	23
4.000	5.000	600	100.0	0.0	CO2	10.00	545	7	36	544	7	35
4.000	5.000	600	100.0	0.0	CO2	70.50	546	7	37	544	7	35
4.000	5.000	600	100.0	0.0	CO2	140.00	547	7	38	544	7	35
4.100	4.600	299	26.0	0.0	CO2	0.94	400	3	66	399	3	65
4.100	4.600	298	26.0	5.10	CO2	1.00	404	3	69	399	3	65
4.100	4.600	299	26.0	10.15	CO2	1.00	405	3	70	399	3	65
4.100	4.600	298	26.0	0.0	CO2	3.19	401	3	67	399	3	65
4.100	4.600	298	26.0	0.0	CO2	6.06	403	3	68	399	3	65
4.100	5.000	300	100.0	0.0	CO2	12.00	542	3	77	536	3	71
4.100	5.000	300	100.0	0.0	CO2	74.69	541	3	76	536	3	71
4.100	5.000	300	100.0	0.0	CO2	137.67	543	3	78	536	3	71
4.100	4.600	597	7.6	14.90	CO2	3.00	280	7	46	275	7	41

SPECTRA CONTAINING FOREIGN GASES (CONT.)

WAVELENGTH (MICRONS)		TEMPERATURE (CENTIGRADE)	CELL LENGTH (CM)	WATER PRESSURE	DILUENT GAS	PRESSURE	SPECTRUM		RUN LOCATION		BACKGROUND	
INITIAL	FINAL						IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
4.100	4.600	597	7.6	7.50	CO2	3.06	279	7	45	275	7	41
4.100	4.600	595	7.6	0.0	CO2	3.50	276	7	42	275	7	41
4.100	4.600	597	7.6	0.0	CO2	6.25	277	7	43	275	7	41
4.100	4.600	596	7.6	0.0	CO2	9.50	27A	7	44	275	7	41
4.100	4.600	605	26.0	0.0	CO2	0.04	443	7	57	482	7	56
4.100	4.600	605	26.0	10.40	CO2	1.06	445	7	59	482	7	56
4.100	4.600	605	26.0	0.0	CO2	5.06	444	7	58	482	7	56
4.100	4.600	900	7.6	0.0	CO2	3.00	289	9	56	287	9	55
4.100	4.600	900	7.6	0.0	CO2	6.19	290	9	57	287	9	55
4.400	5.300	299	26.0	5.11	CO2	10.19	397	4	10	388	4	1
5.000	5.300	305	7.6	30.10	CO2	50.06	142	4	39	141	4	38
5.000	5.300	607	7.6	30.00	CO2	60.25	181	4	55	180	4	54
5.000	5.300	900	7.6	30.00	CO2	59.75	208	4	62	202	4	79
5.400	7.200	300	26.0	5.20	CO2	10.56	414	4	24	409	4	19
5.400	7.200	604	26.0	5.00	CO2	10.12	400	7	64	486	7	60
7.000	7.840	602	26.0	5.00	CO2	9.94	405	7	69	491	7	65
7.000	8.100	600	26.0	5.00	CO2	9.94	501	7	75	496	7	70

RUN LOCATION INDEX

SPECTRUM			BACKGROUND			SPECTRUM			BACKGROUND		
IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
11	3	10	10	3	9	156	4	44	154	4	42
13	3	33	12	3	32	157	4	45	154	4	42
15	3	4A	14	3	47	15A	4	46	154	4	42
19	3	12	18	3	11	160	4	4A	159	4	47
21	3	39	20	3	38	161	4	49	159	4	47
22	3	40	20	3	38	162	4	50	159	4	47
24	2	5A	23	2	57	163	4	51	159	4	47
25	2	59	23	2	57	165	4	5A	164	4	57
27	3	37	26	3	38	166	4	59	164	4	57
29	3	50	28	3	49	167	4	60	164	4	57
31	3	14	30	3	13	16A	4	61	164	4	57
33	2	37	32	2	36	170	4	53	169	4	52
35	2	27	34	2	28	1A1	4	55	1A0	4	54
37	2	14	36	2	13	1A2	4	56	1A0	4	54
38	2	15	36	2	13	1A5	4	75	1A3	4	74
40	2	29	39	2	2A	1A6	4	76	1A3	4	74
41	2	30	39	2	2A	1A7	4	77	1A3	4	74
43	2	48	42	2	47	1A8	4	78	1A3	4	74
44	2	49	42	2	47	1A9	4	71	190	4	72
46	2	17	45	2	18	191	4	73	190	4	72
4A	2	39	47	2	3A	193	4	84	192	4	83
53	3	35	52	3	34	194	4	85	192	4	83
55	1	20	54	1	19	195	4	86	192	4	83
56	1	21	54	1	19	196	4	87	192	4	83
5A	1	30	57	1	23	19A	4	89	197	4	8A
59	1	31	57	1	29	199	4	90	197	4	8A
61	1	33	60	1	32	200	4	91	197	4	8A
63	1	23	62	1	22	201	4	92	197	4	8A
65	3	31	64	3	30	203	4	80	202	4	79
67	3	21	66	3	20	204	4	81	202	4	79
6A	3	22	66	3	20	20A	4	82	202	4	79
69	3	23	66	3	20	216	4	67	215	4	66
70	3	24	66	3	20	217	4	6A	215	4	66
72	6	42	71	6	41	21A	4	69	215	4	66
73	6	43	71	6	41	219	4	70	215	4	66
74	6	44	71	6	41	251	4	63	250	4	62
75	6	45	71	6	41	252	4	64	250	4	62
77	7	2	76	7	1	253	4	65	250	4	62
7A	7	3	76	7	1	271	7	27	270	7	26
79	7	4	76	7	1	272	7	2A	270	7	26
80	7	5	76	7	1	273	7	29	270	7	26
82	7	15	81	7	14	274	7	30	270	7	26
85	7	17	84	7	16	276	7	42	275	7	41
86	7	1A	84	7	16	277	7	43	275	7	41
8A	6	13	87	6	12	27A	7	44	275	7	41
89	6	14	87	6	12	279	7	45	275	7	41
90	6	15	87	6	12	2A0	7	46	275	7	41
92	6	19	91	6	1A	2A2	7	50	2A1	7	49
93	6	20	91	6	1A	2A3	7	51	2A1	7	49
94	6	21	91	6	1A	2A5	9	59	2A4	9	5A
96	6	25	95	6	24	2A6	9	60	2A4	9	5A
97	6	26	95	6	24	2A9	9	56	2A7	9	55
9A	6	27	95	6	24	290	9	57	2A7	9	55
100	5	18	99	5	17	292	8	12	291	A	11
101	5	19	99	5	17	293	8	13	291	A	11
104	5	23	103	5	22	295	8	31	294	A	30
105	5	24	103	5	22	296	8	32	294	A	30
10A	6	49	107	6	4A	297	8	33	294	A	30
109	6	50	107	6	4A	299	8	35	29A	A	34
110	6	51	107	6	4A	300	8	36	29A	A	34
111	6	52	107	6	4A	301	8	37	29A	A	34
113	6	57	112	6	4A	303	9	2	302	9	1
115	6	47	114	6	46	304	9	3	302	9	1
117	6	59	116	6	5A	305	9	4	302	9	1
119	6	17	11A	6	18	307	9	15	306	9	14
121	6	23	120	6	22	308	9	16	306	9	14
125	5	21	124	5	20	309	9	17	306	9	14
127	3	61	126	3	60	310	9	18	306	9	14
12A	3	62	126	3	60	312	9	29	311	9	2A
129	3	63	126	3	60	313	9	30	311	9	2A
130	3	64	126	3	60	314	9	31	311	9	2A
132	4	12	131	4	11	315	9	32	311	9	2A
133	4	13	131	4	11	317	9	42	316	9	41
134	4	14	131	4	11	318	9	43	316	9	41
135	4	15	131	4	11	319	9	44	316	9	41
137	4	17	136	4	35	321	9	27	320	9	26
138	4	18	136	4	35	323	9	24	322	9	23
139	4	36	136	4	35	324	9	25	322	9	23
140	4	37	136	4	35	126	3	2	325	3	1
142	4	39	141	4	38	327	3	3	325	3	1
143	4	40	141	4	38	328	3	4	325	3	1
144	4	41	141	4	38	329	3	5	325	3	1
155	4	43	154	4	42	331	3	6	325	3	1

RUN LOCATION INDEX (CONT.)

SPECTRUM			BACKGROUND			SPECTRUM			BACKGROUND		
IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
338	3	42	336	3	41	458	7	22	454	7	19
339	3	43	336	3	41	460	6	35	459	6	34
340	3	44	336	3	41	461	6	36	459	6	34
343	3	52	343	3	51	462	6	37	459	6	34
346	3	53	343	3	51	463	6	38	459	6	34
347	3	54	343	3	51	467	6	54	466	6	53
349	2	19	348	2	18	468	6	55	466	6	53
350	2	20	348	2	18	470	7	32	469	7	31
351	2	21	348	2	18	471	7	33	469	7	31
352	2	22	348	2	18	472	7	34	469	7	31
354	2	32	353	2	31	473	7	35	473	7	52
355	2	33	353	2	31	475	7	53	473	7	52
356	2	34	353	2	31	476	7	54	473	7	52
357	2	35	353	2	31	478	7	55	473	7	52
362	2	41	361	2	40	481	7	48	480	7	47
363	2	42	361	2	40	483	7	57	482	7	56
364	2	43	361	2	40	484	7	58	482	7	56
365	2	44	361	2	40	485	7	59	482	7	56
366	2	45	361	2	40	487	7	61	486	7	60
367	2	46	361	2	40	488	7	62	486	7	60
369	1	15	368	1	14	489	7	63	486	7	60
370	1	16	368	1	14	490	7	64	486	7	60
371	1	17	368	1	14	492	7	66	491	7	65
372	1	18	368	1	14	493	7	67	491	7	65
374	1	25	373	1	24	494	7	68	491	7	65
375	1	26	373	1	24	495	7	69	491	7	65
376	1	27	373	1	24	497	7	71	496	7	70
377	1	28	373	1	24	498	7	72	496	7	70
379	3	26	378	3	25	499	7	73	496	7	70
380	3	27	378	3	25	500	7	74	496	7	70
381	3	28	378	3	25	501	7	75	496	7	70
382	3	29	378	3	25	503	9	46	502	9	45
384	3	16	383	3	15	504	9	47	502	9	45
385	3	17	383	3	15	505	9	48	502	9	45
386	3	18	383	3	15	508	8	9	506	8	8
387	3	19	383	3	15	509	8	10	506	8	8
389	4	2	388	4	1	511	1	9	510	1	8
390	4	3	388	4	1	512	1	10	510	1	8
391	4	4	388	4	1	514	2	2	513	2	1
392	4	5	388	4	1	515	2	3	513	2	1
393	4	6	388	4	1	516	2	4	513	2	1
394	4	7	388	4	1	517	2	5	513	2	1
395	4	8	388	4	1	519	1	12	518	1	11
396	4	9	388	4	1	520	1	13	518	1	11
397	4	10	388	4	1	522	2	24	521	2	23
400	3	66	399	3	65	523	2	25	521	2	23
401	3	67	399	3	65	525	2	54	524	2	53
403	3	68	399	3	65	526	2	55	524	2	53
404	3	69	399	3	65	527	2	56	524	2	53
405	3	70	399	3	65	532	3	56	531	3	55
407	3	80	406	3	79	533	3	57	531	3	55
408	3	81	406	3	79	534	3	58	531	3	55
410	4	20	409	4	19	535	3	59	531	3	55
411	4	21	409	4	19	537	3	72	536	3	71
412	4	22	409	4	19	538	3	73	536	3	71
413	4	23	409	4	19	539	3	74	536	3	71
414	4	24	409	4	19	540	3	75	536	3	71
415	4	25	409	4	19	541	3	76	536	3	71
416	4	26	409	4	19	542	3	77	536	3	71
417	4	27	409	4	19	543	3	78	536	3	71
419	4	29	418	4	28	545	7	36	544	7	35
420	4	30	418	4	28	546	7	37	544	7	35
421	4	31	418	4	28	547	7	38	544	7	35
422	4	32	418	4	28	549	7	39	544	7	35
423	4	33	418	4	28	550	7	40	544	7	35
424	4	34	418	4	28	553	2	51	554	2	50
433	5	13	432	5	12	556	2	52	554	2	50
434	5	14	432	5	12	558	6	29	557	6	28
435	5	15	432	5	12	559	6	30	557	6	28
436	5	16	432	5	12	561	5	8	560	5	7
438	6	2	437	6	1	562	5	9	560	5	7
439	6	3	437	6	1	563	5	10	560	5	7
440	6	4	437	6	1	564	5	11	560	5	7
441	6	5	437	6	1	566	5	31	565	5	30
442	6	6	437	6	1	567	5	32	565	5	30
444	6	7	437	6	1	568	5	33	565	5	30
447	7	7	446	7	6	570	6	32	569	6	31
448	7	8	446	7	6	571	6	33	569	6	31
449	7	9	446	7	6	573	7	24	572	7	23
450	7	10	446	7	6	574	7	25	572	7	23
451	7	11	446	7	6	576	1	5	575	1	4
456	7	20	454	7	19	578	1	6	575	1	4
457	7	21	454	7	19	579	1	7	575	1	4
						581	1	37	580	1	36

RUN LOCATION INDEX (CONT.)

SPECTRUM			BACKGROUND		
IDENT.	TAPE	SEQ.	IDENT.	TAPE	SEQ.
5A2	1	3A	5A3	1	36
5A3	1	39	5A3	1	36
5A5	2	7	5A4	2	6
5A6	2	8	5A4	2	6
5A7	2	9	5A4	2	6
5A9	6	9	5A4	6	8
593	6	10	5A4	6	8
591	6	11	5A4	6	8
594	5	28	592	5	27
595	5	29	592	5	27
597	5	4	596	5	3
598	5	5	596	5	3
599	5	6	596	5	3
601	8	5	600	8	4
602	8	6	600	8	4
603	8	7	600	8	4
605	8	18	604	8	17
606	8	19	604	8	17
607	8	20	604	8	17
609	8	22	604	8	21
610	8	23	604	8	21
611	8	24	604	8	21
612	8	25	604	8	21
614	9	8	613	9	7
615	9	9	613	9	7
618	9	38	617	9	37
619	9	39	617	9	37
620	9	40	617	9	37
622	9	20	621	9	19
623	9	21	621	9	19
624	9	22	621	9	19
626	9	53	625	9	52
627	9	54	625	9	52
629	4	118	628	4	117
631	4	111	630	4	110
632	4	112	630	4	110
633	4	113	630	4	110
635	4	97	634	4	96
637	4	101	636	4	100
63A	4	102	636	4	100
639	4	103	636	4	100
641	1	2	640	1	1
642	1	3	640	1	1
644	1	35	643	1	34
646	2	11	645	2	10
647	2	12	645	2	10
649	3	8	648	3	7
651	3	46	650	3	45
653	7	13	652	7	12
655	6	40	654	6	39
659	5	26	65A	5	25
661	5	2	660	5	1
664	8	2	662	8	1
665	8	3	662	8	1
667	8	15	666	8	14
66A	8	16	666	8	14
670	8	27	669	8	26
671	8	28	669	8	26
672	8	29	669	8	26
674	9	34	673	9	33
675	9	35	673	9	33
676	9	36	673	9	33
67A	9	11	677	9	10
679	9	12	677	9	10
6A0	9	13	677	9	10
6A2	9	6	6A1	9	5
6A4	9	50	6A3	9	49
6A5	9	51	6A3	9	49
6A7	4	115	6A6	4	114
6A8	4	116	6A6	4	114
690	4	108	6A9	4	107
691	4	109	6	4	107
693	4	105	692	4	104
694	4	106	692	4	104
696	4	99	695	4	98
698	4	94	697	4	93
699	4	95	697	4	93