DRAWING OFFICE PROCEDURE

Introduction

1. The following sheets are divided into two sections namely:-

   Section A. The Scheme Drawing
   Section B. Detailing

2. The methods described in Section A are essential for the maintenance of good engineering design and care must be taken to include in man-hour estimates the time required for the proper completion of the Scheme Drawing.

3. The Programming System has been introduced to prevent a situation arising where work has to be rushed through and Detail Drawings issued on the basis of inadequate Scheming and Checking.

4. It is important that the methods employed in Detailing are the same in all the Drawing Offices. The dimensioning of Detail Drawings should always follow the procedure given in the Drawing Office Manual.

SECTION A

THE SCHEME DRAWING

1. General Remarks

The Scheme Drawing is the original conception of a design and it must show every part required to complete any given Scheme. Every item listed on the Scheme Sheet must be included and all relevant surrounding scenery must be laid in before any Detail Drawings are issued for making Experimental parts or for tooling purposes. The importance of this rule cannot be too highly stressed. Incomplete Scheming is the major cause of fouls and assembly troubles both on Experimental or Prototype build and later on Production vehicles.

2. Scheme Drawing Layout.

A sufficient number of views must be included on the Scheme Drawing to ensure that all the parts have adequate clearance in all their operating positions.

The relative positions of all other adjacent parts must be clearly indicated. Special care must be taken to include parts which are the responsibility of other Drawing Office Sections.

The Body ten-inch lines should be drawn on the Scheme wherever these are applicable so that the relation which exists between Body and Chassis parts can be readily established.

The Practice of drawing one view on top of another should be avoided as far as possible. It is appreciated that this is often necessary on full size Body Layouts, but it must not extend to smaller schemes and in no circumstances should it be used on Detail Drawings.

Care must be taken to ensure that adequate spanner clearance is allowed and consideration must be given to the use of special assembly tools where these are necessary.

3. Dimensioning

The Scheme Drawing must carry all Key dimensions and all important tolerances must be shown. In addition, the maximum and minimum clearance or interference conditions must be carefully stated. The information given on the Scheme Drawing should be sufficient to allow, if necessary, for much of the detailing to be done by junior members of the staff with a minimum of supervision.

This information will also be of great assistance to the Work-Shops during Experimental Build and later to the Production Departments especially during the Planning and Pre-Production Build periods.

4. Special Notes

Only relative notes or special instructions and, where practical, the results of any necessary calculations should also be added.

Any special balance requirements should be noted.

All special surface finish requirements must be noted against

Where Shims are required the appropriate sizes should be noted.

5. Parts Originating from Styling Department

All parts which originate from the Styling Dept. or have Styling work carried out on them are to be examined and agreed in scheme or detail drawing form by the Chief Stylist or Leading Stylist (section leader), whose initials must also appear on the Scheme or detail drawing before this is passed for Purchasing purposes.

6. Parts Originating from Outside Suppliers

Where Bought Out Finished parts such as Electrical Equipment are involved, care must be taken to ensure that the latest manufacturers drawing is always in our possession and also that the latest Rover Scheme drawing is in the hands of the Supplier. All details affecting the fitting of Bought Out components must be clearly shown on the Scheme Drawings.

7. Numbering

As it is intended that much greater use shall be made of the Scheme Drawing it must always carry a Drawing Number which will be the number under which the Scheme is first issued. No Scheme is too small to be included.

The drawings will be filed in the appropriate Drawing Office Section. To enable them to be located easily, the drawings will carry a Prefix as follows:

Engine Section.....EN	Land-Rover Chassis.....LC
Transmission Section...TR	Land-Rover Body.....LB
Design Research.....D	Electrical Car.....ERC
Car Chassis.....CH	Electrical Land-Rover.....ELR
Car Body.....BD	
Styling Dept.....S	

As detailing progresses the Part Numbers of the component parts of a Scheme must be tabulated at the side of the Scheme Drawing, the parts having previously been identified by numbering them 1.2.3.4. etc., Material Specifications should also be shown in this Table.

8. Revisions to Scheme Drawings

When subsequent modifications have to be made to the design the Scheme Drawing must first be corrected before the revised Detail Drawings are issued.

9. Approval

The Scheme must be approved by the Section Leader. This signature must be added to the Scheme Drawing before Detail Drawings are issued for making Experimental parts except in two special cases mentioned in Section B.

The Project Engineer concerned with the Development of the Scheme must also sign the Scheme Drawing and thereby give his approval before Detail Drawings are issued for the Purpose of Tooling or Bulk Purchase. A space should be provided at the side of each tabulated item on the Scheme Drawing so that the Project Engineer can, when the necessity arises, add his signature and thereby gives Development approval to an individual item.

SECTION B.
DETAIL DRAWINGS

1. Drawing Sheet Layout and Sizes

The standard sizes of Detail Drawing Sheets are given on Page 1 and 2 of the Drawing Office Handbook and on Page 3 is shown the Border Layout to be used for Body and Chassis Drawings.

A space is provided on the Detail Drawing Sheet for recording the Scheme Number and this must always be added except in the case of Standard Parts.

A space is also provided for recording a short description of each modification.

2. Projection

Third Angle Projection is used for all Detail Drawings made on the Sheets shown on Page 3 of the Drawing Office Handbook.

The practice of producing a new drawing by modifying a sub-master copy of a current drawing in First Angle Projection is allowable where this method results in considerable time saving.

3. General Procedure.

The general procedure to be followed in Detailing is given on Page Nos. 1 to 29 inclusive of the Drawing Office Handbook.

4. Dimensions and Tolerances.

All dimensions are in inches except where otherwise stated. Inch marks should not be added to any dimension on a Detail Drawing.

Every dimension must carry an individual tolerance except in the circumstances shown on Page 19 of the Drawing Office Handbook. All tolerances should be as large as Engineering requirements allow. The Standard tolerance ranges to be used are also given on Page 19.

Dimensions on all Detail Drawings must be given in decimals. In general dimensions are given to three places of decimals. Standard Size holes with close tolerances must, however, be extended to four places of decimals when sixteenths or less are involved. In other words a hole size of 1 7/16" with a plus tolerance of 1/2 thousandth will be quoted as 1.4375 + 1/2 and not 1.437 + 1/2. Omission of the fourth figure has led to confusion in the past among Planning Personnel who have then been left to assume that a Standard Size is intended. Hole sizes, wherever possible, should be Standard size with a plus tolerance in order to reduce the number of different gauges in use.

5. Standard Parts

When specifying standard fixings every effort must be made to use parts already in existance. Furthermore reference must always be made to the list of Standard Parts currently in large production and use made of these wherever possible. The list has been issued to all Drawing Office Sections and it will be kept up-to-date by Central Drawing Office Services.

6. Modifications.

All modifications to Detail Drawings must be authorised by the Section Leader adding his initials in the column marked 'Scheme Mod.' This will indicate that the Scheme Drawing has been altered accordingly.

7. Finishes and Special Instructions.

Where rust-proofing or other finishes are required reference must be made to the appropriate Technical Instruction. For example the term "Parkerise" should not be used on Detail Drawings; parts requiring Phosphate treatment should carry the note "Phosphate Treatment to T.I. No. 5.

Any related Engineering Department Instructions must also be quoted on the Detail Drawing. It is not sufficient merely to issue an E.D.I. There is no guarantee that its requirements will be met if reference to it is omitted from the Drawing.

There is always room for improvement in the phrasing of instructional notes on Detail Drawings. Shorter and more explicit notes can often be less ambiguous than longer descriptive ones.

For example:-

> "The spigot for the Brake Disc is to be true with the axis of the bearing bores to within .001" clock reading".

would be better expressed as:-

> "Relative to diameters A & B, the maximum eccentricity of diameter C to be .001 T.I.R."

Many of the Q.A.F.I. forms we receive from Quality Control and the applications we receive from the Planning Department request additonal information such as eccentricity tolerances, squareness of face requirements, tolerances on radii etc. The additon of these items to drawings already issued to Production means much extra work in the preparation of Modification notes. Every effort must be made to ensure that the Detail Drawing is in every way complete when it is first issued.

8. Economy in Pictorial Detail

Drawing time can be saved if superfluous pictorial detail is avoided; for example, it is unnecessary to draw all the splines on a sectional view of the gearbox mainshaft. Three splines only should be shown and the remainder indicated by chain-dotted circles.

Other methods of conventional representation are shown on Sheet No.11 of the Drawing Office Handbook and these should be adhered to wherever possible.

9. Detail Drawing Approval and Release Categories

All Detail Drawings, Sub-assembly Drawings and Arrangement Drawings are to be issued under the following categories.

(a) Category I Drawings bearing 'E' or 'B' Part Numbers issued for:-

(1) Buying enquiries and time estimates - Purchase Dept.
(2) Manufacturing feasibility, tool study and assessment - Planning Dept.
(3) Company Project time estimates.
(4) Value analysis.
(5) Build of Engineering Department Experimental and Prototype Models.

Before issue to any departments other than those making parts for Experimental Vehicles, all prints will be endorsed with the following Stamp:-

Drawing Release Category I For Quotation Purposes only.

The prints must be accompanied by the standard proforma shown in Appendix 'A' to Administrative Instruction No. 10 in addition to any other explanatory note.

The drawings issued for the purpose of making Parts for Experimental Vehicles will be endorsed with the following stamp:-

= | Drawing Release Category I |

The Scheme must be approved by the Section Leader and his signature must be added to the Scheme Drawing before the Detail Drawings are issued for the manufacture of Experimental parts except in the following cases:-

A. In the case of drawings intended purely for Experimental purposes, i.e. those not related to a specific vehicle Scheme and intended only for preliminary investigations the Procedure can be relaxed at the discretion of the Drawing Office Head.

B. In cases where considerable pattern or tool making is involved, it is permissable to issue detail drawings for experimental purposes before the design has been finalised provided that the final authorised drawing is issued before half the estimated pattern or tool making time has elapsed.

(b) Category II Drawings issued to Planning, Purchase and Quality Control Departments for:-

(1) Tooling of Made In and Bought Out Finished Parts.
(2) The provision of jigs, machine tools, facilities, material for proving machine tools and tooling to specific requirements advised by Planning Department.
(3) Quality Control assessment and the provisioning of gauges and acceptance fixtures.

Drawings in this Category Must not be issued until the Project Engineer concerned with their development has signed the Scheme Drawing and thereby given his Engineering approval. Before issue a prefix 'P' will be added to the 'E' or 'B' Part Number and the following Stamp will be applied to the drawing in the topright hand border.

Drawing Release Category II

Drawings in this Category will be issued with an accompanying explanatory note on a 'Pink Form' and they will not be subject to modification Note Procedure.

Note.

It is agreed that the prefix 'P/E' or 'P/B' will be amended in ink to a '5' or '3' on Category II prints issued to Purchase Department at the time orders are placed for Tooling.

(c) Category III These are Production Drawings subject to full modification note procedure. The 'P/E' and 'P/B' suffixes will be replaced by '5' and '3' respectively and the Category Stamps will be cancelled or erased. In connection with this Category it should be noted that:-

(1) Engineering Aproval will have been given at this stage. This indicates that the Technical Director accepts that the agreed functional and design requirements for the project, or specific parts of a project, have been achieved and that all the necessary information for the completion of a specification has been made available to the Central Drawing Office Services Section. Ultimately, such information must be sufficient for the build of pre-production models or the minimum possible sanction.

(2) Thereafter all modifications proposed by the Engineering Department will be subject to the normal Modification Procedure.

(3) Category III drawings will not have the category endorsed on them but will be identified by the first digit of the drawing number namely the '5' or '3'.

10. Engineering Release

Engineering release is a further stage at which the specification is jointly confirmed by the Technical Director and Executive Director (Planning) and drawings approved for full production of vehicles to sales standard.

The following having obtained the prior authority of the Technical Director:-

(a) The Technical Manager, Engines and Transmissions in the case of engine and transmission drawings.

(b) The Assistant Chief Engineer (Cars) or (Land Rover) as appropriate.

This stage will become effective when notification of the Engineering Release has been circulated to all concerned.

11. Programming.

The release of drawings by Categories will be programmed for all Company Programmed Projects and usually for all other Priority I projects. Programmed dates will be noted on P.A.F.'s and progressed accordingly.

(a) The Purchase Department, to obtain time and cost estimates from suppliers.

(b) The Planning Department, to make manufacturing feasibility and tool studies, time and cost estimates.

(c) The Company Project Programming Section, to prepare programming networks.

If necessary Category I and II drawings may be issued with explanatory notes and endorsements, drawing attention to areas in which complete data is not yet available or where subsequent modification is probable.

12. Development

As work proceeds deviations from the information contained in Category I drawings will often occur. It will not be necessary to issue subsequent or supplementary drawings to Category I to agencies or departments outside the Engineering Department, before the issue of Category III, unless changes to tooling or manufacturing processes are involved as a result of these changes.

13. Consultation with Suppliers.

General In certain cases it is most important for designers to consult suppliers at the earliest possible design stage in order to achieve the most economical and efficient design, e.g. aluminium die castings and complex pressings where:-

(a) expensive tooling is involved.
(b) different suppliers employ significantly different manufacturing techniques.

Object The object of early consultation with the supplier who will be given the production contract is to:-

(a) avoid wasted time and effort when one supplier is consulted during design stages and another who employs different techniques, receives the order.
(b) to ensure that prototype components represent, as closely as possible, the component produced off tools.

Procedures

(a) Whenever necessary, and in order to meet the above requirements Category I drawings will be released at the earliest possible stage, the drawings being produced without special reference to any particular supplier.
(b) The appropriate Purchase Department will be asked to obtain competitive quotations on the basis of the drawings and to inform the Engineering Department of the suppliers to be consulted.
(c) The Design Office concerned will consult with the suppliers and revise the drawing accordingly, which will then be issued as a Category II or III release in due course.

Reservations It must be noted that the Production Purchase Dept. cannot always guarantee that the suppliers originally selected for consultation will necessarily receive the production orders; this is due to the fact that ordrs may not be placed until a considerable time after original quotations have been received

Scheme Sheets

Most Scheme Sheets are issued, in the first instance to authorise the ordering of parts required for Experimental Purposes. It is, therefore, important to ensure that the information given on the Scheme Sheet conveys as clearly as possible the action to be taken by the Engineering Provisioning Department.

For example:-

i) Part Numbers entered in the 'Production Part No. Column' should be restricted to items which are used on current Production vehicles. Such items can then be obtained on a requisition from Production sources.

The Standard Charts giving details of Bolts, Lockers, Plugs, Unions, Springs etc. contain many Production Part Nos. for items which are not in current use. Every effort should be made to select Standard Parts which are already in use and if possible preference should be given to those which are currently used in the largest quantities. It is important that this procedure is always followed because it will reduce as far as possible the number of different Standard Parts in current use. Information on the availability of a particular Standard Part can be obtained from the Computer Input Control Department, internal telephone No. 603.

In cases where it is found to be absolutely necessary to introduce a Non-Current Standard Part, the Production Part No. should be entered on the Scheme Sheet in the 'Experimental Column'. This will be an indication to the Provisioning Department that the part will have to be ordered specially.

ii) The item numbers of parts comprising an Assembly should always be stated in the 'Description Column'.

iii) The finish required for each item should be noted in the 'Finish Column'. The Finish symbol only is required at this stage. The list of Finish Symbols is given in the front of all Basic Production Specifications.

iv) It will also assist the Provisioning Department if the diameters and lengths of Bolts and Studs and the diameters of Washers are included in the 'Material Column'.