



ThinkPad X20, X21, X22
Hardware Maintenance Manual

note

Before using this information and the product it supports, be sure to read the general information under “Chapter 4. Notices” on page 119

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Chapter 1. Introduction

Important service information

Important

BIOS and device driver fixes are customer-installable. The BIOS and device drivers are posted on the IBM support site

<http://www.ibm.com/pc/support/>

Advise customers to contact the PC Company HelpCenter at 800-772-2227 if they need assistance in obtaining or installing any diskette fixes.

FRU replacement strategy

Before replacing parts

Ensure that all BIOS and device driver fixes are installed before replacing any FRUs listed in this manual.

Use the following strategy to prevent unnecessary FRU replacement and service expense:

- **If you are instructed to replace a FRU, but the replacement does not correct the problem, reinstall the original FRU before you continue.**
- Some computers have both a processor board and a system board. If you are instructed to replace either the processor board or the system board, and the first board that you replace does not correct the problem, reinstall the original board, and then replace the other (processor or system) board.
- If an adapter or device consists of more than one FRU, any of the FRUs may be the cause of the error. Before replacing the adapter or device, remove the FRUs, one by one, to see if the symptoms change. Replace only the FRU that changed the symptoms.

Attention

A customized setup configuration (other than default settings) may exist on the computer you are servicing. Running Automatic Configuration may alter those settings. Note the current configuration settings (using the View Configuration option); then, when service has been completed, verify that the settings are in place.

Hard disk drive replacement strategy:

Always try to run a low-level format before replacing a hard disk drive.

Attention

The drive startup sequence in the computer you are servicing might have been changed. Be extremely careful during write operations such as copying, saving, or formatting. If you select an incorrect drive, data or programs can be overwritten.

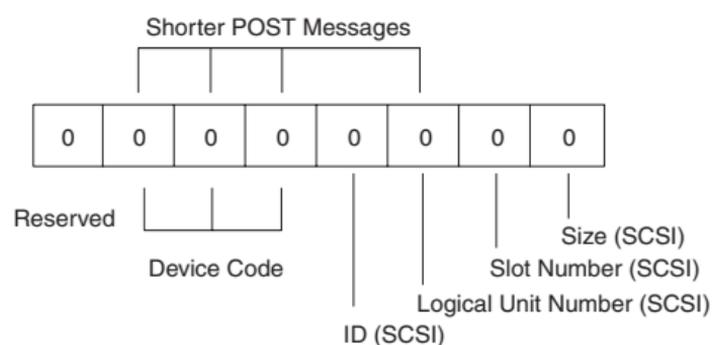
How to use error messages

Use the error codes displayed on the screen to diagnose failures. If more than one error code is displayed, begin the diagnosis with the first error code. Whatever causes the first error code may also cause false error codes. If no error code is displayed, see if the error symptom is listed in the Symptom-to-FRU Index for the computer you are servicing.

How to read POST error messages

POST error messages are displayed on the screen as three, four, five, or eight digits. The error messages that can be displayed as shorter POST messages are highlighted in this index. Some digits have one meaning for SCSI errors and a different meaning for non-SCSI errors.

The following example shows which digits display the shorter POST error messages and also defines the SCSI information in each digit of an eight-digit error message.



Each SCSI device is assigned a unique SCSI ID. Duplicate SCSI ID settings can generate a false error message. Use the SCSI ID to determine whether an error message is coming from an internal or an external device.

Safety notices: multilingual translations

The following safety notices are provided in English, French, German, Italian, and Spanish languages.

Safety Notice 1

Before the computer is powered-on after FRU replacement, make sure all screws, springs, or other small parts are in place and are not left loose inside the computer. Verify this by shaking the computer and listening for rattling sounds. Metallic parts or metal flakes can cause electrical shorts.

Avant de remettre l'ordinateur sous tension après remplacement d'une unité en clientèle, vérifiez que tous les ressorts, vis et autres pièces sont bien en place et bien fixées. Pour ce faire, secouez l'unité et assurez-vous qu'aucun bruit suspect ne se produit. Des pièces métalliques ou des copeaux de métal pourraient causer un court-circuit.

Bevor nach einem FRU-Austausch der Computer wieder angeschlossen wird, muß sichergestellt werden, daß keine Schrauben, Federn oder andere Kleinteile fehlen oder im Gehäuse vergessen wurden. Der Computer muß geschüttelt und auf Klappergeräusche geprüft werden. Metallteile oder -splitter können Kurzschlüsse erzeugen.

Prima di accendere l'elaboratore dopo che é stata effettuata la sostituzione di una FRU, accertarsi che tutte le viti, le molle e tutte le altre parti di piccole dimensioni siano nella corretta posizione e non siano sparse all'interno dell'elaboratore. Verificare ciò scuotendo l'elaboratore e prestando attenzione ad eventuali rumori; eventuali parti o pezzetti metallici possono provocare cortocircuiti pericolosi.

Antes de encender el sistema despues de sustituir una FRU, compruebe que todos los tornillos, muelles y demás piezas pequeñas se encuentran en su sitio y no se encuentran sueltas dentro del sistema. Compruébelo agitando el sistema y escuchando los posibles ruidos que provocarían. Las piezas metálicas pueden causar cortocircuitos eléctricos.

Safety Notice 2

Some standby batteries contain a small amount of nickel and cadmium. Do not disassemble it, recharge it, throw it into fire or water, or short-circuit it. Dispose of the battery as required by local ordinances or regulations. Use only the battery in the appropriate parts listing. Use of an incorrect battery can result in ignition or explosion of the battery.

Certaines batteries de secours contiennent du nickel et du cadmium. Ne les démontez pas, ne les rechargez pas, ne les exposez ni au feu ni à l'eau. Ne les mettez pas en court-circuit. Pour les mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la pile de sauvegarde ou celle de l'horloge temps réel, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. Une batterie ou une pile inappropriée risque de prendre feu ou d'exploser.

Die Bereitschaftsbatterie, die sich unter dem Diskettenlaufwerk befindet, kann geringe Mengen Nickel und Cadmium enthalten. Sie darf nur durch die Verkaufsstelle oder den IBM Kundendienst ausgetauscht werden. Sie darf nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Die Batterie kann schwere Verbrennungen oder Verätzungen verursachen. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Bereitschafts- oder Systembatterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

Alcune batterie di riserva contengono una piccola quantità di nichel e cadmio. Non smontarle, ricaricarle, gettarle nel fuoco o nell'acqua né cortocircuitarle. Smaltirle secondo la normativa in vigore (DPR 915/82, successive disposizioni e disposizioni locali). Quando si sostituisce la batteria dell'RTC (real time clock) o la batteria di supporto, utilizzare soltanto i tipi inseriti nell'appropriato Catalogo parti. L'impiego di una batteria non adatta potrebbe determinare l'incendio o l'esplosione della batteria stessa.

Safety Notice 2

Algunas baterías de reserva contienen una pequeña cantidad de níquel y cadmio. No las desmonte, ni recargue, ni las eche al fuego o al agua ni las cortocircuite. Deséchelas tal como dispone la normativa local. Utilice sólo baterías que se encuentren en la lista de piezas. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

Safety Notice 3

The battery pack contains small amounts of nickel. Do not disassemble it, throw it into fire or water, or short-circuit it. Dispose of the battery pack as required by local ordinances or regulations. Use only the battery in the appropriate parts listing when replacing the battery pack. Use of an incorrect battery can result in ignition or explosion of the battery.

La batterie contient du nickel. Ne la démontez pas, ne l'exposez ni au feu ni à l'eau. Ne la mettez pas en court-circuit. Pour la mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la batterie, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. En effet, une batterie inappropriée risque de prendre feu ou d'exploser.

Akkus enthalten geringe Mengen von Nickel. Sie dürfen nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

La batteria contiene piccole quantità di nichel. Non smontarla, gettarla nel fuoco o nell'acqua né cortocircuitarla. Smaltirla secondo la normativa in vigore (DPR 915/82, successive disposizioni e disposizioni locali). Quando si sostituisce la batteria, utilizzare soltanto i tipi inseriti nell'appropriato Catalogo parti. L'impiego di una batteria non adatta potrebbe determinare l'incendio o l'esplosione della batteria stessa.

Las baterías contienen pequeñas cantidades de níquel. No las desmonte, ni recargue, ni las eche al fuego o al agua ni las cortocircuite. Deséchelas tal como dispone la normativa local. Utilice sólo baterías que se encuentren en la lista de piezas al sustituir la batería. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

Safety Notice 4

The lithium battery can cause a fire, explosion, or severe burn. Do not recharge it, remove its polarized connector, disassemble it, heat it above 100°C (212°F), incinerate it, or expose its cell contents to water. Dispose of the battery as required by local ordinances or regulations. Use only the battery in the appropriate parts listing. Use of an incorrect battery can result in ignition or explosion of the battery.

La pile de sauvegarde contient du lithium. Elle présente des risques d'incendie, d'explosion ou de brûlures graves. Ne la rechargez pas, ne retirez pas son connecteur polarisé et ne la démontez pas. Ne l'exposez pas à une température supérieure à 100°C, ne la faites pas brûler et n'en exposez pas le contenu à l'eau. Mettez la pile au rebut conformément à la réglementation en vigueur. Une pile inappropriée risque de prendre feu ou d'exploser.

Die Systematterie ist eine Lithiumatterie. Sie kann sich entzünden, explodieren oder schwere Verbrennungen hervorrufen. Batterien dieses Typs dürfen nicht aufgeladen, zerlegt, über 100 C erhitzt oder verbrannt werden. Auch darf ihr Inhalt nicht mit Wasser in Verbindung gebracht oder der zur richtigen Polung angebrachte Verbindungsstecker entfernt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

La batteria di supporto è una batteria al litio e può incendiarsi, esplodere o procurare gravi ustioni. Evitare di ricaricarla, smontarne il connettore polarizzato, smontarla, riscaldarla ad una temperatura superiore ai 100 gradi centigradi, incendiarla o gettarla in acqua. Smaltirla secondo la normativa in vigore (DPR 915/82, successive disposizioni e disposizioni locali). L'impiego di una batteria non adatta potrebbe determinare l'incendio o l'esplosione della batteria stessa.

Safety Notice 4

La batería de repuesto es una batería de litio y puede provocar incendios, explosiones o quemaduras graves. No la recargue, ni quite el conector polarizado, ni la desmonte, ni caliente por encima de los 100°C (212°F), ni la incinere ni exponga el contenido de sus celdas al agua. Deséchela tal como dispone la normativa local.

Safety Notice 5

If the LCD breaks and the fluid from inside the LCD gets into your eyes or on your hands, immediately wash the affected areas with water for at least 15 minutes. Seek medical care if any symptoms from the fluid are present after washing.

Si le panneau d'affichage à cristaux liquides se brise et que vous recevez dans les yeux ou sur les mains une partie du fluide, rincez-les abondamment pendant au moins quinze minutes. Consultez un médecin si des symptômes persistent après le lavage.

Die Leuchtstoffröhre im LCD-Bildschirm enthält Quecksilber. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Der LCD-Bildschirm besteht aus Glas und kann zerbrechen, wenn er unsachgemäß behandelt wird oder der Computer auf den Boden fällt. Wenn der Bildschirm beschädigt ist und die darin befindliche Flüssigkeit in Kontakt mit Haut und Augen gerät, sollten die betroffenen Stellen mindestens 15 Minuten mit Wasser abgespült und bei Beschwerden anschließend ein Arzt aufgesucht werden.

Nel caso che caso l'LCD si dovesse rompere ed il liquido in esso contenuto entrasse in contatto con gli occhi o le mani, lavare immediatamente le parti interessate con acqua corrente per almeno 15 minuti; poi consultare un medico se i sintomi dovessero permanere.

Si la LCD se rompe y el fluido de su interior entra en contacto con sus ojos o sus manos, lave inmediatamente las áreas afectadas con agua durante 15 minutos como mínimo. Obtenga atención medica si se presenta algún síntoma del fluido despues de lavarse.

Safety Notice 6

To avoid shock, do not remove the plastic cover that surrounds the lower portion of the inverter card.

Afin d'éviter tout risque de choc électrique, ne retirez pas le cache en plastique protégeant la partie inférieure de la carte d'alimentation.

Aus Sicherheitsgründen die Kunststoffabdeckung, die den unteren Teil der Spannungswandlerplatine umgibt, nicht entfernen.

Per evitare scosse elettriche, non rimuovere la copertura in plastica che avvolge la parte inferiore della scheda invertitore.

Para evitar descargas, no quite la cubierta de plástico que rodea la parte baja de la tarjeta invertida.

Safety Notice 7

Though main batteries have low voltage, a shorted or grounded battery can produce enough current to burn combustible materials or personnel.

Bien que le voltage des batteries principales soit peu élevé, le court-circuit ou la mise à la masse d'une batterie peut produire suffisamment de courant pour brûler des matériaux combustibles ou causer des brûlures corporelles graves.

Obwohl Hauptbatterien eine niedrige Spannung haben, können sie doch bei Kurzschluß oder Erdung genug Strom abgeben, um brennbare Materialien zu entzünden oder Verletzungen bei Personen hervorzurufen.

Sebbene le batterie di alimentazione siano a basso voltaggio, una batteria in corto circuito o a massa può fornire corrente sufficiente da bruciare materiali combustibili o provocare ustioni ai tecnici di manutenzione.

Aunque las baterías principales tienen un voltaje bajo, una batería cortocircuitada o con contacto a tierra puede producir la corriente suficiente como para quemar material combustible o provocar quemaduras en el personal.

Safety Notice 8

Before removing any FRU, power-off the computer, unplug all power cords from electrical outlets, remove the battery pack, then disconnect any interconnecting cables.

Avant de retirer une unité remplaçable en clientèle, mettez le système hors tension, débranchez tous les cordons d'alimentation des socles de prise de courant, retirez la batterie et déconnectez tous les cordons d'interface.

Die Stromzufuhr muß abgeschaltet, alle Stromkabel aus der Steckdose gezogen, der Akku entfernt und alle Verbindungskabel abgenommen sein, bevor eine FRU entfernt wird.

Prima di rimuovere qualsiasi FRU, spegnere il sistema, scollegare dalle prese elettriche tutti i cavi di alimentazione, rimuovere la batteria e poi scollegare i cavi di interconnessione.

Antes de quitar una FRU, apague el sistema, desenchufe todos los cables de las tomas de corriente eléctrica, quite la batería y, a continuación, desconecte cualquier cable de conexión entre dispositivos.

Safety information

The following section contains the safety information that you need to be familiar with before servicing an IBM mobile computer.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
 1. Ensure you can stand safely without slipping.
 2. Distribute the weight of the object equally between your feet.
 3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
 4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*
- Do not perform any action that causes hazards, or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your toolbox away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a non-conductive clip, approximately 8 centimeters (3 inches) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

Attention: Metal objects are good electrical conductors.

- Wear safety glasses when you are hammering, drilling, soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.

- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

Electrical safety

Observe the following rules when working on electrical equipment.

Important

Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents.

Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
 - Performing a mechanical inspection
 - Working near power supplies
 - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
 - Ensure that another person, familiar with the power-off controls, is near you.

Attention: Another person must be there to switch off the power, if necessary.
 - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

Attention: An electrical shock can occur only when there is a complete circuit. By observing the above rule, you may prevent a current from passing through your body.

- When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
- Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- Never assume that power has been disconnected from a circuit. First, check that it has been powered off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, non-grounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
- Do not service the following parts with the power on when they are removed from their normal operating places in a machine:
 - Power supply units
 - Pumps
 - Blowers and fans
 - Motor generators

and similar units. (This practice ensures correct grounding of the units.)

- If an electrical accident occurs:
 - Use caution; do not become a victim yourself.
 - Switch off power.
 - Send another person to get medical aid.

Safety inspection guide

The purpose of this inspection guide is to assist you in identifying potentially unsafe conditions. As each machine was designed and built, required safety items were installed to protect users and service personnel from injury. This guide addresses only those items. You should use good judgment to identify potential safety hazards due to attachment of non-IBM features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock)
- Explosive hazards, such as a damaged CRT face or a bulging capacitor
- Mechanical hazards, such as loose or missing hardware

The guide consists of a series of steps presented in a checklist. Begin the checks with the power off, and the power cord disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power-off the computer. Disconnect the power cord.
3. Check the power cord for:
 - a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
 - b. The power cord should be the type specified in the parts list.
 - c. Insulation must not be frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Handling electrostatic discharge-sensitive devices

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge.

notes

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

When handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product. Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

note

The use of a grounding system is desirable but not required to protect against ESD damage.

- Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
- Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
- Use the round ground-prong of the AC plug on AC-operated computers.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Laser compliance statement

Some IBM Personal Computer models are equipped from the factory with a CD-ROM drive. CD-ROM drives are also sold separately as options. The CD-ROM drive is a laser product. The CD-ROM drive is certified in the U.S. to conform to the requirements of the Department of Health and Human Services 21 Code of Federal Regulations (DHHS 21 CFR) Subchapter J for Class 1 laser products. Elsewhere, the drive is certified to conform to the requirements of the International Electrotechnical Commission (IEC) 825 and CENELEC EN 60 825 for Class 1 laser products.

When a CD-ROM drive is installed, note the following:



CAUTION:

Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

O uso de controles, ajustes ou desempenho de procedimentos diferentes daqueles aqui especificados pode resultar em perigosa exposição à radiação.

凡未在这里指明的任何控制用法、调整、行为，都会导致严重后果。

Pour éviter tout risque d'exposition au rayon laser, respectez les consignes de réglage et d'utilisation des commandes, ainsi que les procédures décrites.

Werden Steuer- und Einstellelemente anders als hier festgesetzt verwendet, kann gefährliche Laserstrahlung auftreten.

Az itt előírt eljárásoktól, beállításoktól és vezérlésektől eltérni a lézersugárzás veszélye miatt kockázatos !

L'utilizzo di controlli, regolazioni o l'esecuzione di procedure diverse da quelle specificate possono provocare l'esposizione a

Использование элементов настройки и выполнение процедур иных, чем указано здесь, может привести к опасному радиационному облучению.

Použitie kontrol, úprav alebo iných vykonaní od iných výrobcov, ako je v tomto špecifikované, mohlo by mať za následok nebezpečenstvo vystavenia sa vyžiarovaniu.

El uso de controles o ajustes o la ejecución de procedimientos distintos de los aquí especificados puede provocar la exposición a radiaciones peligrosas.

Laser radiation

Opening the CD-ROM drive could result in exposure to hazardous laser radiation. There are no serviceable parts inside the CD-ROM drive. Do not open.

Some CD-ROM drives contain an embedded Class 3A or Class 3B laser diode. Note the following.

DANGER

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Radiação por raio laser ao abrir. Não olhe fixo no feixe de luz, não olhe diretamente por meio de instrumentos óticos e evite exposição direta com o feixe de luz.

开启时会有激光发射时，请勿盯视激光光束，请勿直接查看视觉仪器，并且避免直接接触在激光光束之中。

Rayonnement laser si carter ouvert. Évitez de fixer le faisceau, de le regarder directement avec des instruments optiques, ou de vous exposer au rayon.

Laserstrahlung bei geöffnetem Gerät. Nicht direkt oder über optische Instrumente in den Laserstrahl sehen und den Strahlungsbereich meiden.

Kinyitáskor lézersugár ! Ne nézzen bele se szabad szemmel, se optikai eszközökkel. Kerülje a sugárnyalábbal való érintkezést !

Aprenendo l'unità vengono emesse radiazioni laser. Non fissare il fascio, non guardarlo direttamente con strumenti ottici e evitare l'esposizione diretta al fascio.

Открывая, берегитесь лазерного излучения. Не смотрите на луч, не разглядывайте его с помощью оптических инструментов, а также избегайте прямого воздействия лазерного луча.

Keď je laserová jednotka otvorená. Vyhnite sa priamemu pohľadu a nehládte priamo s optickými nástrojmi do lúča a vyhnite sa priamemu vystaveniu lúčov.

Radiación láser al abrir. No mire fijamente ni examine con instrumental óptico el haz de luz. Evite la exposición directa al haz.

Chapter 2. General descriptions

This chapter includes descriptions for any ThinkPad model that has the PC-Doctor DOS diagnostics program. Some descriptions might not apply to your particular computer.

Read this first

Before you go to the checkout guide, be sure to read this section.

Important notes:

- **Only certified trained personnel should service the computer.**
- **Read the entire FRU removal and replacement page before replacing any FRU.**
- **Use new nylon-coated screws when you replace FRUs.**
- **Be extremely careful during such write operations as copying, saving, or formatting.** Drives in the computer that you are servicing may have had their start sequence altered. If you select an incorrect drive, data or programs might be overwritten.
- **Replace FRUs only for the correct model.** When you replace a FRU, make sure the model of the machine and the FRU part number are correct by referring to the FRU parts list.
- **A FRU should not be replaced because of a single, unreproducible failure.** Single failures can occur for a variety of reasons that have nothing to do with a hardware defect, such as cosmic radiation, electrostatic discharge, or software errors. Consider replacing a FRU only when a problem reoccurs. If you suspect that a FRU is defective, clear the error log and run the test again. If the error does not recur, do not replace the FRU.
- **Be careful not to replace a nondefective FRU.**
- Service applied by an unauthorized/trained Thinkpad technician may potentially void your warranty

What to do first: When you do return a FRU, you must include the following information in the parts exchange form or parts return form that you attach to it:

1. Name and phone number of servicer
2. Date of service
3. Date on which the machine failed
4. Date of purchase

5. Failure symptoms, error codes appearing on the display, and beep symptoms
6. Procedure index and page number in which the failing FRU was detected
7. Failing FRU name and part number
8. Machine type, model number, and serial number
9. Customer's name and address

Note for warranty: During the warranty period, the customer may be responsible for repair costs if the computer damage was caused by misuse, accident, modification, unsuitable physical or operating environment, or improper maintenance by the customer. The following list provides some common items that are not covered under warranty and some symptoms that might indicate that the system was subjected to stress beyond normal use.

Before checking problems with the computer, determine whether the damage is covered under the warranty by referring to the following: **The following are not covered under warranty:**

- LCD panel cracked from the application of excessive force or from being dropped
- Scratched (cosmetic) parts
- Cracked or broken plastic parts, broken latches, broken pins, or broken connectors caused by excessive force
- Damage caused by liquid spilled into the system
- Damage caused by the improper insertion of a PC Card or the installation of an incompatible card
- Damage caused by foreign material in the diskette drive
- Diskette drive damage caused by pressure on the diskette drive cover or by the insertion of a diskette with multiple labels
- Damaged or bent diskette eject button
- Fuses blown by attachment of a non-supported device
- Forgotten computer password (making the computer unusable)

The following symptoms might indicate damage caused by non-warranted activities:

- Missing parts might be a symptom of unauthorized service or modification.
- If the spindle of a hard disk drive becomes noisy it may have been subjected to excessive force or from being dropped.
- I9990303 errors can be caused by exposure to strong magnetic fields.

Related service information

This section provides information about the following:

- Service Website
- Passwords
- Power management

Service Web site

The latest maintenance diskette is available at

<http://www.pc.ibm.com/partner/infotips/>

The latest system program service diskette is available at

<http://www.pc.ibm.com/us/support/thinkpad/tpopsys.html>
or at <http://www.pc.ibm.com/partner/infotips/>

Using Recovery CD

To create Service Partition and install the preloaded system from Recovery CD, do the following;

To create Service Partition [SP]:

1. Erase all partitions on the hard-disk drive using FDISK or similar application.
2. Boot with Recovery CD (and boot diskette if required).
3. A menu will appear stating **“Your computer originally included a Product Recovery program ... Reinstall the Product Recovery Program? (Y/N) []”**.

Note: If the hard-disk drive contains any partitions, you will not receive this menu - go to step 1.

4. Enter **“Y”**, and Service Partition will be created and loaded with Product Recovery Program files.

Note: If you do not want to create Service Partition, press **“N”**, and then go to the “Install preloaded system from CD” procedure.

5. Press **“ENTER”**, at next window to continue.
 - Service Partition will be created. System will automatically reboot during this process.
 - Recovery process will copy some files to the Service Partition, PKUNZIP others
 - Follow prompts - you may be prompted to change CDs.
 - System will reboot. When completed, continue with “Install preloaded system from CD” procedure to install preloaded system.

Install preloaded system from CD:

1. Boot with Recovery CD (and boot diskette if required)
2. If the hard-disk drive is blank, a menu will appear stating “**Your computer originally included a Product Recovery program ... Reinstall the Product Recovery Program? (Y/N) []**,”.
 - To install Service Partition, go to step 4 of “To create Service Partition [SP],” procedure.
 - To preload hard-disk drive without installing Service Partition, press “**N**,”.
3. If a menu appears asking which operating system to install, highlight proper operating system and press “**ENTER**,”.
4. A menu will appear stating “**Full Recovery:**,”. Press “**ENTER**,” to select.
5. Enter “**Y**,” at the three windows which follow.
6. Follow prompts to complete the Recovery Process.

Passwords

As many as three passwords may be set for any ThinkPad computer: the power-on password (POP), the hard disk password (HDP), and the supervisor password (SVP).

When the power-on password, the hard disk password, or the supervisor password is used, a password prompt appears on the screen whenever the computer is turned on. The computer does not start until the password is entered.

Power-on password: A power-on password (POP) protects the system from being powered on by an unauthorized person. The password must be entered before an operating system can be booted.

Hard disk password: There are two hard-disk passwords (HDPs):

- User HDP - for the user
- Master HDP - for the system administrator, who can use it to get access to the hard disk even if the user has changed the user HDP

Note: There are two modes for the HDP: User only and **Master + User**. The **Master + User** mode requires two HDPs and is designed for the system administrator to input both in the same operation. The system administrator then provides the user HDP to the system user.

Attention:

If the user HDP is forgotten, check to see if a master HDP was set. If a master HDP was set and can be recalled, this will allow access to the hard-disk drive. If no master HDP is available, IBM does not provide any services to reset either the user or the master HDPs nor recover data from the hard-disk drive. The hard-disk drive can be replaced for a scheduled fee.

Supervisor password: A supervisor password (SVP) protects the system information stored in the IBM BIOS Setup Utility . The SVP must be entered in order to access the IBM BIOS Setup Utility and make changes to system configuration settings.

Attention:

If the SVP has been forgotten and cannot be made available to the servicer, there is no service procedure to reset the password. The system board must be replaced for a scheduled fee.

How to remove the power-on password: To remove the POP, do the following:

(A) If SVP is installed and known by the servicer

1. Power on the computer while pressing and holding **F1**.
2. Enter the supervisor password. The IBM BIOS Setup Utility menu appears.
3. Select **Password**, using the cursor keys to move down the menu.
4. Select **Power-on password**. A pop-up window opens.
5. Enter the password. When the Enter New Password field opens, leave it blank and press **Enter** twice.
6. Press **F10**; then click **Exit**.
7. Select **Yes** in the Setup Configuration window. The POP has been removed.

(B) If SVP is not installed

1. Turn off the computer.
2. Remove the DIMM cover from the bottom of the computer.
3. Remove the backup battery. For information on how to remove the backup battery, see "1030 Backup battery" on page 56
4. Turn on the computer and wait until the POST ends. After the POST ends, the password prompt does not appear. The POP has been removed.
5. Reinstall the backup battery and the DIMM cover.

How to remove the hard-disk password:

Attention:

If **User only** mode is selected and the user HDP is forgotten and cannot be made available to the servicer, IBM does not provide any services to reset the user HDPs nor recover data from the hard-disk drive. The hard-disk drive can be replaced for a scheduled fee.

To remove the user HDP that has been forgotten, when the SVP and master HDP is known, do the following:

1. Power on the computer by pressing and holding **F1**.
2. Enter the SVP. The IBM BIOS Setup Utility menu appears.
3. Select **Password**, using the cursor keys to move down the menu.
4. Select **Hard-disk x password**, where x is the letter of the hard-disk drive. A pop-up window opens.
5. Select either User HDP or Master HDP.
6. Enter the master HDP; then leave the New Password field blank and press **Enter** twice.
7. Press **F10**
8. Select **Yes** in the Setup Configuration window. Both user HDP and master HDP will have been removed.

Power management

To reduce power consumption, the computer has three power management modes: screen blank, standby, and hibernation.

Screen blank mode: In screen blank mode, the following occurs:

- The LCD backlight turns off.
- The hard disk drive motor stops.
- The speaker is muted.

Note: Screen blank mode in Windows 98 is called standby mode in Windows 95.

To enter screen blank mode, press **Fn + F3**. To end screen blank mode and resume normal operation, press any key.

Standby mode: When the computer enters standby mode, the following events occur in addition to what occurs in screen blank mode:

- The LCD is powered off.
- The hard disk drive is powered off.
- The CPU stops.

Note: Screen blank mode in Windows 98 and Windows 2000 is called standby mode in Windows 95.

To enter standby mode, do any of the following:

- Press **Fn + F4**.
- Close the LCD cover. (To prevent the computer from entering standby mode when the LCD is closed, click **Will not suspend even if LCD is closed** in the Power Management Properties window. Then only the LCD turns off.)

In certain circumstances, the computer goes into standby mode automatically:

- If a "suspend time" has been set on the timer, and the user does not do any operation with the keyboard, the TrackPoint, the hard disk, the parallel connector, or the diskette drive within the time set.
- If the AC adapter is plugged in.
- If the battery indicator blinks orange, indicating that the battery power is low. (Alternatively, if **Hibernate when battery becomes low** has been selected in the "Power Management Properties" window, the computer goes into hibernation mode.)

Note: Even if you don't set the low-battery alarm, the charge indicator lets you know that the battery is low, and then the computer enters the power-saving mode automatically. This default low-battery behavior is independent of the operating system; so if you have set the low-battery alarm, the computer may not do what you specified. It chooses either your setting or the default setting, whichever is appropriate.

Any one of the following events causes the computer to resume operation from standby mode:

- The **Fn** key is pressed.
- The LCD cover is opened.
- The ring indicator (RI) is signaled by a serial device or a PC Card device. The power switch is turned on.
- The resume timer is set. In Windows 98, the **Scheduled Tasks** setting has priority over the **Resume on timer** selection in the "Power Management Properties" window.

Note: The computer does not accept any input immediately after it enters suspend mode. Wait a few seconds before taking any action to reenter operation mode.

Hibernation mode

Note for Windows NT

A Windows NT user cannot create a hibernation file in a Windows NT system that uses NTFS format, the Windows NT default format. If you want to use hibernation mode, you will need to reinstall Windows NT with FAT format.

In hibernation mode, the following occurs:

- The system status, RAM, VRAM, and setup data are stored on the hard disk.
- The system is powered off.

Notes:

1. In the ThinkPad Configuration program, the computer can be set to **suspend/hibernate while docked**.
2. The computer cannot enter hibernation mode when it is powered with AC power and a communication PC Card is used.
3. If the computer enters the hibernation mode when it is docked to the docking station, do not undock it from the docking station before resuming normal operation. If you do undock it, then if you try to resume normal operation, you will get an error message, and you will have to restart the system.

Any one of the following events causes the computer to enter hibernation mode:

- The **Fn + F12** keys are pressed.
- The power switch is turned off and the mode is set to **Power switch mode Hibernation**.
- The timer conditions are satisfied in suspend mode (for operating systems other than Windows 98).
- A critically low battery condition occurs and the mode is set to **Hibernate when battery becomes low**.

When the power is turned on, the computer leaves hibernation mode and resumes operation. The hibernation file in the boot record on the hard disk drive is read, and system status is restored from the hard disk drive.

Checkout guide

Use the following procedures as a guide in identifying and correcting problems with the ThinkPad computer.

Note: The diagnostic tests are intended to test only IBM products. The use of non-IBM products, prototype cards, or modified options can lead to false indications of errors and invalid system responses.

1. Identify the failing symptoms in as much detail as possible.
2. Verify the symptoms. Try to re-create the failure by running the diagnostic test or by repeating the operation.

Testing the computer

The ThinkPad computer has a test program called PC-Doctor DOS (hereafter called PC-Doctor). You can detect errors by running the diagnostics test included in PC-Doctor. This section is an overview of the procedure. For details that depend on model-unique functions, refer to “Product overview” on page 39

For some possible configurations of the computer, PC-Doctor might not run correctly. To avoid this problem, you need to initialize the computer setup by running the IBM BIOS Setup Utility before you run PC-Doctor. In the IBM BIOS Setup Utility screen, press **F9**, **Enter**, **F10**, then **Enter**.

Note: When you initialize the computer configuration, some devices are disabled, such as the serial port. If you test one of these devices, you will need to enable it by using PS2.EXE.

PC-Doctor cannot be used to test a device that is in the docking station. If a device is in the Ultrabay 2000 or connected to the USB connector of the docking station, remove it and install it in the Ultrabay 2000 or connect it to the USB connector of the computer. Then test it with PC-Doctor.

To run the test, do as follows:

Note: In the following procedure, you can select an item not only with the arrow keys, but also with the TrackPoint. Instead of pressing **Enter**, click the left button.

1. Insert the PC-Doctor disk into the diskette drive; then power on the computer.

If the computer cannot be powered on, go to “Power system checkout” on page 32 and check the power sources.

If an error code appears, go to “Symptom-to-FRU index” on page 44.

On the first screen, select the model and press **Enter**. Follow the instructions on the screen.

2. The main panel of PC-Doctor appears.
3. Select **Diagnostics** with the arrow keys, and press **Enter**.

A pull-down menu appears. (Its exact form depends on the model.)

The options on the test menu are as follows:

Diagnostics	Interactive Tests
<ul style="list-style-type: none">• Run Normal Test• Run Quick Test• CPU/Coprocessor• Systemboard• Video Adapter• Serial Ports• Parallel Ports• Fixed Disks• Diskette Drives• Other Devices• ZIP Drive• LS-120/240 Drive• Wireless LAN• Memory Test-Full• Memory Test-Quick	<ul style="list-style-type: none">• Keyboard• Video• Internal Speaker• Mouse• Joystick Test• Diskette• System Load• CD-ROM/DVD Test• Stereo Speaker• 802.11 Wireless Radio Test

Notes:

- In the **Keyboard** test in **Interactive tests**, the **Fn** key is scanned only once. Because of this, each key should be held down for at least 2 seconds or it will not be sensed.
- The sound card is not recognized in the **Stereo Speaker** in the **Interactive Tests**. To test it, use the audio device test in the **Other Devices (Diagnostics)**.
- **Video Adapter** test supports only the LCD display on ThinkPad. Before running PC-Doctor DOS, detach the external Monitor.
- To test **ZIP Drive** or **LS-120 Drive**, each media is needed to be inserted before start testing.
- **Wireless LAN** test is only for some models. Some model do not have them.
- To test **Digital Signature Chip**, the chip must be enabled and initialized.

4. Run the applicable function test.
5. Follow the instructions on the screen. If there is a problem, PC-Doctor shows messages describing it.
6. To exit the test, select **Quit-Exit Diag**. To cancel the test, press **Esc**.

Note: After executing PC-Doctor, check the system time/date and reset them if needed.

Detecting system information with PC-Doctor

PC-Doctor can detect the following system information:

Hardware Info:

- System Configuration
- Memory Contents
- Physical Disk Drives
- Logical Disk Drives
- VGA Information
- IDE Drive Info
- PCI Information
- PNPISA Info
- SMBIOS Info
- VESA LCD Info

Utility:

- Run External Tests
- Surface Scan Hard Disk
- Benchmark System
- DOS Shell
- Tech Support Form
- Battery Rundown
- View Test Log
- Print Log
- Save Log
- Full Erase Hard Drive
- Quick Erase Hard Drive

Power system checkout

To verify the symptom of a problem, do the following:

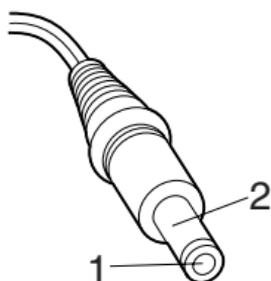
1. Power off the computer.
2. Remove the battery pack.
3. Connect the AC adapter.
4. Check that power is supplied when you power on the computer.
5. Power off the computer.
6. Disconnect the AC adapter and install the charged battery pack.
7. Check that the battery pack supplies power when you power on the computer.

If you suspect a power problem, see the appropriate one of the following power supply checkouts:

- "Checking the AC adapter" 33
- "Checking operational charging" 33
- "Checking the battery pack" 34
- "Checking the backup battery" 34

Checking the AC adapter: If the computer fails only when the AC adapter is used, check the following:

- If the power problem occurs only when the port replicator is used, replace the port replicator.
 - If the power-on indicator does not turn on, check the power cord of the AC adapter for correct continuity and installation.
 - If the computer does not charge during operation, go to "Checking operational charging."
1. Unplug the AC adapter cable from the computer and measure the output voltage at the plug of the AC adapter cable. See the following figure:



(16 - 10 V)

Pin	Voltage (V dc)
1	+15.5 to +17.0
2	Ground

If the voltage is not correct, replace the AC adapter. If the voltage is acceptable, do the following:

- Replace the system board.
- If the problem persists, go to "Product overview" on page 39.

Note: Noise from the AC adapter does not always indicate a defect.

Checking operational charging: To check operational charging, use a discharged battery pack or a battery pack that has less than 50% of the total power remaining when installed in the computer.

Perform operational charging. If the battery status indicator or icon does not turn on, remove the battery pack and let it return to room temperature. Reinstall the battery pack.

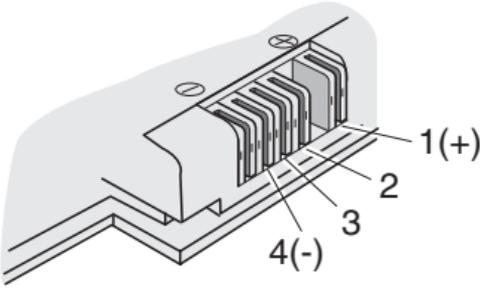
If the charge indicator or icon still does not turn on, replace the battery pack. If the charge indicator still does not turn on, replace the system board. Then reinstall the battery pack. If the reinstalled battery pack has not been charged, go to the next section.

Checking the battery pack: Battery charging does not start until the Fuel Gauge shows that less than 95% of the total power remains; under this condition the battery pack can charge to 100% of its capacity. This protects the battery pack from being overcharged or from having a shortened life.

Note: If the battery pack becomes hot, it may not be able to charge. Remove it from the computer and leave it at room temperature for a while. After it cools down, reinstall and recharge it.

To check the battery pack, do the following:

1. Power off the computer.
2. Remove the battery pack and measure the voltage between battery terminals 1 (+) and 4 (-). See the following figure:



Terminal	Voltage (V dc)
1	+ 0 to + 12.6 (6-cell) +0 to 16.8(4-cell)
4	Ground (-)

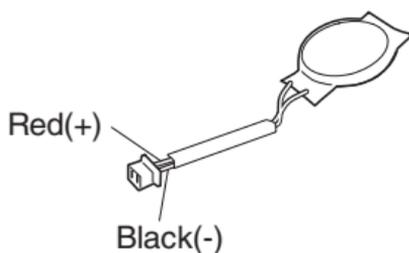
3. If the voltage is less than +11.0 V dc, the battery pack has been discharged.
4. If the voltage is more than +11.0 V dc, measure the resistance between battery terminals 3 and 4. The resistance between battery terminals 3 and 4 must be from 4 to 30k ohms.

Note: Recharging will take at least 3 hours, even if the indicator does not turn on.
 If the voltage is still less than +11.0 V dc after recharging, replace the battery.

Checking the backup battery: Do the following:

1. Power off the computer, and unplug the AC adapter from it.

2. Turn the computer upside down.
3. Remove the backup battery (see “1030 Backup battery” on page 56).
4. Measure the voltage of the backup battery. See the following figure.



Wire	Voltage (V dc)
Red	+2.5 to +3.2
Black	Ground

- a. If the voltage is correct, replace the system board.
- b. If the voltage is not correct, replace the backup battery.
- c. If the backup battery discharges quickly after replacement, replace the system board.

Chapter 3. ThinkPad X20, X21, X22

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Product overview

This section presents the following product-unique information:

- Specifications
- Status indicators
- Fn key combinations

Specifications

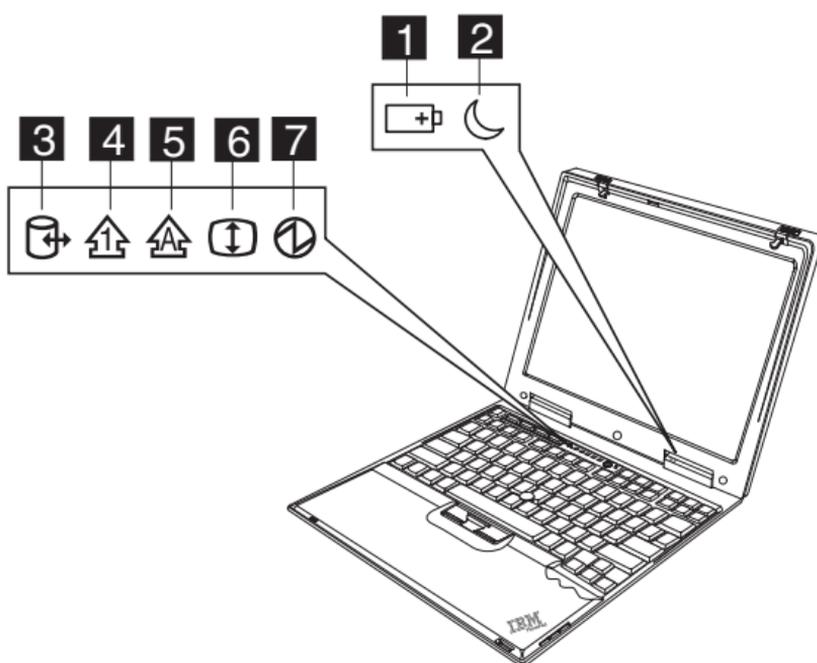
The following table lists the specifications of the ThinkPad X20, X21, X22 series:

Feature	Description
Processor	<p>X20, X21</p> <ul style="list-style-type: none"> • Intel®mobile Pentium®III 700MHz, L2 256-KB cache • Intel®Celeron processor 600MHz, L2 128-KB cache • Intel®Celeron processor 500MHz, L2 128-KB cache <p>X22</p> <ul style="list-style-type: none"> • Intel®mobile Pentium®III-M 733MHz, L2 512KB cache • Intel®mobile Pentium®III-M 800MHz, L2 512KB cache
Bus architecture	<p>X20, X21</p> <ul style="list-style-type: none"> • PCI BUS <p>X22</p> <ul style="list-style-type: none"> • Hub Architecture • PCI / LPC BUS
Memory (standard)	<p>X20, X21</p> <ul style="list-style-type: none"> • 128 MB (on the system board) <p>X22</p> <ul style="list-style-type: none"> • 64MB, 128 MB
Memory (optional)	<p>X20, X21</p> <ul style="list-style-type: none"> • 64 MB, 128 MB, or 256 MB SDRAM card (maximum of 384 MB) <p>X22</p> <ul style="list-style-type: none"> • 64 MB, 128 MB, 256 MB or 512 MB SDRAM card (maximum of 640 MB)

CMOS RAM	<p>X20, X21</p> <ul style="list-style-type: none"> • 114 bytes +4 Kbytes <p>X22</p> <ul style="list-style-type: none"> • 256bytes
Display	<p>X20, X21</p> <ul style="list-style-type: none"> • 12.1-inch, 16M colors SVGA (800×600 resolution) TFT color LCD • 12.1-inch, 16M colors XGA (1024×768 resolution) TFT color LCD <p>X22</p> <ul style="list-style-type: none"> • 12.1-inch, 16M colors XGA (1024×768 resolution) TFT color LCD
Hard disk drive	<p>X20, X21</p> <ul style="list-style-type: none"> • 10GB, 20GB <p>X22</p> <p>10GB, 15GB, 20GB, 30GB</p>
I/O port	<p>X20, X21</p> <ul style="list-style-type: none"> • USB, RJ11, RJ45, VGA, Mic, Line-in, Headphone, Docking <p>X22</p> <p>USB, RJ11, RJ45, VGA, Mic, IrDA, Line-in, Headphone, Docking</p>
Internal modem	<p>X20, X21, X22</p> <ul style="list-style-type: none"> • V.90 D/F
Audio	<p>X20, X21</p> <ul style="list-style-type: none"> • CS4281/CS4279A Mono Speaker <p>X22</p> <p>CS4299 Mono Speaker</p>
PC Card	<p>X20, X21, X22</p> <p>T2, Cardbus</p>
AC adapter	<p>X20, X21</p> <p>72W AC/DC</p> <p>X22</p> <p>56W AC/DC</p>

Status indicators

The system status indicators show the current computer status in different colors (green or orange):



Indicator	Meaning
1 Battery	<p>Green:The battery is fully charged.</p> <p>Blinking green: The battery has enough power to operate but is charging.</p> <p>Orange: The battery power is low. The battery is charging.</p> <p>Blinking orange: The battery needs charging.</p>
2 Standby status	<p>Green:The computer is in standby mode.</p> <p>Blinking green: The computer is entering standby mode or hibernation mode, or is resuming normal operation.</p>
3 Drive in use	<p>Green:Data is read from or written to the hard disk drive, diskette drive, or drive in the Ultrabay 2000.</p>
4 Num lock	<p>Green:The numeric keypad on the keyboard is enabled.</p>
5 Caps lock	<p>Green:Caps Lock mode is enabled.</p>
6 Scroll lock	<p>Green:Arrow keys can be used as screen-scroll function keys.</p>
7 Power on	<p>Green:The power is on.</p>

The following table shows the test for each FRU.

FRU	Applicable test
-----	-----------------

System board	<ol style="list-style-type: none"> 1. Diagnostics --> CPU/Coprocessor 2. Diagnostics --> Systemboard
Power	Diagnostics --> Other Devices --> IBM AC Adapter, IBM Battery
LCD unit	<ol style="list-style-type: none"> 1. Diagnostics --> Video Adapter 2. Interactive Tests --> Video
Modem	<ol style="list-style-type: none"> 1. Make sure the modem is set up correctly. 2. Replace the modem jack and the modem card in turn, and run the following test in Diagnostics --> Other Devices. <ol style="list-style-type: none"> a. Modem Loopback Test b. Modem Dialtone/DTMF Test c. Lucent Soft Modem Loopback d. Lucent Soft Modem Dialtone e. Intel Modem Register f. Intel Modem Loopback/DTMF g. 3Com MiniPCI Modem Test h. 3Com MiniPCI Dialtone Test
Audio	<ol style="list-style-type: none"> 1. Interactive Tests --> Internal Speaker 2. Diagnostics --> Other Devices --> Crystal SoundFusion Test
Speaker	Interactive Tests --> Internal Speaker
PC Card slots	Diagnostic --> System Board --> PCMCIA, PCMCIA External Loop
Keyboard	<ol style="list-style-type: none"> 1. Diagnostics --> System Board --> Keyboard 2. Interactive Test --> Keyboard
TrackPoint or pointing device	<p>If the TrackPoint does not work, check the configuration in the ThinkPad Configuration program. If the TrackPoint is disabled, select Enable to enable it.</p> <p>After you use the TrackPoint, the pointer may drift on the screen for a short time. This drift can occur when a slight, steady pressure is applied to the TrackPoint pointer. This symptom is not a hardware problem. No service action is necessary if the pointer stops after a short time</p> <p>If enabling the TrackPoint does not correct the problem, continue with the following.</p> <ul style="list-style-type: none"> • Interactive Tests --> Mouse
Hard disk drive	Diagnostics --> Fixed Disks
Diskette drive	<ol style="list-style-type: none"> 1. Diagnostics --> Diskette Drives 2. Interactive Tests --> Diskette

CD-ROM or DVD drive	<ol style="list-style-type: none"> 1. Diagnostics --> Other Devices --> CD-ROM/DVD 2. Interactive Tests --> CD-ROM/DVD Test
Memory	<ol style="list-style-type: none"> 1. If two DIMMs are installed, remove one of them and run Diagnostics --> Memory Test - Quick. 2. If the problem does not recur, replace the DIMM, remove the other one, and run the test again. 3. If the test does not detect the error, run Diagnostics --> Memory Test - Full.
Fan	<ol style="list-style-type: none"> 1. Turn on the computer and check the air turbulence at the louver near the power switch. 2. Run Diagnostics --> Other Devices --> IBM Fan.

Fn key combinations

The following table shows the function of each combination of Fn with a function key.

The Fn key works independently from the operating system.

Key Combination	Result
Fn + F1	Reserved.
Fn + F2	Reserved.
Fn + F3	Standby mode.
Fn + F4	Suspend mode.
Fn + F5	Reserved.
Fn + F6	Reserved.
Fn + F7	Switch between the LCD, the external monitor, and both the LCD and external monitor.
Fn + F8	Reserved.
Fn + F9	Reserved.
Fn + F12	Hibernation mode.
Fn + PgUp	ThinkLight On/Off.
Fn + Home	The LCD becomes brighter.
Fn + End	The LCD becomes less bright.

Symptom-to-FRU index

The symptom-to-FRU index lists symptoms and errors and their possible causes. The most likely cause is listed first, in boldface type.

Note: Do the FRU replacement or other actions in the sequence shown in the column headed "FRU or action, in Sequence". If replacing a FRU does not solve the problem, put the original part back in the computer. Do not replace a non-defective FRU.

This index can also help you determine, during regular servicing, what FRUs are likely to need to be replaced next.

A numeric error is displayed for each error detected in POST or system operation. In the displays, n can be any number.

If no numeric code is displayed, check the narrative descriptions of symptoms. If the symptom is not described there, go to "Intermittent problems" on page 48.

Note: For an IBM devices not supported by diagnostic codes in the ThinkPad notebook computers, see the manual for that device.

Numeric error codes

Symptom or error	FRU or action, in sequence
0175 Bad CRC1, stop POST task. The EEPROM checksum is not correct.	1. System board.
0187 EAIA data access error	1. System board.
0190 Critical low battery error.	1. Critical low battery error. Charge the battery pack. 2. Battery pack.
0193 RF antenna has been removed.	1. Enter the supervisor password.
0194 The computer has been carried through a security gate.	1. Enter the supervisor password.

0200 Fixed disk failure	<ol style="list-style-type: none"> Reseat the hard disk drive. Load Setup Defaults in IBM BIOS Setup Utility. Hard disk drive. System board.
021x Monitor type does not match CMOS	<ol style="list-style-type: none"> Load Setup Defaults in IBM BIOS Setup Utility.
0220 Shadow RAM failure at offset nnnn	<ol style="list-style-type: none"> System board.
0232 Extended RAM failure at offset nnnn	<ol style="list-style-type: none"> DIMM. System board.
0250 System battery is dead—replace and run setup	<ol style="list-style-type: none"> Replace the backup battery and run IBM BIOS Setup Utility to reset the time and date.
0251 System CMOS checksum bad—Default configuration used	<ol style="list-style-type: none"> Replace the backup battery and run IBM BIOS Setup Utility to reset the time and date..
0252 Password checksum bad.	<ol style="list-style-type: none"> Reset the password by running IBM BIOS Setup Utility.
0260 System timer error	<ol style="list-style-type: none"> Replace the backup battery and run IBM BIOS Setup Utility to reset the time and date. System board.
0270 Real time clock error	<ol style="list-style-type: none"> Replace the backup battery and run IBM BIOS Setup Utility to reset the time and date. System board.
0271 Date and time error	<ol style="list-style-type: none"> Run IBM BIOS Setup Utility to reset the time and date..
0280 Boot incomplete error— Default configuration used	<ol style="list-style-type: none"> Load Setup Defaults in IBM BIOS Setup Utility. DIMM. System board.

02F4 EISA CMOS not writable.	<ol style="list-style-type: none"> 1. Load Setup Defaults in IBM BIOS Setup Utility. Replace the backup battery. 2. System board.
02F5 DIMM test failure	<ol style="list-style-type: none"> 1. DIMM. 2. System board.
02F6 Software NMI failure	<ol style="list-style-type: none"> 1. DIMM. 2. System board.
02F7 Fail-safe timer NMI failure	<ol style="list-style-type: none"> 1. DIMM. 2. System board.

Error messages

Symptom or error	FRU or action, in sequence
Device address conflict	<ol style="list-style-type: none"> 1. Load Setup Defaults in IBM BIOS Setup Utility. 2. Backup battery. 3. System board.
Allocation error for device	<ol style="list-style-type: none"> 1. Load Setup Defaults in IBM BIOS Setup Utility. 2. Backup battery. 3. System board.
Failing bits: nnnn	<ol style="list-style-type: none"> 1. DIMM. 2. System board.
Invalid system configuration data	<ol style="list-style-type: none"> 1. DIMM. 2. System board.
I/O device IRQ conflict	<ol style="list-style-type: none"> 1. Load Setup Defaults in IBM BIOS Setup Utility. 2. Backup battery. 3. System board.
Operating system not found	<ol style="list-style-type: none"> 1. Enter IBM BIOS Setup Utility and see whether the hard disk drive and the diskette drive are properly identified. 2. Diskette drive. 3. Hard disk drive. 4. System board.

Hibernation error	<ol style="list-style-type: none"> 1. Restore the system configuration to what it was the before the computer entered hibernation mode. 2. If memory size has been changed, re-create the hibernation file.
Operating system not found	<ol style="list-style-type: none"> 1. Reseat the hard disk drive. 2. Check the boot sequence by use of IBM BIOS Setup
Fan error	<ol style="list-style-type: none"> 1. Fan.

Beep symptoms

Symptom or error	FRU or action, in sequence
One beep and a blank, unreadable, or flashing LCD	<ol style="list-style-type: none"> 1. Reseat the LCD connector. 2. LCD assembly. 3. System board.
One long and two short beeps, and a blank or unreadable LCD	<ol style="list-style-type: none"> 1. System board. 2. LCD assembly.
Two short beeps with error codes	POST error. See “Numeric error codes” on page 44
Two short beeps with blank screen	<ol style="list-style-type: none"> 1. System board.
Only cursor appears	<ol style="list-style-type: none"> 1. Reinstall operating system.

No beep symptoms

Symptom or error	FRU or action, in sequence
No beep, power-on indicator on, LCD blank, and no POST	<ol style="list-style-type: none"> 1. Make sure that every connector is connected tightly and correctly. 2. DIMM. 3. System board.
No beep, power-on indicator on, and LCD blank during POST	<ol style="list-style-type: none"> 1. Reseat DIMM. 2. System board.
No beep during POST, but system runs correctly	<ol style="list-style-type: none"> 1. Speaker.

The power-on password prompt	A power-on password or a supervisor password is set. Type the password and press Enter .
The hard disk password prompt	A hard disk password is set. Type the password and press Enter .
The DOS-full screen looks smaller.	Start the ThinkPad Configuration program and set the Screen expansion function.

LCD-related symptoms

Important:

The TFT LCD for the notebook computer contains many thin-film transistors (TFTs). A small number of dots that are missing, discolored, or always lighted is characteristic of TFT LCD technology, but excessive pixel problems can cause viewing concerns. The LCD should be replaced if the number of missing, discolored, or lighted dots in any background is:

- **SVGA(X20, X21):** 5 or more bright dots, 5 or more dark dots, or a total of 9 or more bright and dark dots.
- **XGA(X22):** 8 or more bright dots, 8 or more dark dots, or a total of 9 or more bright and dark dots.

Symptom or error	FRU or action, in sequence
No beep, power-on indicator on, and a blank LCD during POST	1. System board.
<ul style="list-style-type: none"> • LCD backlight not working • LCD too dark • LCD brightness cannot be adjusted • LCD contrast cannot be adjusted 	<ol style="list-style-type: none"> 1. Reseat the LCD connectors. 2. LCD assembly. 3. System board.
<ul style="list-style-type: none"> • LCD screen unreadable • Characters missing pixels • Screen abnormal • Wrong color displayed 	<ol style="list-style-type: none"> 1. See important note for "LCD-related symptoms". 2. Reseat all LCD connectors. 3. LCD assembly.
<ul style="list-style-type: none"> • Horizontal or vertical lines displayed on LCD 	1. LCD assembly.

Intermittent problems

Intermittent system hang problems can be due to a variety of causes that have nothing to do with a hardware defect,

such as: cosmic radiation, electrostatic discharge, or software errors. FRU replacement should be considered only when a recurring problem exists.

When analyzing an intermittent problem, do the following:

1. Run the diagnostic test for the system board in loop mode **at least 10 times**.
2. If no error is detected, do **not** replace any FRUs.
3. If any error is detected, replace the FRU shown by the FRU code. Re-run the test to verify that no more errors exist.

Undetermined problems

If the diagnostic tests did not identify which adapter or device failed, which installed devices are incorrect, whether or not a short circuit is suspected, or if the system is inoperative. Follow these procedures to isolate the failing FRU (do not isolate FRUs that have no defects).

Verify that all attached devices are supported by the computer.

Verify that the power supply being used at the time of the failure is operating correctly. (See “Power system checkout” on page 32)

1. Power off the computer.
2. Visually check each FRU for damage. Replace any damaged FRU.
3. Remove or disconnect all of the following devices:
 - a. Non-IBM devices
 - b. Devices attached to the port replicator
 - c. Printer, mouse, and other external devices
 - d. Battery pack
 - e. Hard disk drive
 - f. External diskette drive
 - g. DIMM
 - h. CD-ROM and diskette drive in the UltraBase X2
 - i. PC Cards
4. Power on the computer.
5. Determine whether the problem has changed.
6. If the problem does not recur, reconnect the removed devices one at a time until you find the failing FRU.
7. If the problem remains, replace the following FRUs one at a time (do not replace a non-defective FRU):
 - a. System board
 - b. LCD assembly

FRU replacement notices

This section contains notices related to removing and replacing parts. Read this section carefully before replacing any FRU.

Screw notices

Loose screws can cause a reliability problem. The IBM ThinkPad computer addresses this problem with special nylon-coated screws that have the following characteristics:

- They maintain tight connections.
- They do not easily come loose, even with shock or vibration.
- They are harder to tighten.
- They should be used only once.

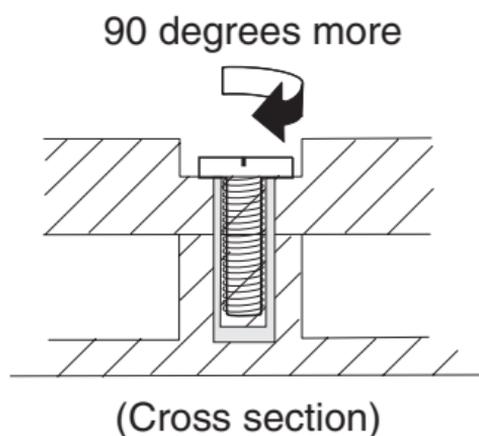
Do the following when you service this machine:

- Keep the screw kit (P/N 05K4841) in your tool bag.
- Always use new screws.
- Use a torque screwdriver if you have one.

Tighten screws as follows:

- **Plastic to plastic**

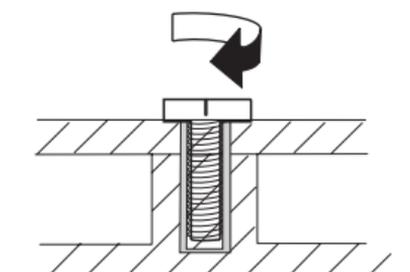
Turn an additional 90 degrees after the screw head touches the surface of the plastic part:



- **Logic card to plastic**

Turn an additional 180 degrees after the screw head touches the surface of the logic card:

180 degrees more



(Cross section)

- **Torque driver**

If you have a torque driver, refer to the "Torque" column with each step.

- Make sure you use the correct screw. If you have a torque screwdriver, tighten all screws firmly to the torque shown in the table. **Never use a screw that you removed. Use a new one. Make sure the screws are tightened firmly**

Retaining serial numbers

This section includes the following descriptions:

- "Restoring the serial number of the system unit"
- "Retaining the UUID"

Restoring the serial number of the system unit

When the computer was manufactured, the EEPROM on the system board was loaded with the serial numbers of the system and all major components. The numbers need to remain the same throughout the life of the computer.

If you replace the system board, you must restore serial number of the system unit to its original value.

Before replacing the system board, save the original serial number by doing the following:

1. Install the ThinkPad Hardware Maintenance Diskette Version 1.60, and restart the computer.
2. From the main menu, select **1. Set System Identification**.
3. Select **2. Read S/N data from EEPROM**.

The serial number for each device is displayed. Write down the serial number of the system unit, designated as follows:

20: System unit serial number

After you have replaced the system board, restore the serial number by doing the following:

1. Install the ThinkPad Hardware Maintenance Diskette Version 1.60 and restart the computer.
2. From the main menu, select **1. Set System Identification**.
3. Select **1. Add S/N data from EEPROM**.

Follow the instructions on the screen.

Note: The serial number of the system unit is written on the label attached on the bottom of the computer.

Retaining the UUID

The Universally Unique Identifier (UUID) is a 128-bit number uniquely assigned to your computer at production and stored in the EEPROM of your system board. The algorithm that generates the unique number is designed to provide unique IDs until the year A.D. 3400. No two computers in the world have the same number.

When you replace the system board, you must set the UUID on the new system board as follows:

1. Install the ThinkPad Hardware Maintenance Diskette Version 1.60, and restart the computer.
2. Select **4. Assign UUID** from the main menu. A new UUID is created and written. If a valid UUID already exists, it is not overwritten.

Removing and replacing a FRU

This section presents information and drawings for use in removing and replacing a FRU. Be sure to observe the following general rules:

1. Do not try to service the computer unless you have been trained and certified. An untrained person runs the risk of damaging parts.
2. Before replacing any FRU, review “FRU replacement notices” on page 50.
3. Begin by removing any FRUs that have to be removed before the failing FRU. Any such FRUs are listed at the top of the page. Remove them in the order in which they are listed.
4. Follow the correct sequence in the steps for removing the FRU, as indicated in the drawings by the numbers in square callouts.
5. When turning a screw to replace a FRU, turn it in the direction indicated by the arrow in the drawing.
6. When removing the FRU, move it in the direction indicated by the arrow in the drawing.
7. To put the new FRU in place, reverse the removal procedure and follow any notes that pertain to replacement. For information about connecting and arranging internal cables, see “Locations” on page 92.
8. When replacing a FRU, use the correct screw as shown in the procedures.

CAUTION:

Before removing any FRU, power off the computer, unplug all power cords from electrical outlets, remove the battery pack, and then disconnect any interconnecting cables.

CAUTION:

The battery consists of small amount of nickel. Do not disassemble it, throw it into fire or water, or short-circuit it. Dispose of the battery pack as required by local ordinances or regulations.

Attention:

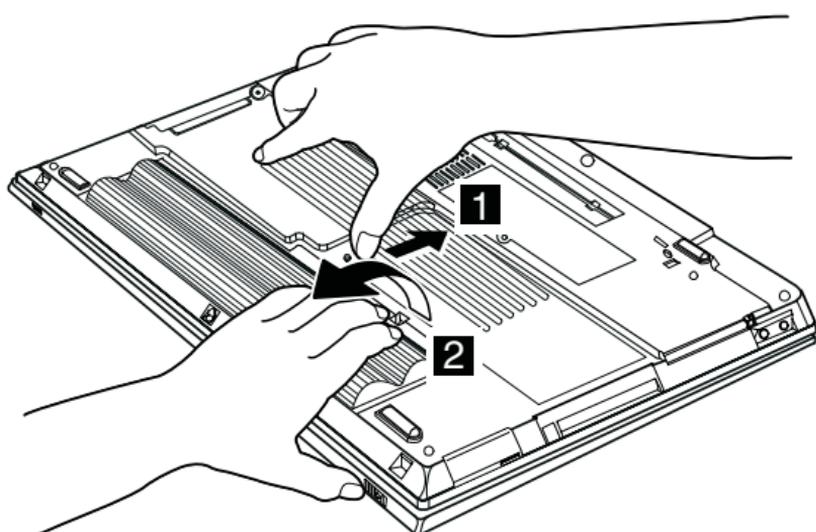
Before the computer is powered on after FRU replacement, make sure all screws, springs, and other small parts are in place and are not loose inside the computer. Verify this by shaking the computer gently and listening for rattling sounds. Metallic parts or metal flakes can cause electrical short circuits.

Attention:

The system board is sensitive, and can be damaged by electrostatic discharge. Establish personal grounding by touching a ground point with one hand before touching these units.

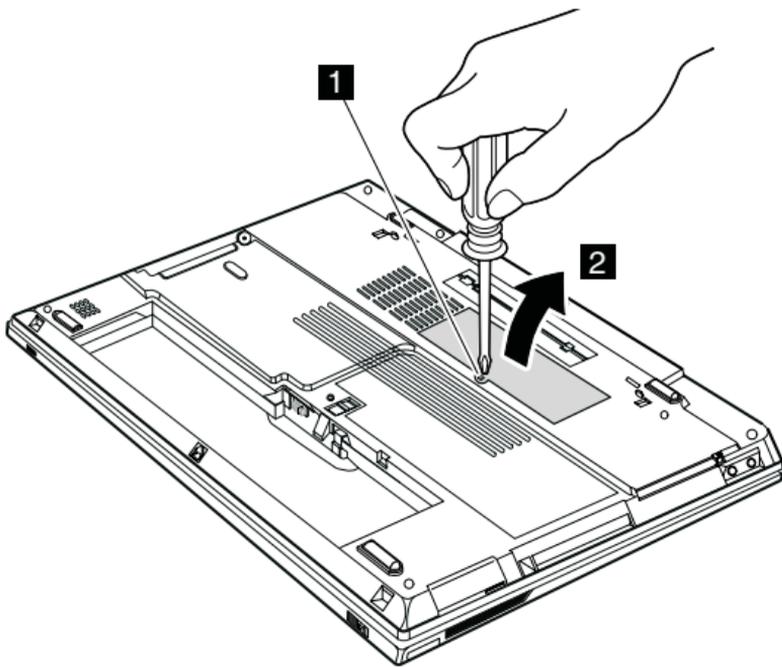
You must use an electrostatic discharge (ESD) strap (P/N 6405959) to establish personal grounding.

1010 Battery pack



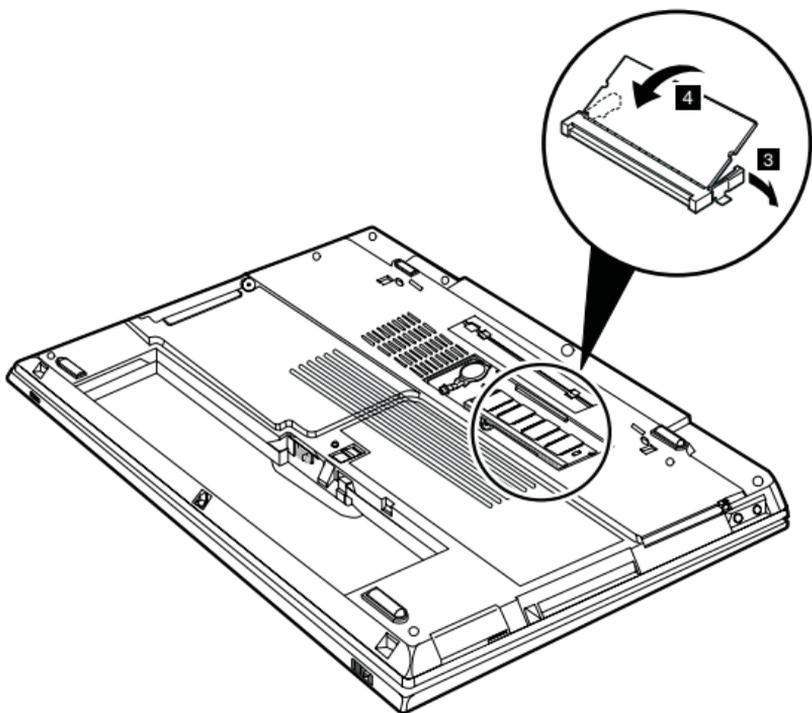
1020 DIMM

- Battery pack (1010)



Note: Loosen the screw **1** but do not remove it.

Step	Screw (quantity)	Torque
1	M2 × 3.4 mm, Nylock-coated (1) BK	14.7 Ncm (1.5 kgfcm)

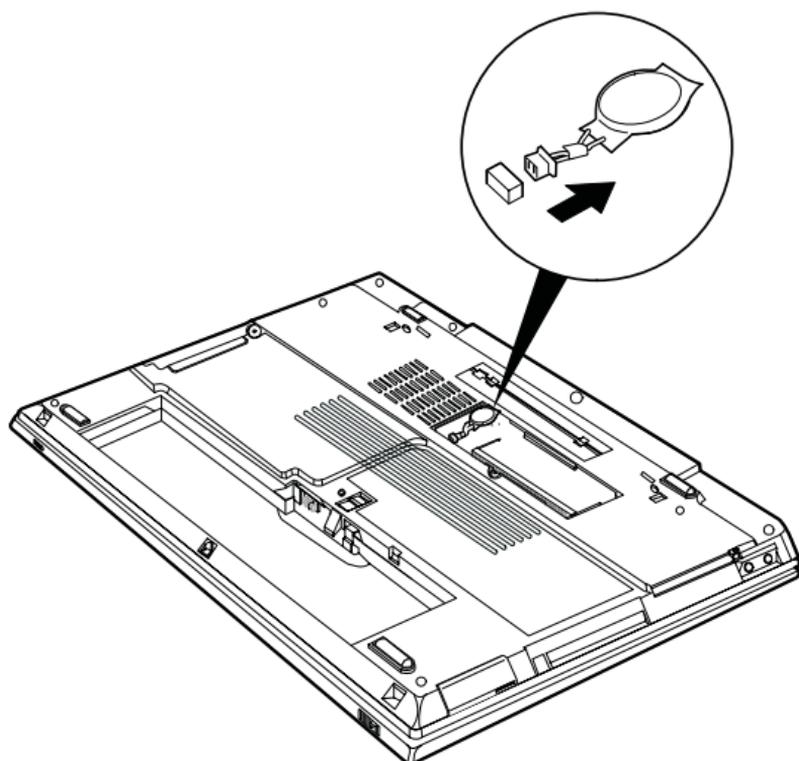


1030 Backup battery

- Battery pack (1010)
- DIMM (1020)

CAUTION:

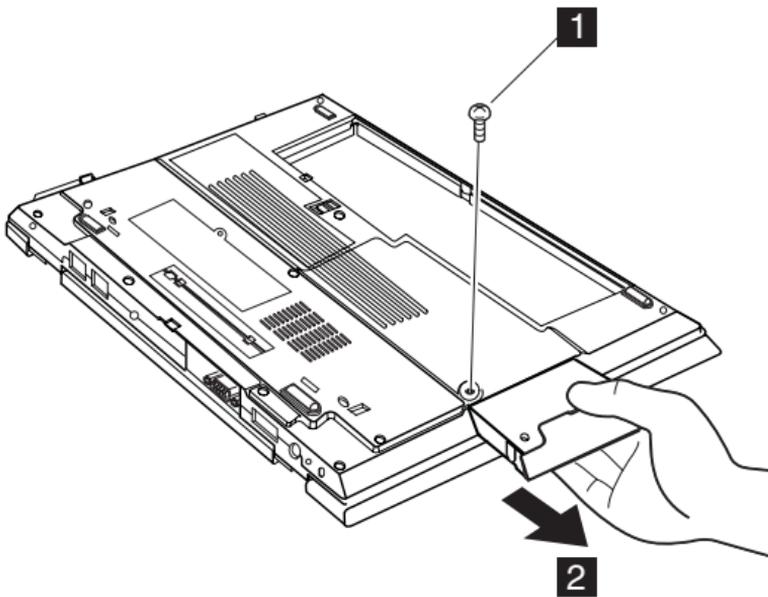
The backup battery is a lithium battery and can cause a fire, an explosion, or severe burns. Do not recharge it, remove its polarized connector, disassemble it, heat it above 100°C (212°F), incinerate it, or expose its cell contents to water. Dispose of the battery as required by local ordinances or regulations. The use of an incorrect battery can result in ignition or explosion of the battery.



1040 Hard disk drive

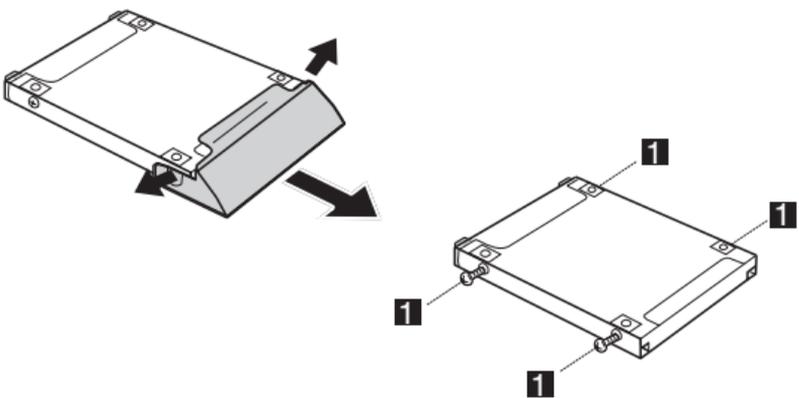
- Battery pack (1010)

Attention: Do not drop the hard disk drive or apply any shock to it. The hard disk drive is sensitive to physical shock. Incorrect handling can cause damage and permanent loss of data. Before removing the drive, have the user make a backup copy of all the information on the drive if possible. Never remove the drive while the system is operating or is in suspend mode.



Note: The hard disk is attached to the cover.

Step	Screw (quantity)	Torque
1	M3 × 3.5mm, Nylock-coated (1) BK	19.6 Ncm (2 kgfcm)



When installing: Make sure that the HDD connector is firmly connected.

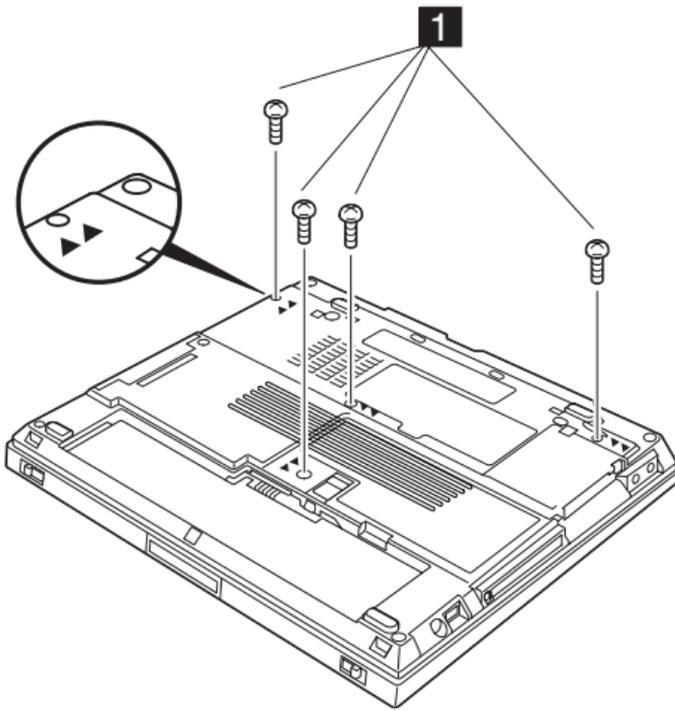
Step	Screw (quantity)	Torque
------	------------------	--------

1	M3 ×3 mm (4) Red	19.6 Ncm (2 kgfcm)
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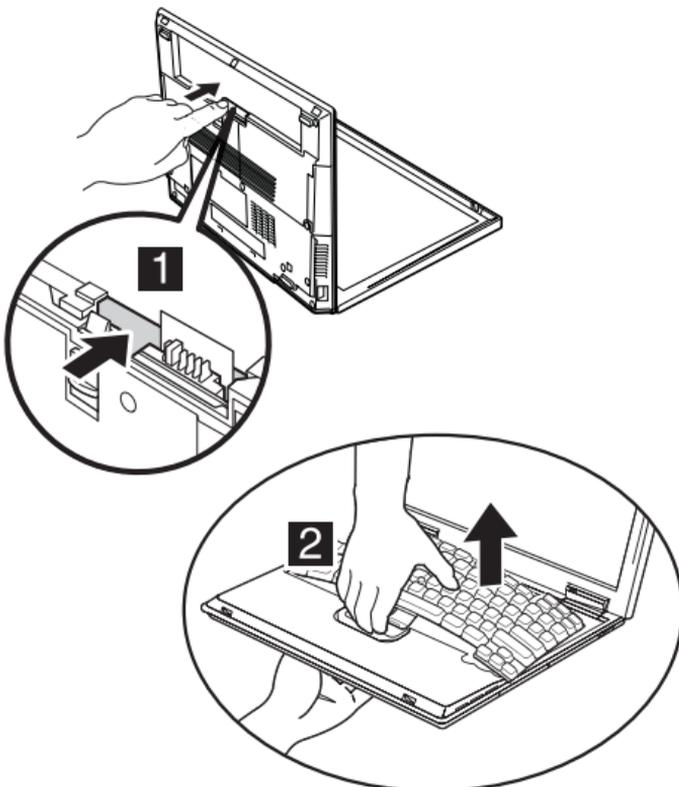
1050 Keyboard

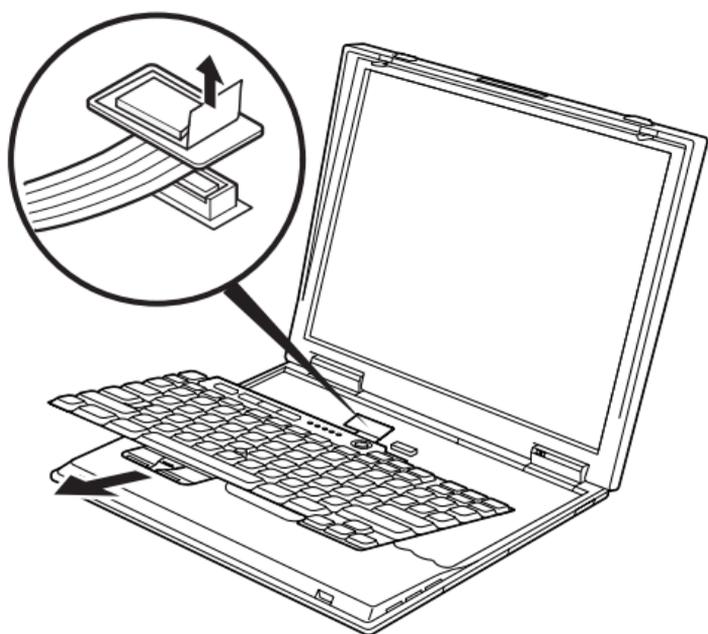
- Battery pack (1010)
- Hard Disk Drive (1040)

For X20, X21



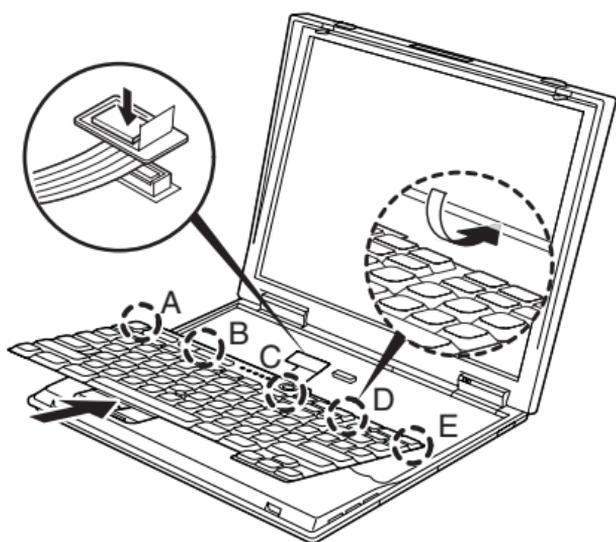
Step	Screw (quantity)	Torque
1	M2 × 4.5 mm, Nylock-coated (4) BK	19.6 Ncm (2 kgfcm)



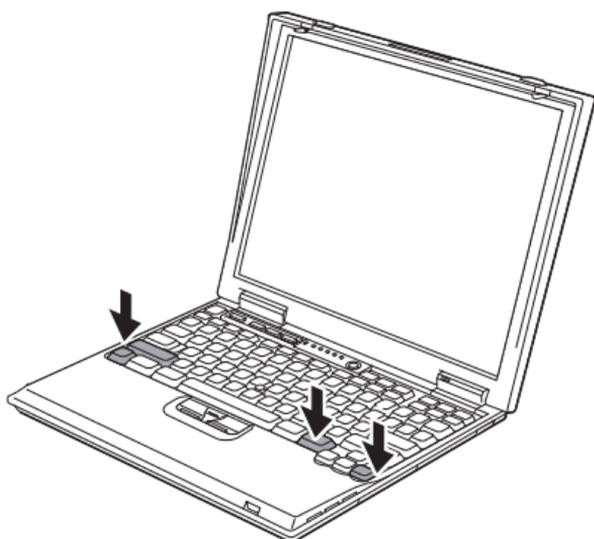


When installing: When installing the keyboard, do as follows:

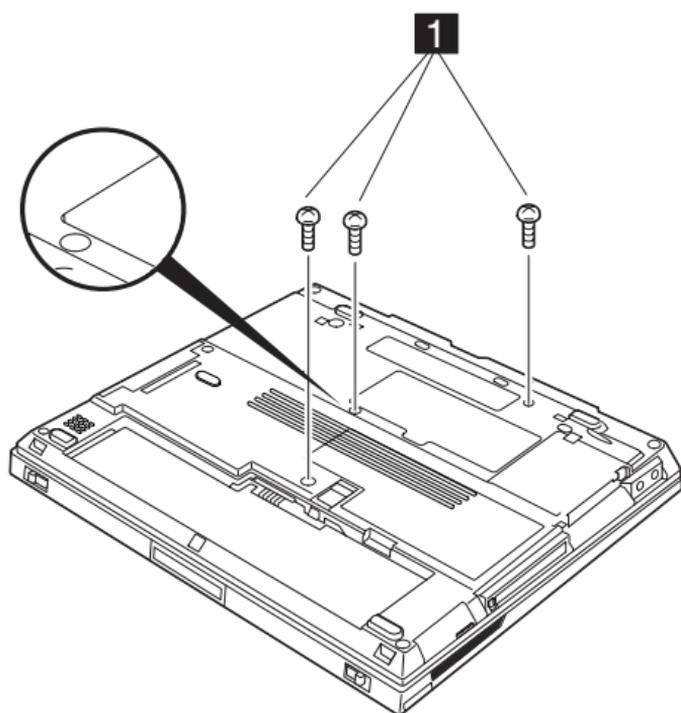
1. Install the new keyboard, following the directions in the figure. Make sure that the keyboard edges, shown in the figure as (A), (B), (C), (D) and (E), are under the frame.



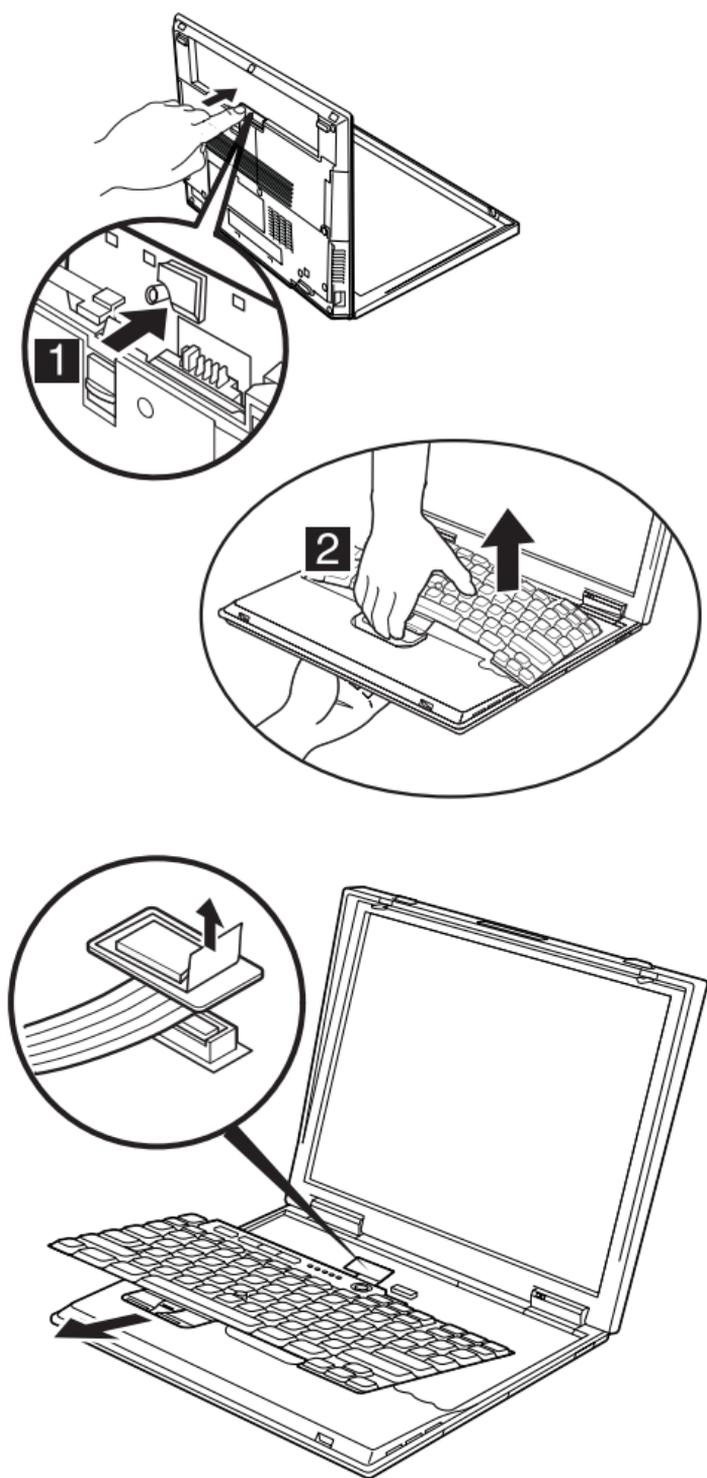
- Align the tabs of the keyboard with the corresponding slots; then press the keyboard until it snaps into place.



For X22



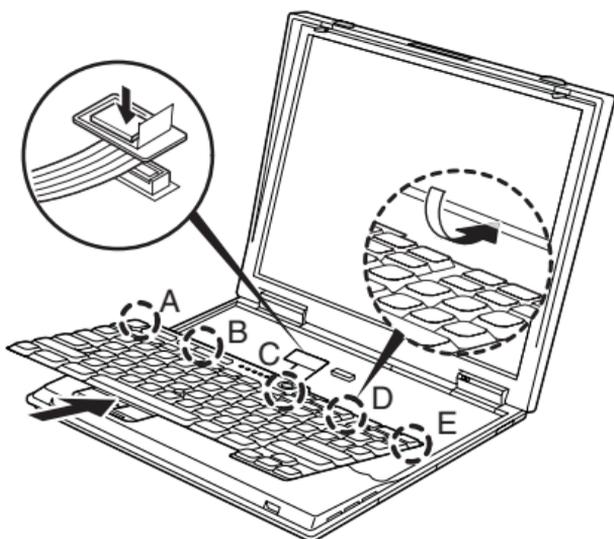
Step	Screw (quantity)	Torque
1	M2 × 7 mm, Nylock-coated (3) BK	19.6 Ncm (2 kgfcm)



When installing: When installing the keyboard, do as follows:

1. Install the new keyboard, following the directions in the figure. Make sure that the keyboard edges, shown in the figure as (A), (B), (C), (D) and (E), are under the

frame.

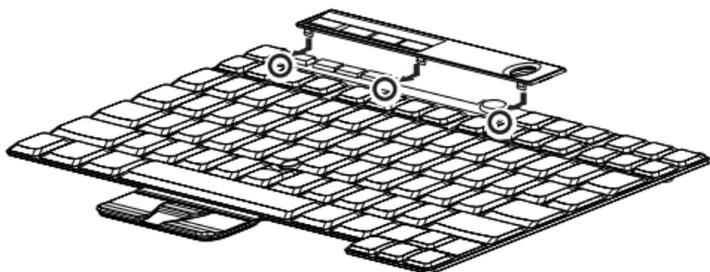


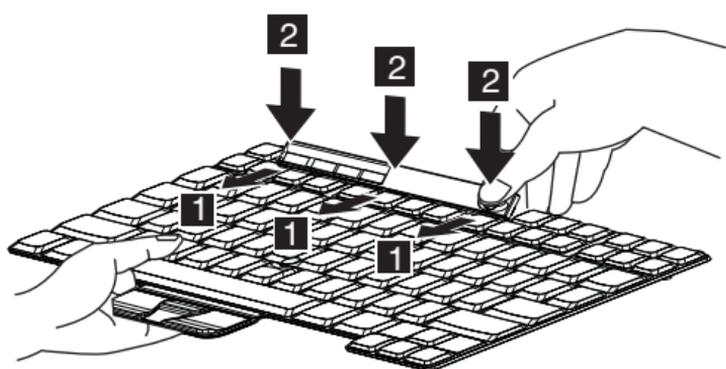
2. Align the tabs of the keyboard with the corresponding slots; then press the keyboard until it snaps into place.



1060 KBD Control Panel Assemble

- Battery pack (1010)
- Keyboard assembly (1050)



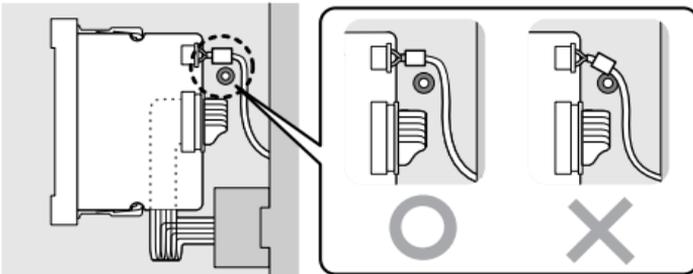
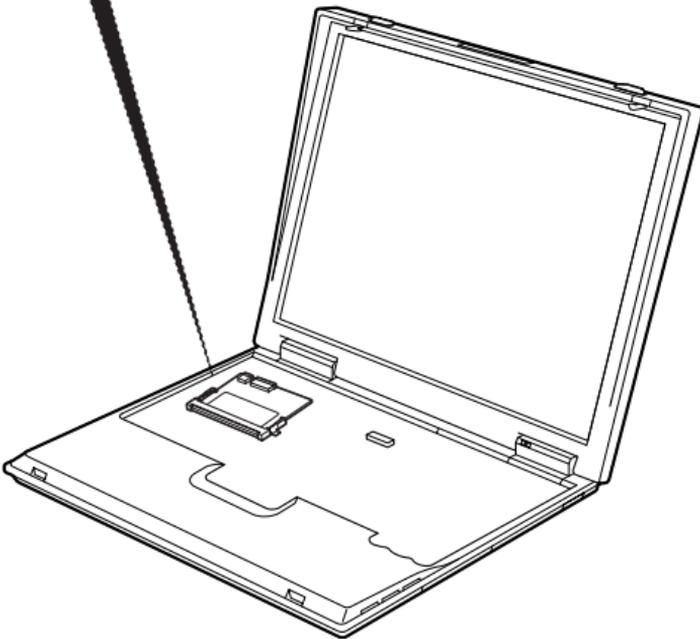
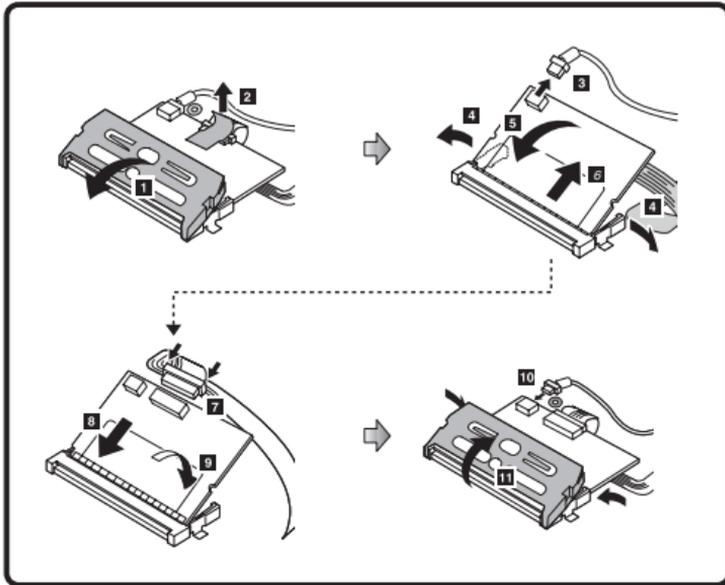


1. Align the KBD Control Panel hooks with the corresponding slots like the picture.
2. Press the KBD Control Panel until its snaps fit.

1070 Mini PCI adapter

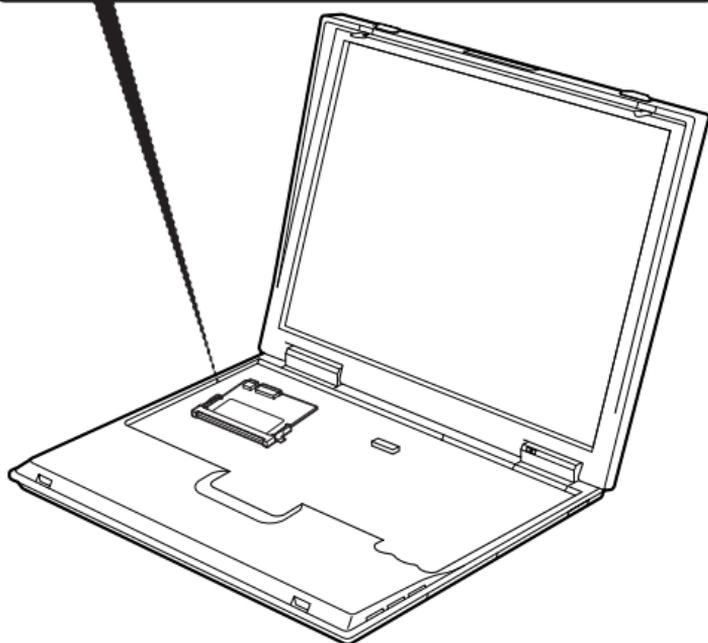
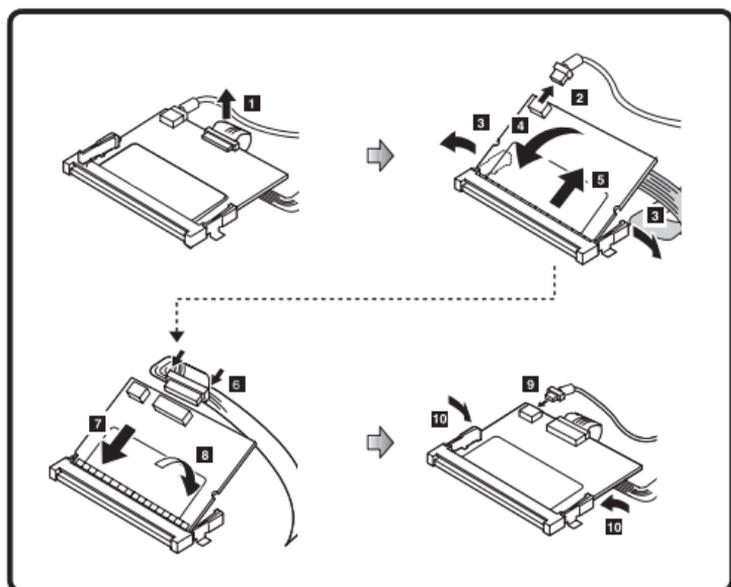
For X21, X20

- Battery pack (1010)
- Keyboard assembly (1050)



For X22

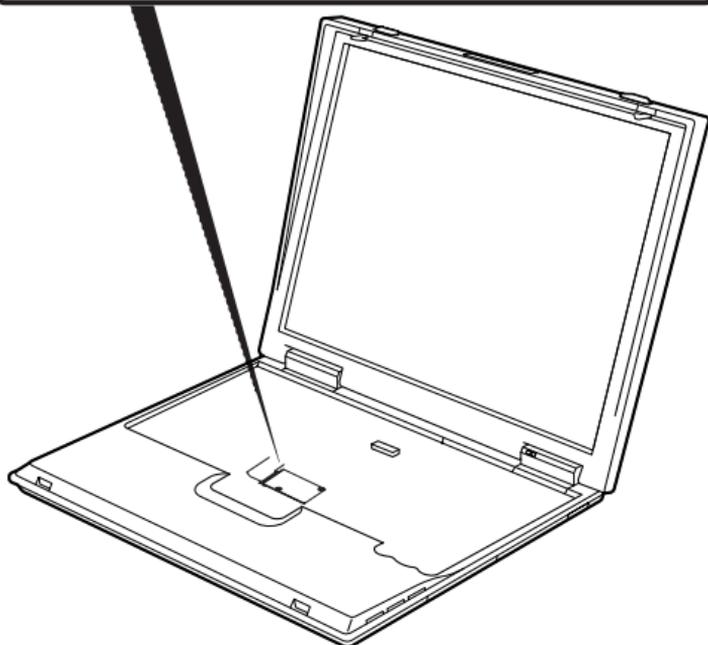
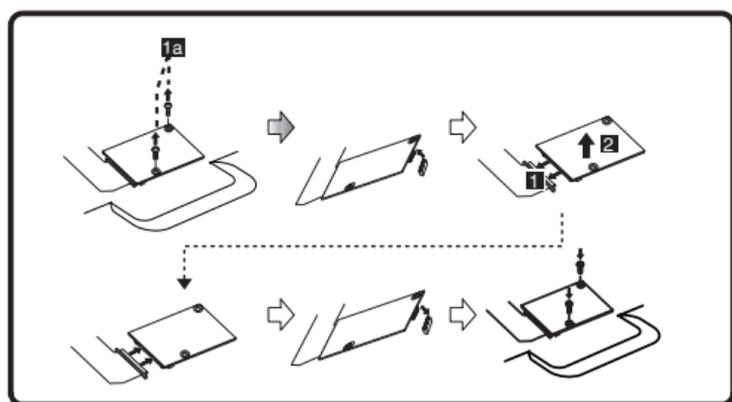
- Battery pack (1010)
- Keyboard assembly (1050)



1080 CDC adapter

For X22

- Battery pack (1010)
- Keyboard assembly (1050)

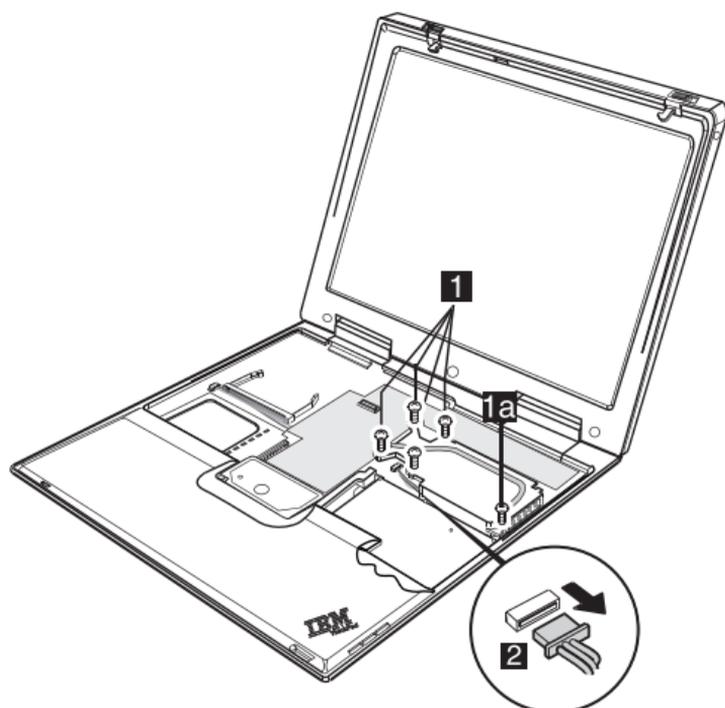


Step	Screw (quantity)	Torque
1	M2 × 3.5mm (2) Nylock-coated Silver	19.6 Ncm (2 kgfcm)

1090 Fan assembly

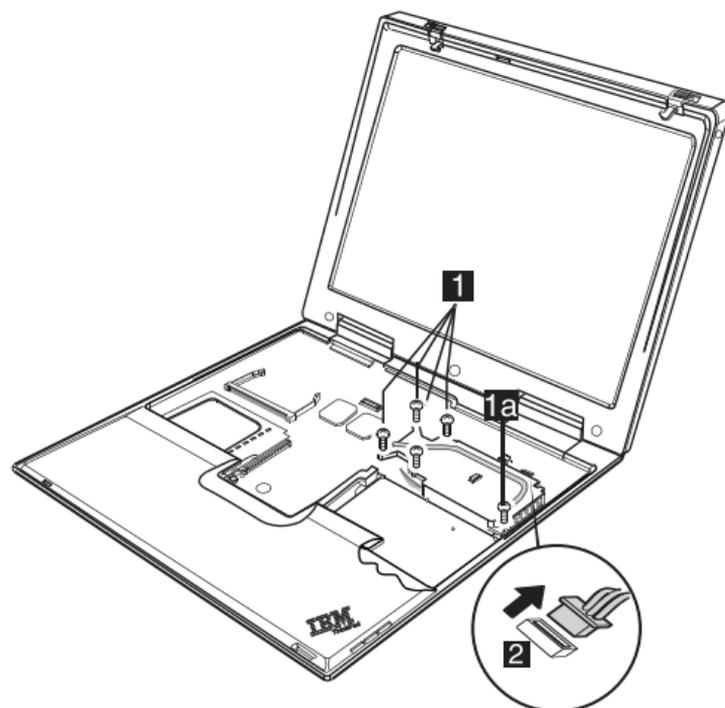
- Battery pack (1010)
- Keyboard assembly (1050)

For X20, X21



Step	Screw (quantity)	Torque
1	M2 × 3mm (4) White	19.6 Ncm (2 kgfcm)
1a	M2 × 6mm, Nylock-coated (1) BK	19.6 Ncm (2 kgfcm)

For X22

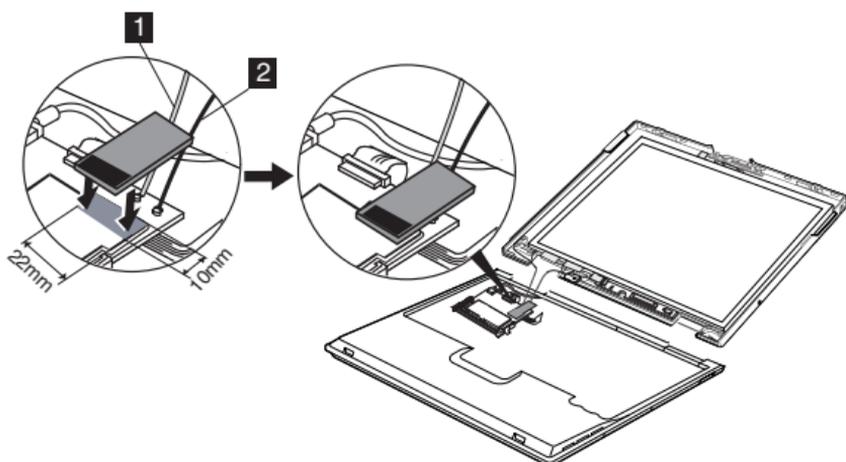


Step	Screw (quantity)	Torque
1	M2 × 3.5mm (4) Silver	19.6 Ncm (2 kgfcm)

1a	M2 × 6mm, Nylock-coated (1) BK	19.6 Ncm (2 kgfcm)
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1100 Wirelesslan assembly for X22

- Battery pack (1010)
- Keyboard assembly (1050)

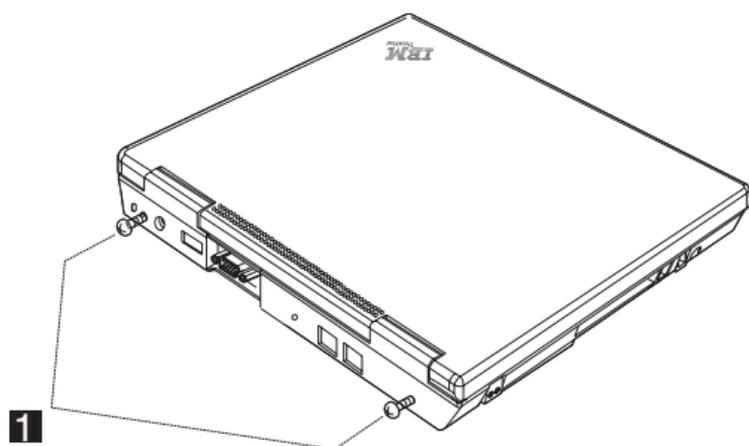
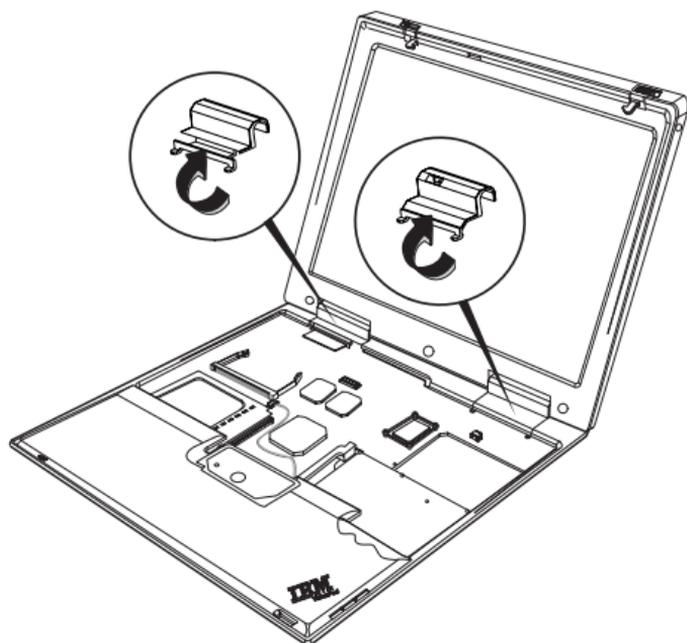


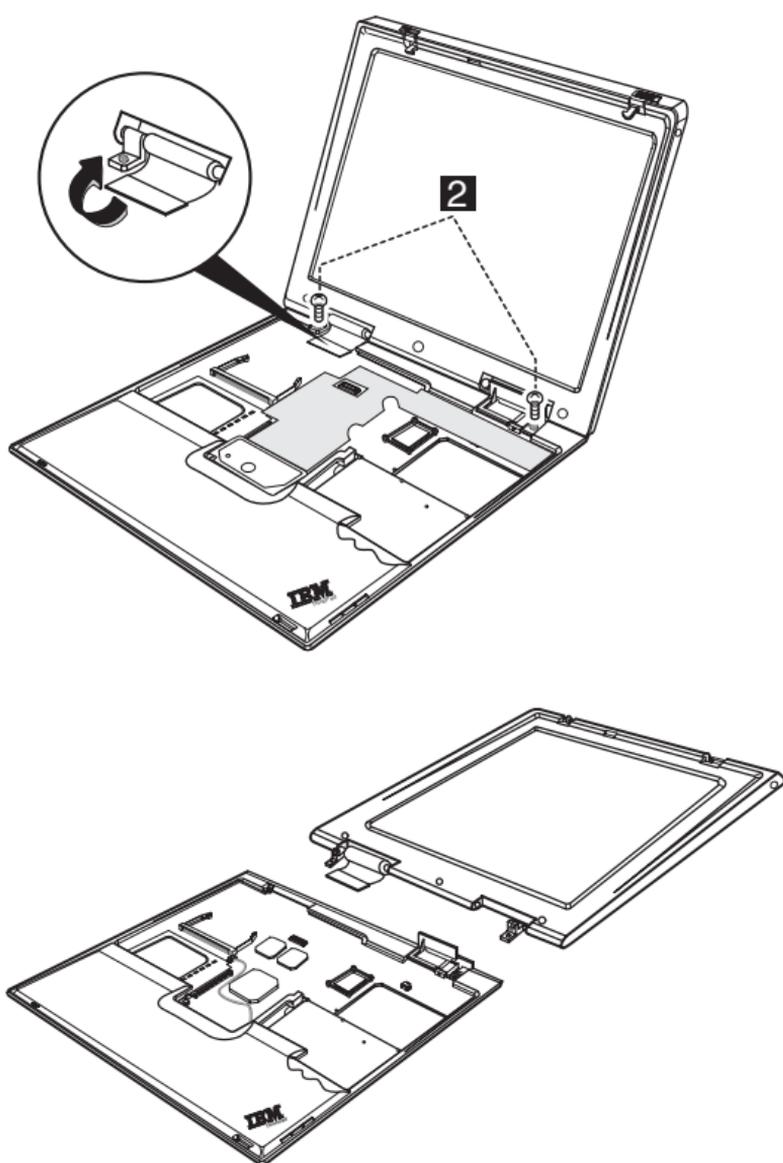
Step	Antena Color	Wireless LAN Board
1	Gray Color	Main (J1)
2	Black Color	Aux (J2)

1110 LCD assembly

- Battery pack (1010)
- Keyboard assembly (1050)
- Wirelesslan assembly (1100)

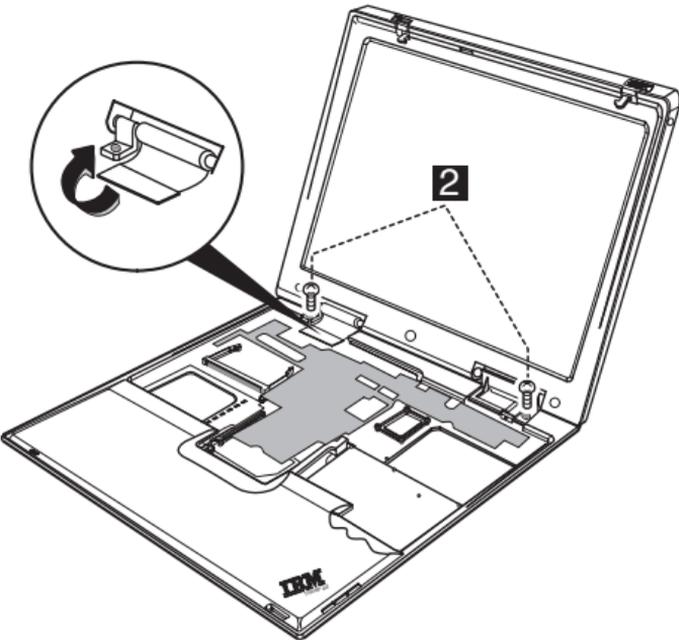
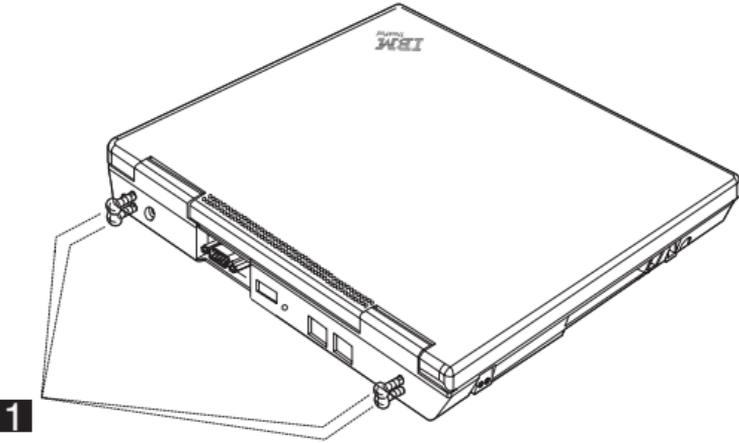
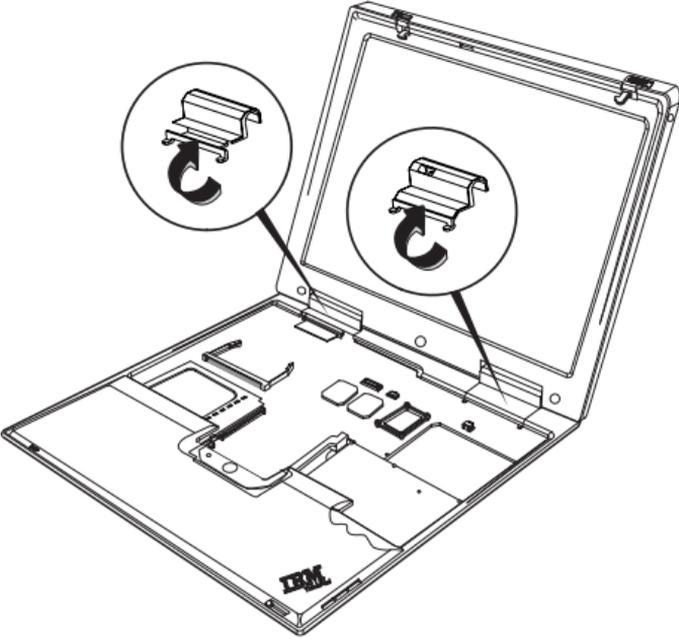
For X20, X21

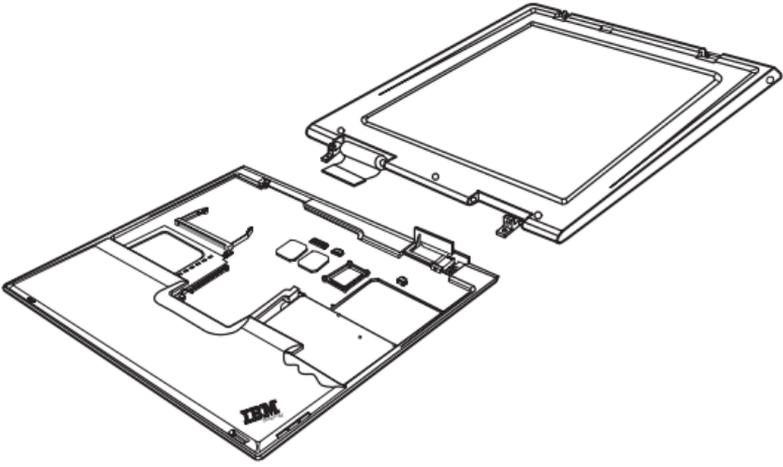




Step	Screw (quantity)	Torque
1	M2.6 × 4mm (2) BK	29.4 Ncm (3 kgfcm)
2	M2 × 8mm, Nylock-coated(2) BK	29.4 Ncm (3 kgfcm)

For X22



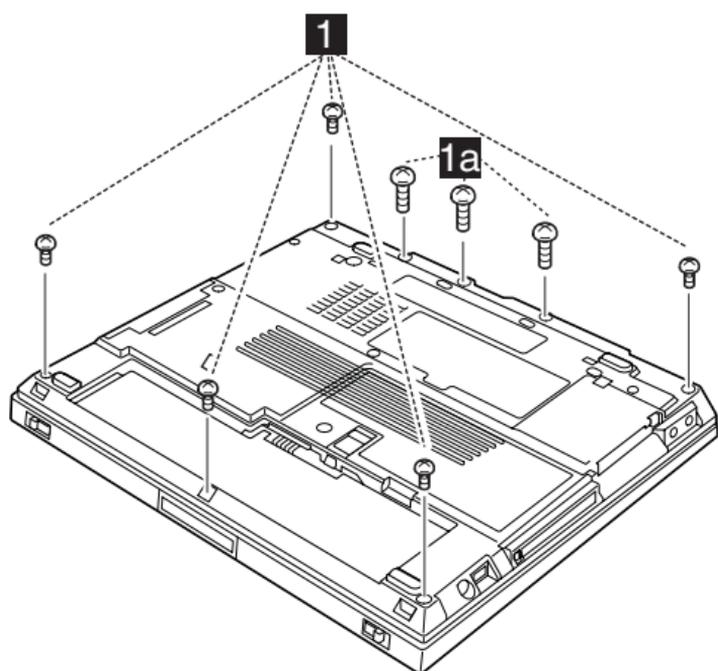


Step	Screw (quantity)	Torque
1	M2.6 × 4mm (4) BK	29.4 Ncm (3 kgfcm)
2	M2 × 8mm, Nylock-coated(2) BK	29.4 Ncm (3 kgfcm)

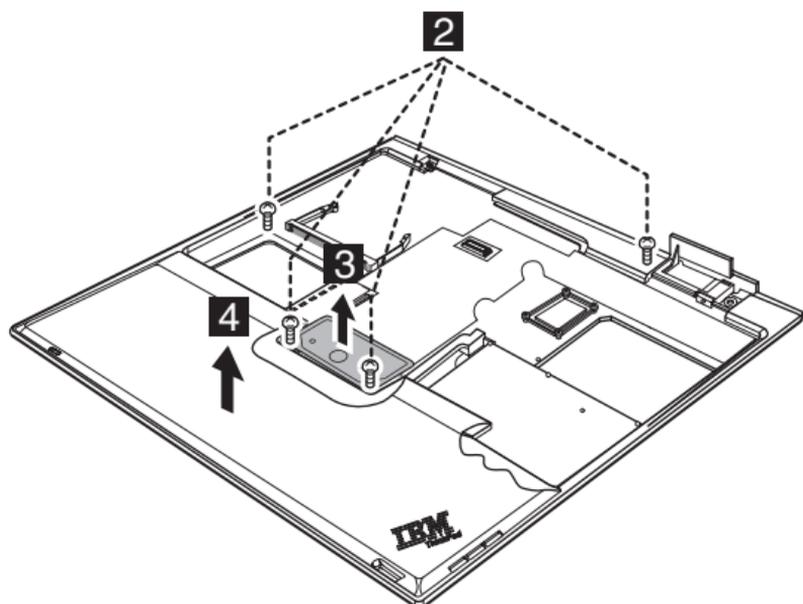
1120 Case Keyboard deck

- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1090)
- Wirelesslan assembly (1100)
- LCD assembly (1110)

For X20, X21



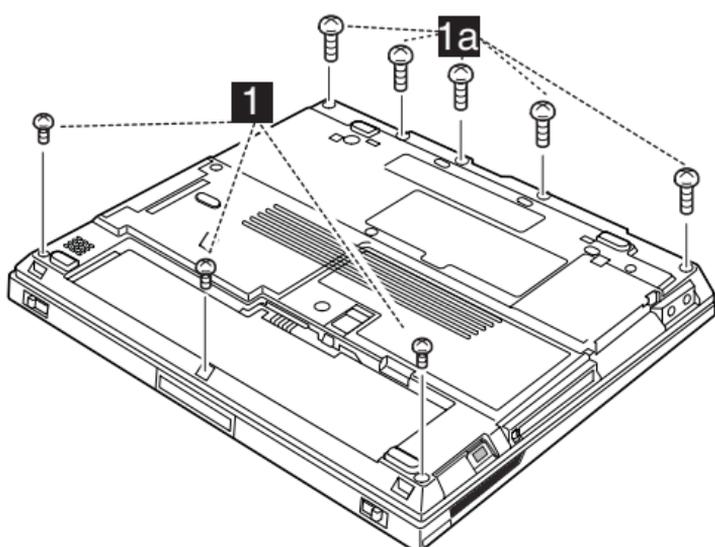
Step	Screw (quantity)	Torque
1	M2 × 3.5mm, Nylock-coated (5) BK	19.6 Ncm (2 kgfcm)
1a	M2 × 6mm, Nylock-coated (3) BK	19.6 Ncm (2 kgfcm)



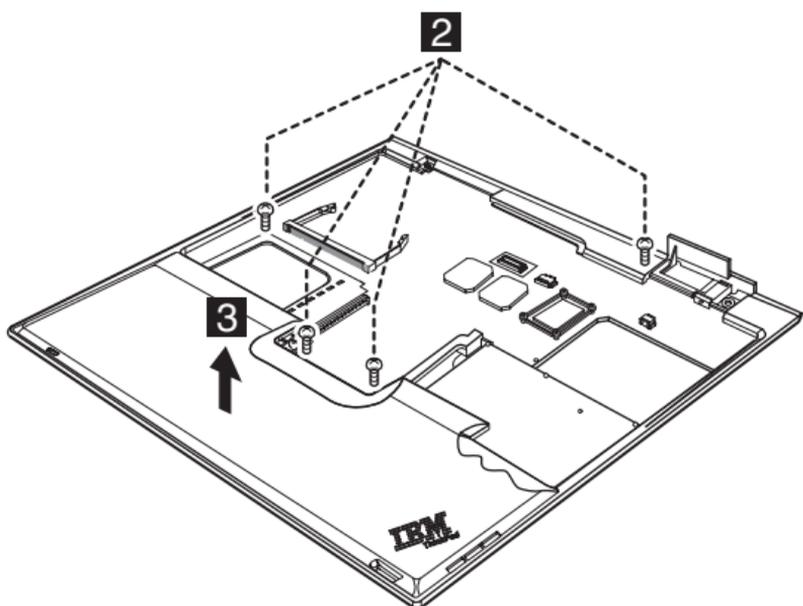
Case Keyboard deck up; then remove it

Step	Screw (quantity)	Torque
2	M2 × 6mm, Nylock-coated (4) BK	19.6 Ncm (2 kgfcm)

For X22



Step	Screw (quantity)	Torque
1	M2 × 3.5mm, Nylock-coated (3) BK	19.6 Ncm (2 kgfcm)
1a	M2 × 6mm, Nylock-coated (5) BK	19.6 Ncm (2 kgfcm)



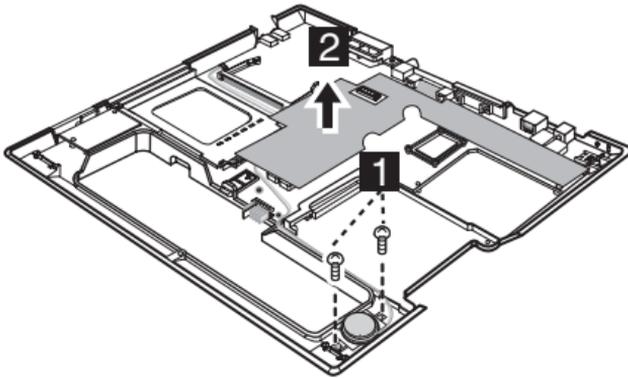
Case Keyboard deck up; then remove it

Step	Screw (quantity)	Torque
2	M2 × 6mm, Nylock-coated (4) BK	19.6 Ncm (2 kgfcm)

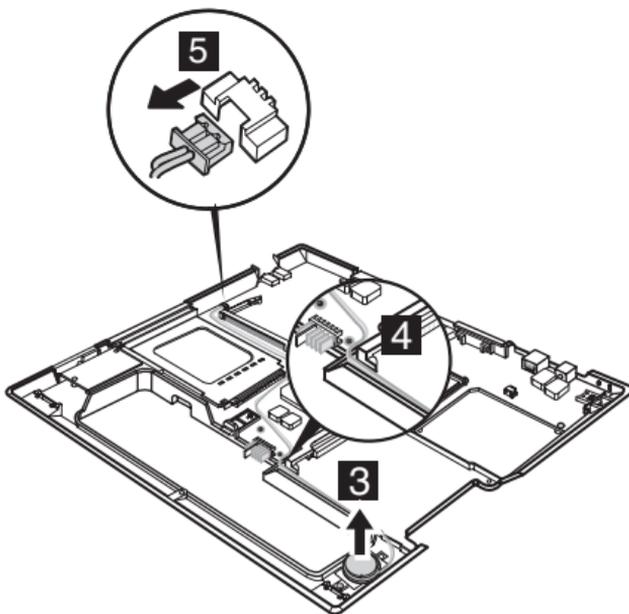
1130 Speaker

- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1090)
- Wirelesslan assembly (1100)
- LCD assembly (1110)
- Case keyboard deck (1120)

For X20, X21

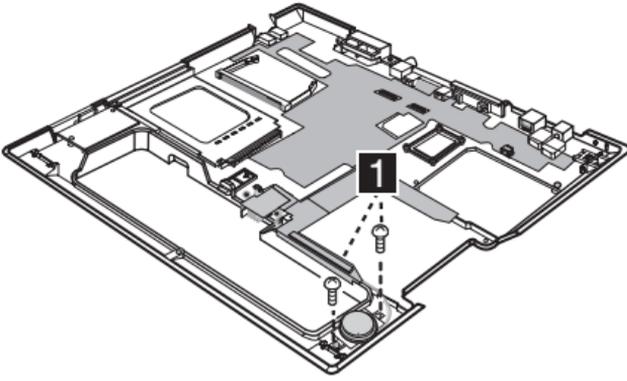


Step	Screw (quantity)	Torque
1	M2 × 3mm, Nylock-coated (2) BK	19.6 Ncm (2 kgfcm)

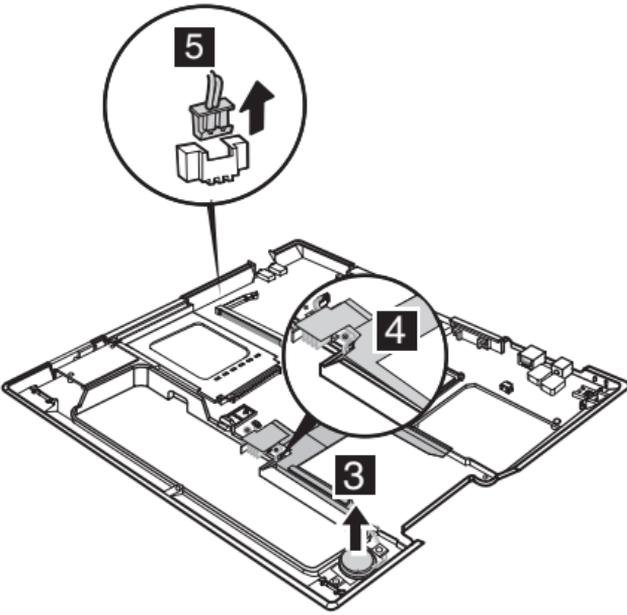


When installing: Make sure that you fasten the connector firmly.

For X22



Step	Screw (quantity)	Torque
1	M2 × 3.5mm, Nylock-coated (2) Silver	19.6 Ncm (2 kgfcm)

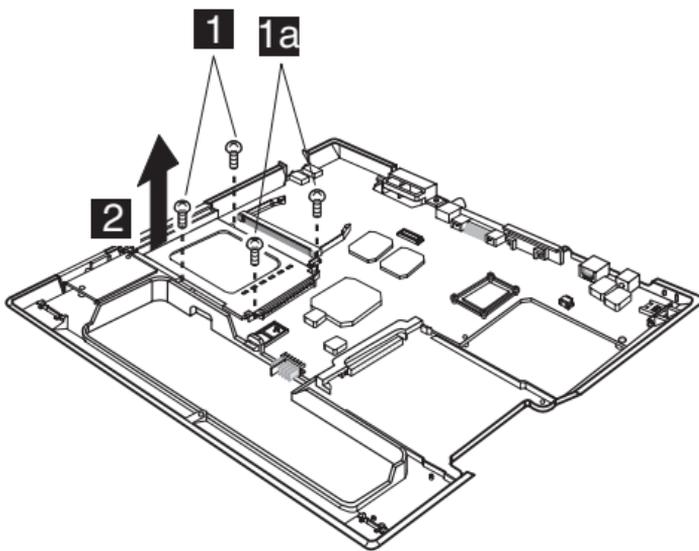


When installing: Make sure that you fasten the connector firmly.

1140 PC Card slot assembly

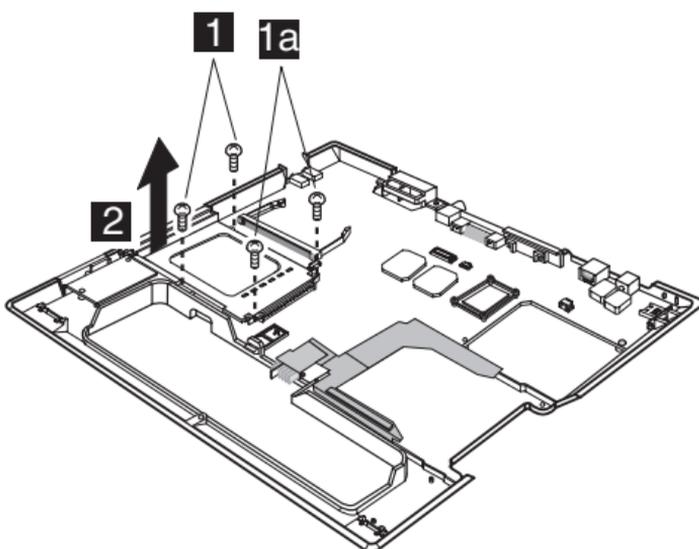
- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1090)
- Wirelesslan assembly (1100)
- LCD assembly (1110)
- Case keyboard deck (1120)
- Speaker (1130)

For X20, X21



Step	Screw (quantity)	Torque
1	M2 × 3mm (2) White	14.7 Ncm (1.5 kgfcm)
1a	M2 × 6mm, Nylock-coated (2) BK	19.6 Ncm (2 kgfcm)

For X22



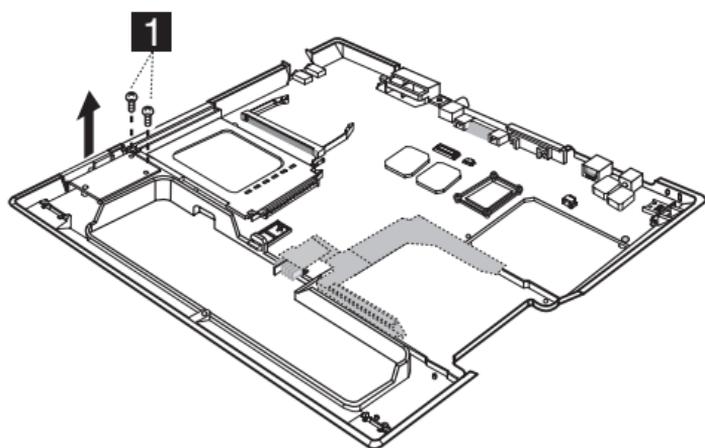
Step	Screw (quantity)	Torque
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1	M2 × 3.5mm (2) Silver	14.7 Ncm (1.5 kgfcm)
1a	M2 × 6mm, Nylock-coated (2) BK	19.6 Ncm (2 kgfcm)

1150 IRDA Port

- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1090)
- Wirelesslan assembly (1100)
- LCD assembly (1110)
- Case keyboard deck (1120)
- Speaker (1130)
- PC Card slot assembly (1140)

For X22

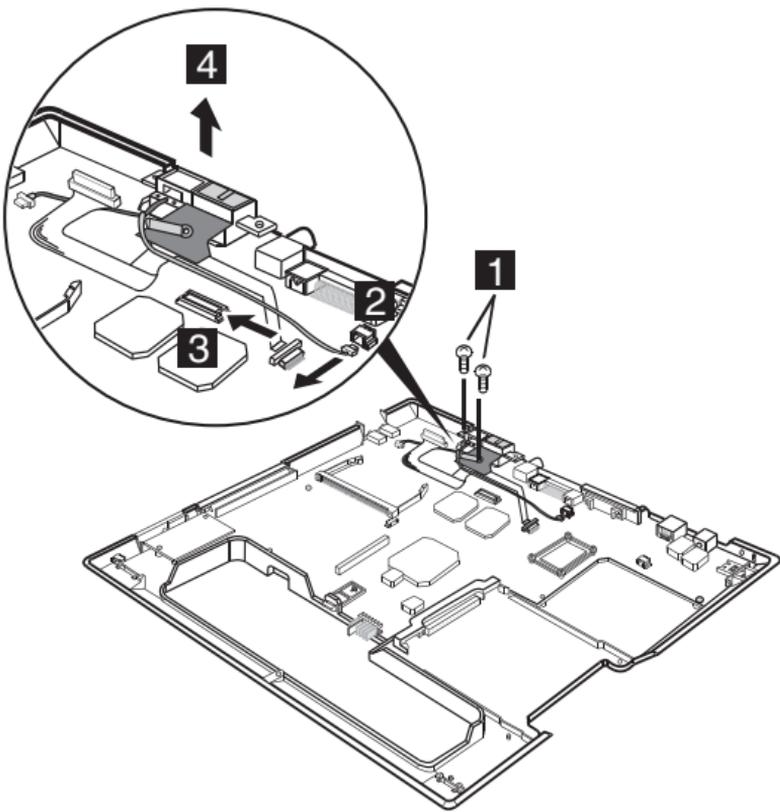


Step	Screw (quantity)	Torque
1	M2 × 3.5mm (2) Nylock-coated Silver	19.6 Ncm (2 kgfcm)

1160 RJ11, RJ45

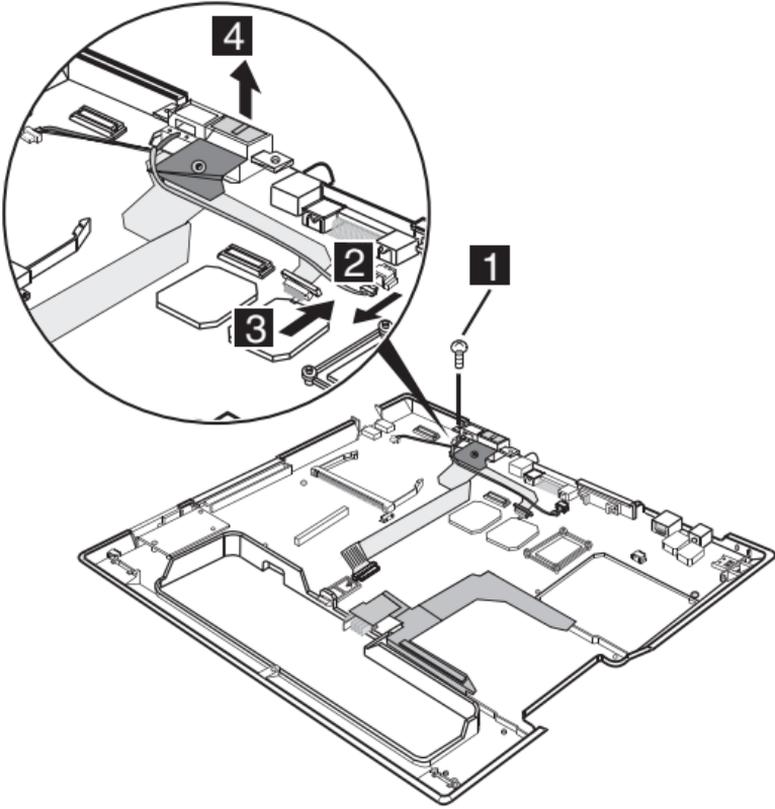
- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1090)
- Wirelesslan assembly (1100)
- LCD assembly (1110)
- Case keyboard deck (1120)
- Speaker (1130)
- PC Card slot assembly (1140)
- IRDA Port (1150)

For X20, X21



Step	Screw (quantity)	Torque
2	M2 × 6mm, Nylock-coated (2) BK	19.6 Ncm (2 kgfcm)

For X22

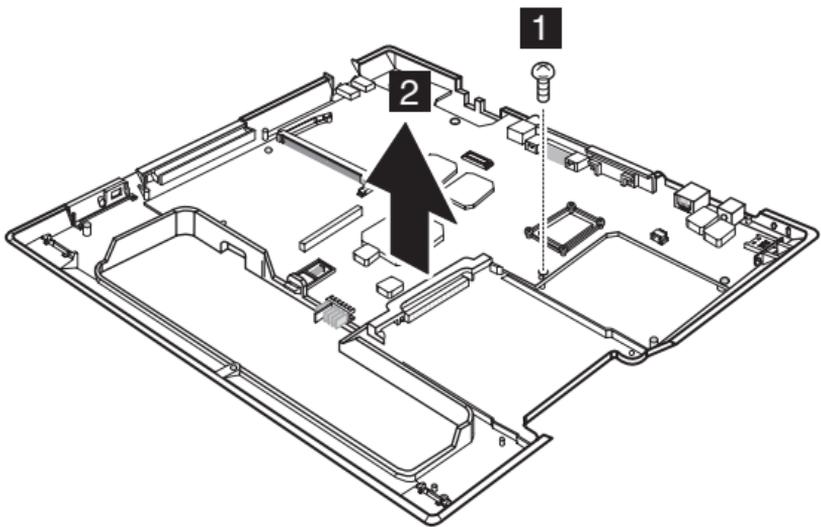


Step	Screw (quantity)	Torque
2	M2 × 6mm, Nylock-coated (1) BK	19.6 Ncm (2 kgfcm)

1170 System board

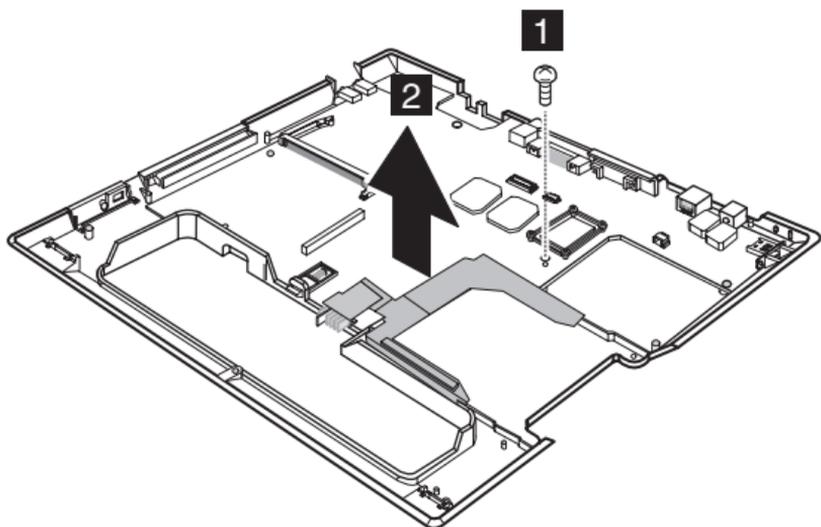
- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1090)
- Wirelesslan assembly (1100)
- LCD assembly (1110)
- Case keyboard deck (1120)
- Speaker (1130)
- PC Card slot assembly (1140)
- IRDA Port (1150)
- RJ11, RJ45 (1160)

For X20, X21



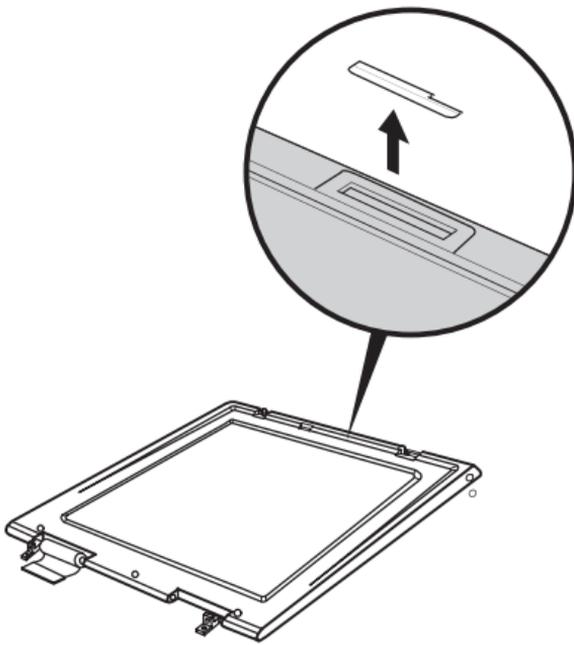
Step	Screw (quantity)	Torque
2	M2 × 3mm (1) White	19.6 Ncm (2 kgfcm)

For X22



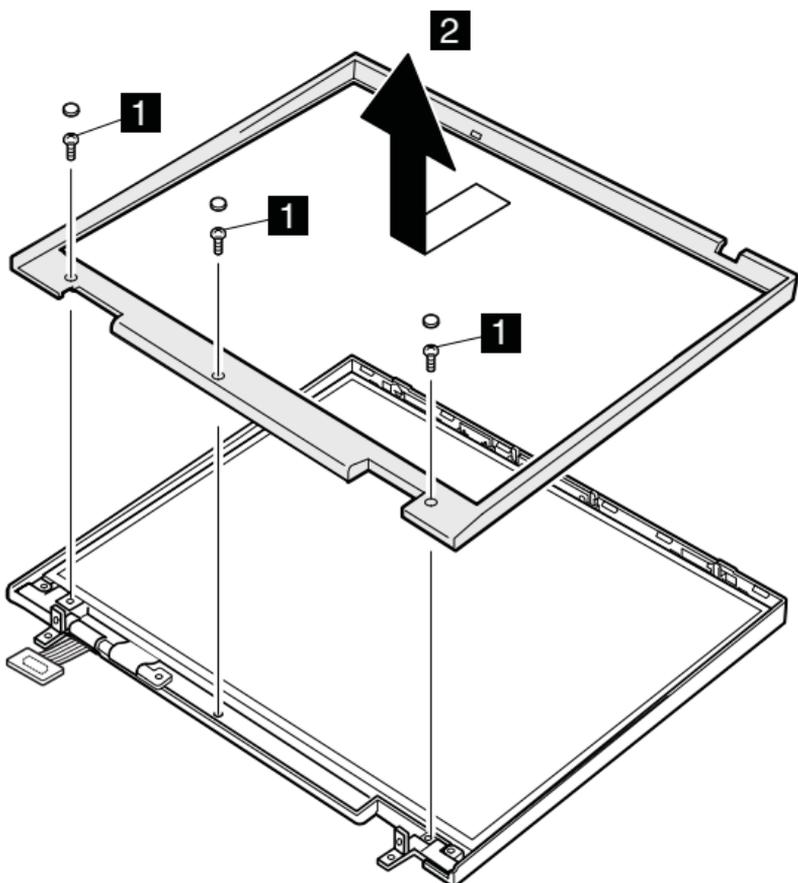
Step	Screw (quantity)	Torque
2	M2 × 3.5mm (1) Silver	19.6 Ncm (2 kgfcm)

1180 LCD USB cover



1190 Front bezel

- Battery pack (1010)
- Keyboard assembly (1050)
- Wirelesslan assembly (1100)
- LCD assembly (1110)

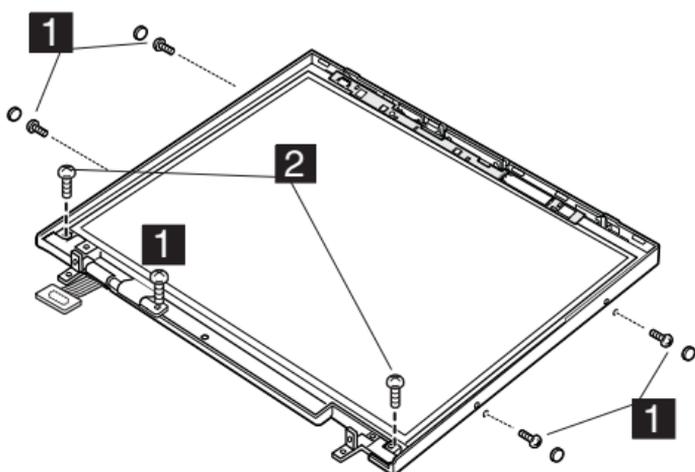


Step	Screw (quantity)	Torque
1	M2.6 × 5mm (3) BK	29.4 Ncm (3 kgfcm)

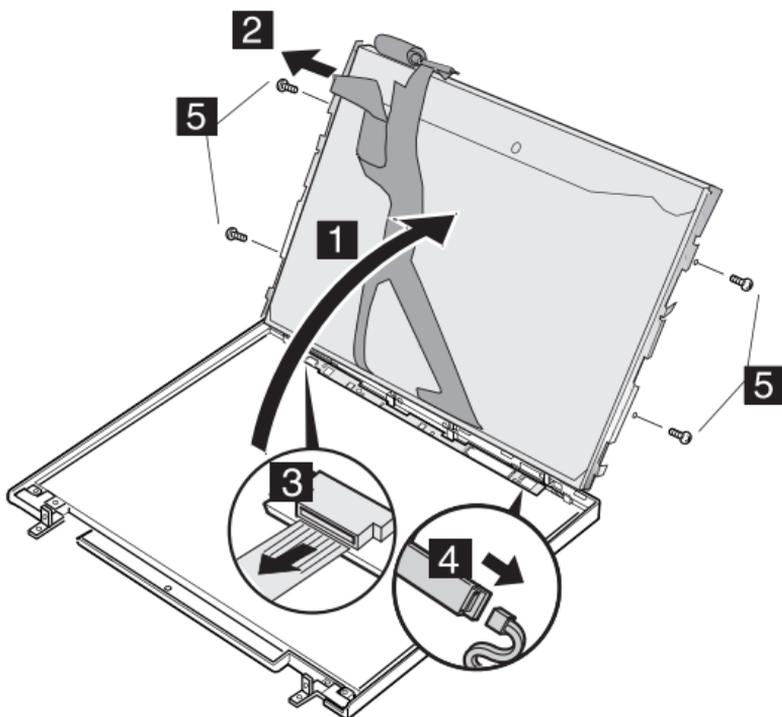
1200 LCD panel

- Battery pack (1010)
- Keyboard assembly (1050)
- Wirelesslan assembly (1100)
- LCD assembly (1110)
- Front bezel (1190)

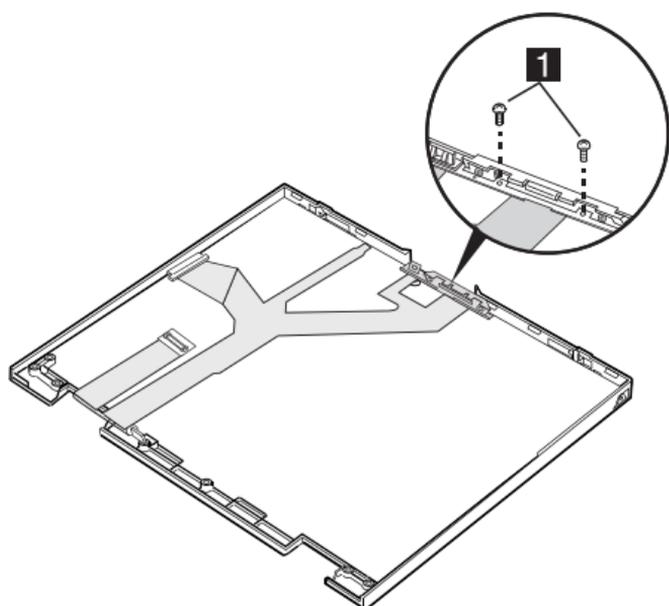
XGA for X20, X21



Step	Screw (quantity)	Torque
1	M2 × 3.5mm (5) BK	19.6 Ncm (2 kgfcm)
2	M2.6 × 4mm (2) BK	29.4 Ncm (3 kgfcm)

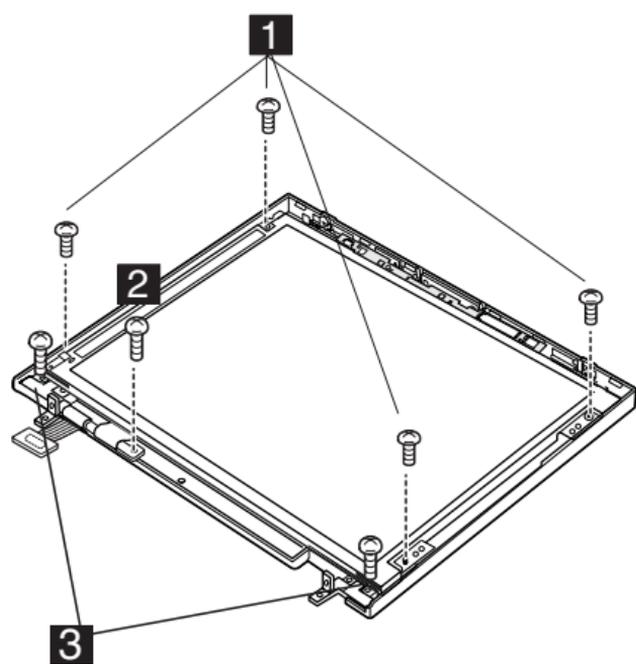


Step	Screw (quantity)	Torque
5	M2 × 3mm (4) WH	19.6 Ncm (2 kgfcm)

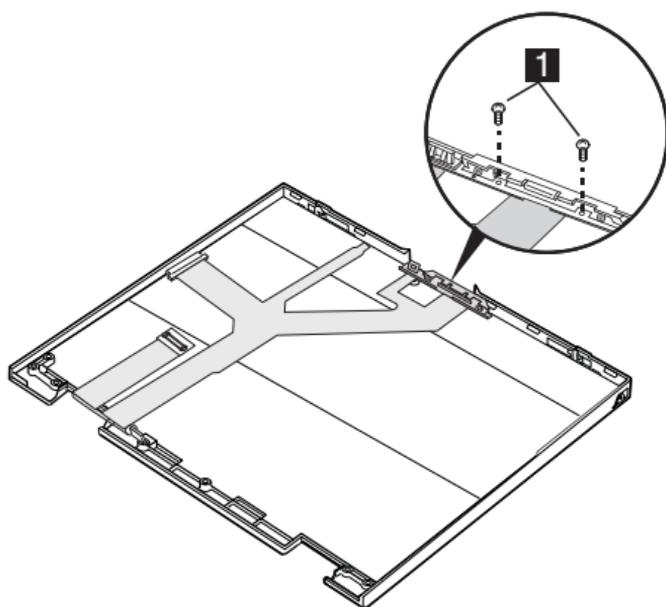
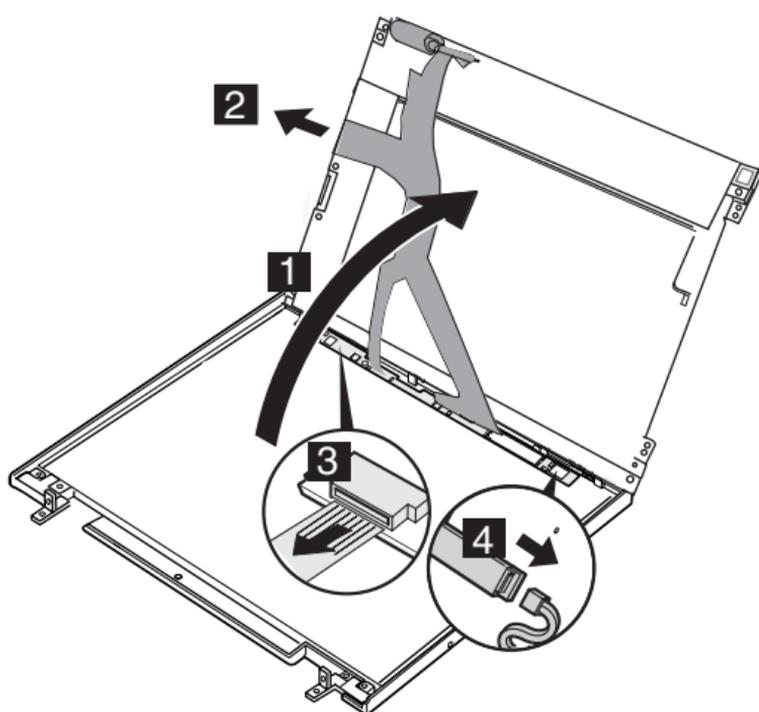


Step	Screw (quantity)	Torque
1	M2 × 3.5mm (2) BK	19.6 Ncm (2 kgfcm)

SVGA for X20, X21

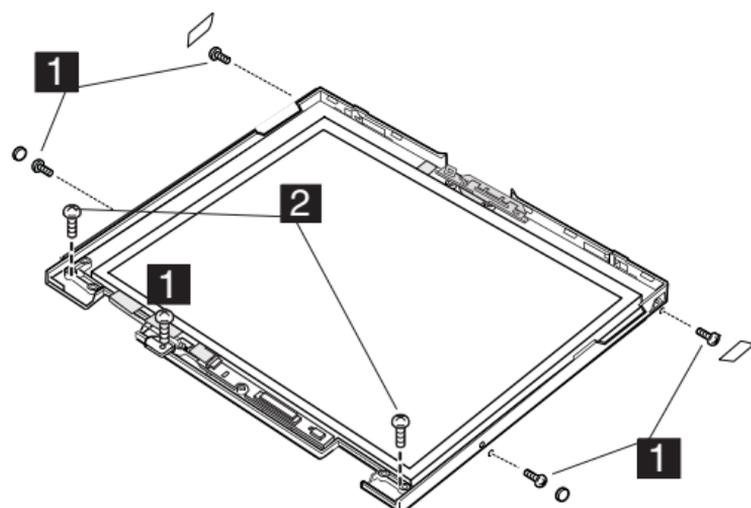


Step	Screw (quantity)	Torque
1	M2 × 2.7mm (4) White	19.6 Ncm (2 kgfcm)
2	M2 × 3.5mm (1) BK	19.6 Ncm (2 kgfcm)
3	M2.6 × 4mm (1) BK	29.4 Ncm (3 kgfcm)

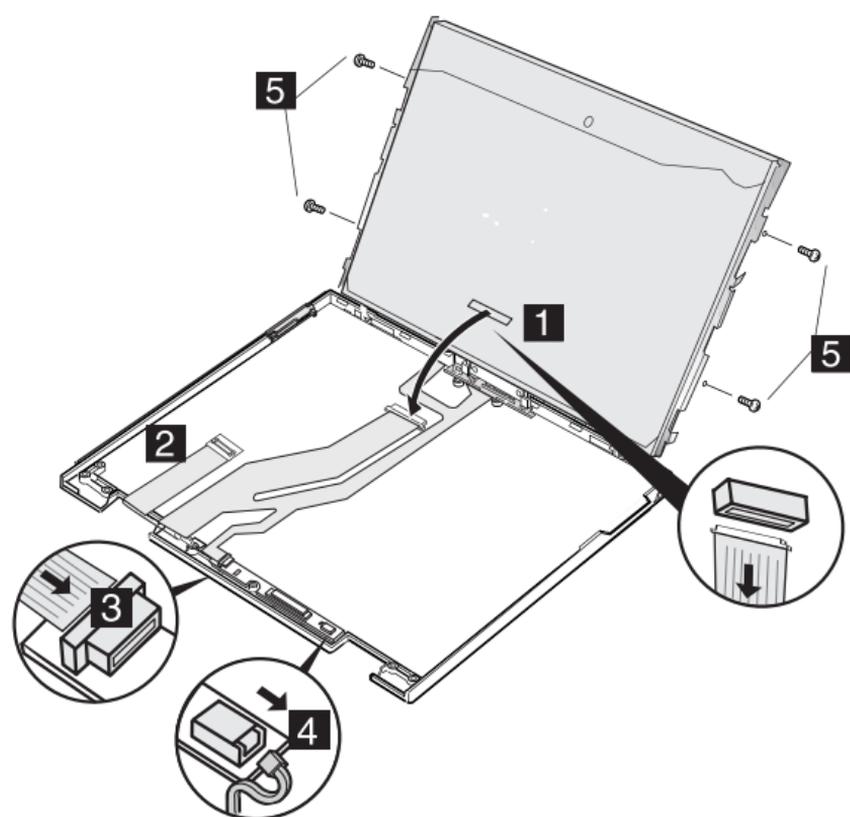


Step	Screw (quantity)	Torque
1	M2 × 3.5mm (2) BK	19.6 Ncm (2 kgfcm)

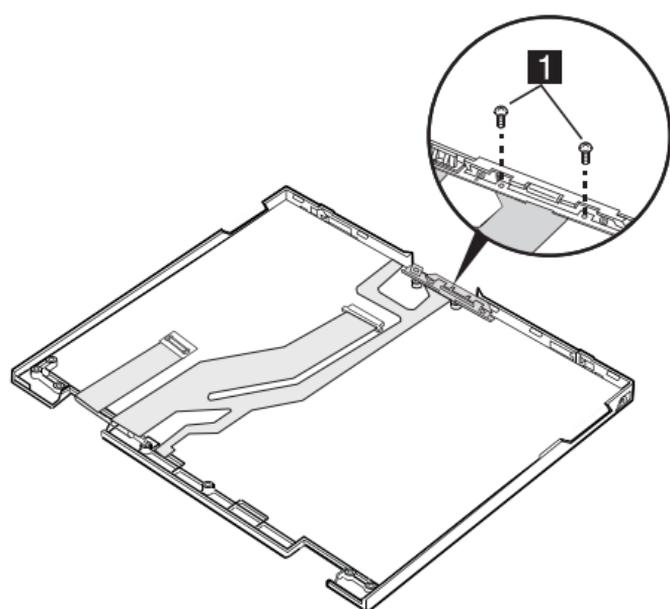
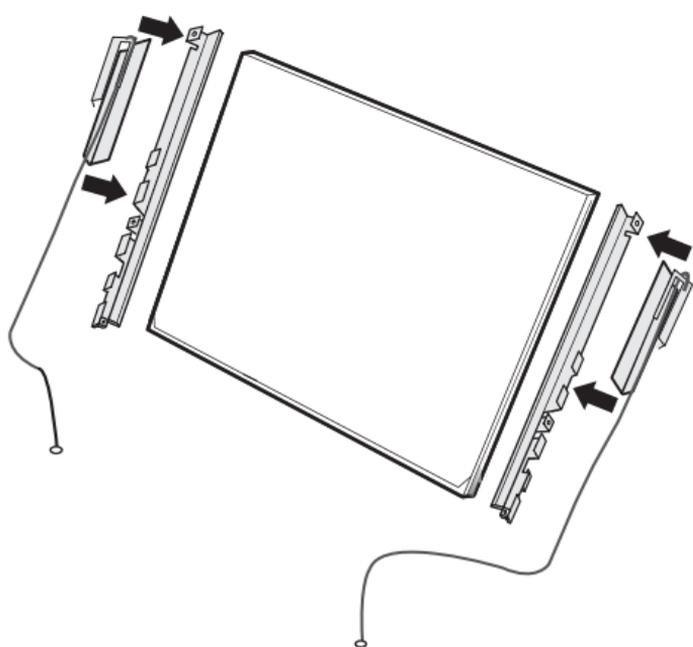
XGA for X22



Step	Screw (quantity)	Torque
1	M2 × 3.5mm (5) BK	19.6 Ncm (2 kgfcm)
2	M2.6 × 4mm (2) BK	29.4 Ncm (3 kgfcm)



Step	Screw (quantity)	Torque
5	M2 × 3mm (4) WH	19.6 Ncm (2 kgfcm)

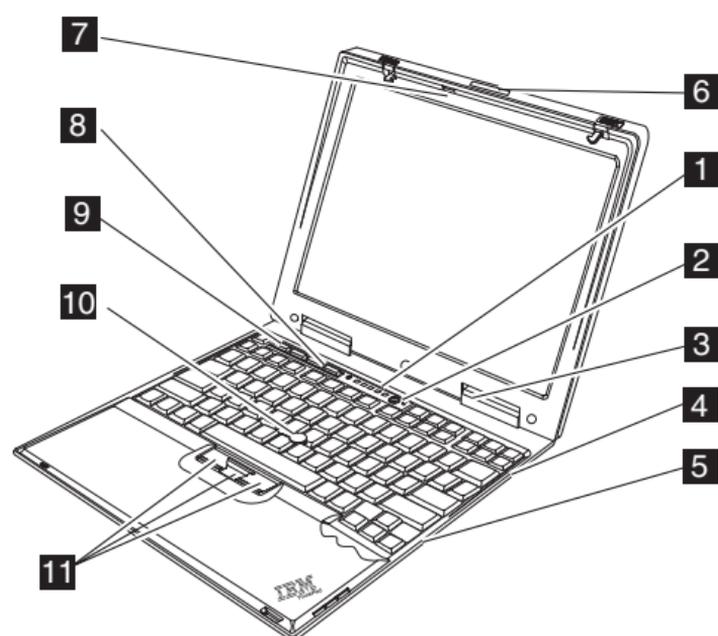


Step	Screw (quantity)	Torque
1	M2 × 3.5mm (2) BK	19.6 Ncm (2 kgfcm)

Locations

Front view for X20, X21

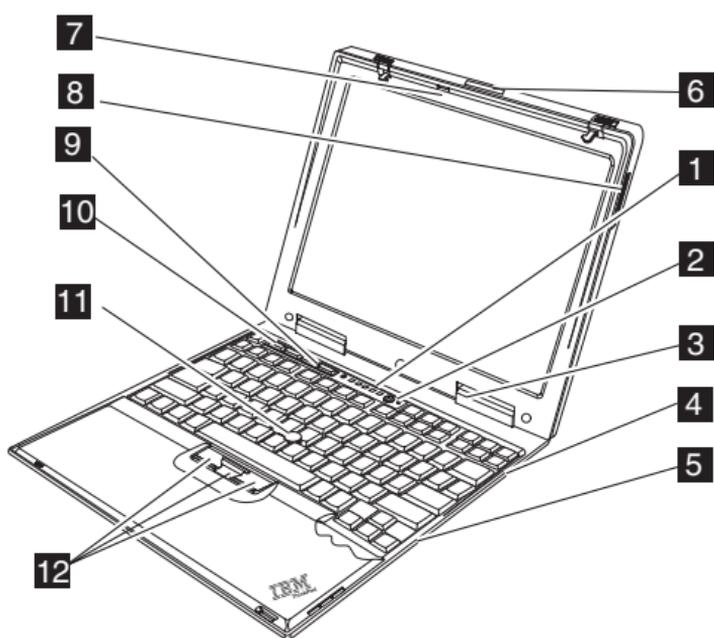
- 1 System status indicators
- 2 Power switch
- 3 Battery and standby mode status indicators
- 4 USB port
- 5 Hard Disk Drive
- 6 Ultraport connector
- 7 Think Light
- 8 Volume Buttons
- 9 ThinkPad Button
- 10 TrackPoint pointing stick
- 11 TrackPoint Buttons



Front view for X22

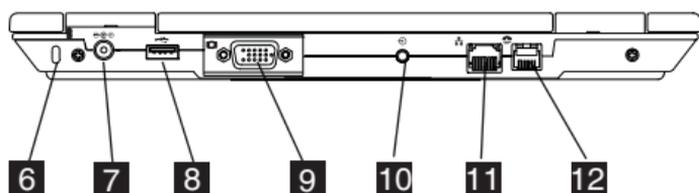
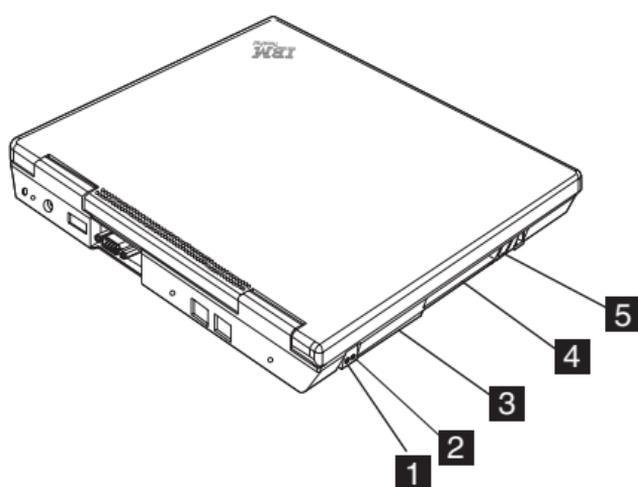
- 1 System status indicators
- 2 Power switch
- 3 Battery and standby mode status indicators
- 4 USB port
- 5 Hard Disk Drive

- 6** Ultraport connector
- 7** Think Light
- 8** Transmitter antenna
- 9** Volume Buttons
- 10** ThinkPad Button
- 11** TrackPoint pointing stick
- 12** TrackPoint Buttons



Rear view for X20, X21

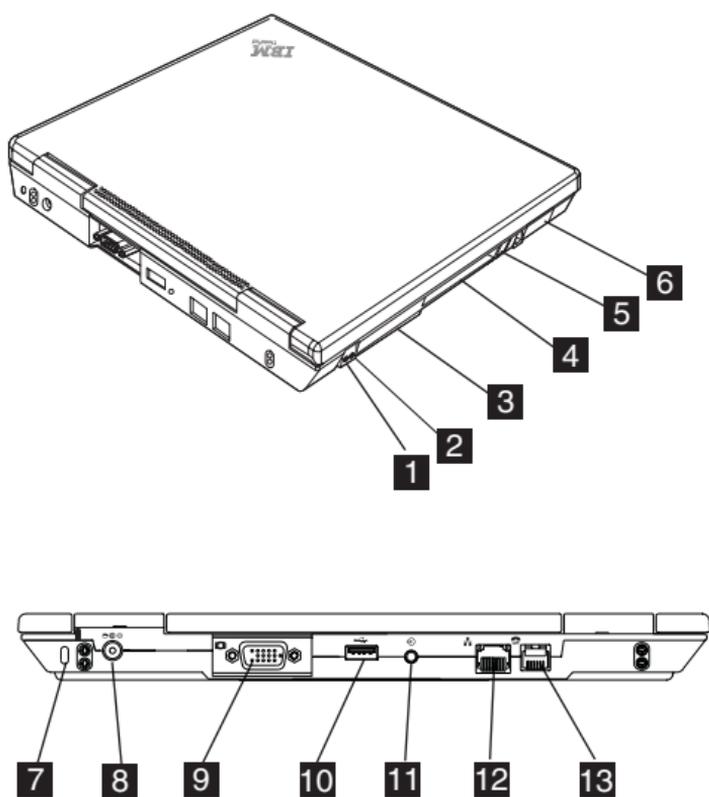
- 1 Headphone jack
- 2 Mic jack
- 3 Compact flash slot
- 4 PC card slot
- 5 PC Card eject button
- 6 Security keyhole
- 7 Power jack
- 8 Universal serial bus (USB) connector
- 9 External-monitor connector
- 10 Line-in jack
- 11 LAN connector
- 12 Modem connector



Rear view for X22

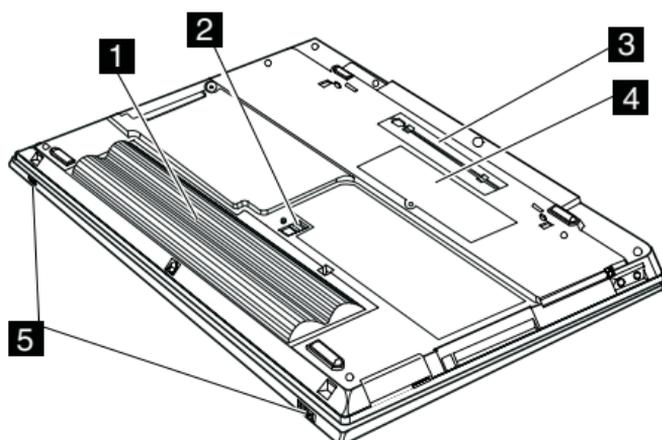
- 1 Headphone jack
- 2 Mic jack
- 3 Compact flash slot

- 4** PC card slot
- 5** PC Card eject button
- 6** IrDA port
- 7** Security keyhole
- 8** Power jack
- 9** External-monitor connector
- 10** Universal serial bus (USB) connector
- 11** Line-in jack
- 12** LAN connector
- 13** Modem connector



Bottom view

- 1** Battery Pack
- 2** Battery Pack latches
- 3** Docking connector
- 4** Memory cover
- 5** LCD latches



Parts List

X20 series model matrix

The X20 series includes several models. The following table summarizes the characteristics of each model, to help you determine which FRU in the part list meets your need.

CPU	LCD	Mini PCI
2662-11X / 12C		
• Celeron 500 LV	12.1" TFT, SVGA	V.90 DF Modem
2661-21J / 22J		
• Celeron 500 LV	12.1" TFT, XGA	V.90 DF Modem
2661-24J / 25J		
• Celeron 500 LV	12.1" TFT, XGA	Intel Ether. Combo
2662-31X /32X		
• Pentium III 600 LV	12.1" TFT, XGA	V.90 DF Modem
2662-34X /35X		
• Pentium III 600 LV	12.1" TFT, XGA	Intel Ether. Combo
2662-36X /37X		
• Pentium III 600 LV	12.1" TFT, XGA	3COM Ether. Combo
2662-38X /39X		
• Pentium III 600 LV	12.1" TFT, XGA	Empty Slot

X21 series model matrix

The X22 series includes several models. The following table summarizes the characteristics of each model, to help you determine which FRU in the part list meets your need.

CPU	LCD	Mini PCI
2662-54J / 55J		
• Celeron 500 ULV	12.1" TFT, XGA	Strata
2662-41X / 42X		
• Pentium III 600 LV	12.1" TFT, SVGA	V.90 DF Modem
2660/2662-61X /62X		
• Pentium III 700 LV	12.1" TFT, XGA	V.90 DF Modem
2660/2662-64X /65X		

• Pentium III 700 LV	12.1" TFT, XGA	Strata
2660/2662-66X /67X		
• Pentium III 700 LV	12.1" TFT, XGA	3COM Ether. Combo

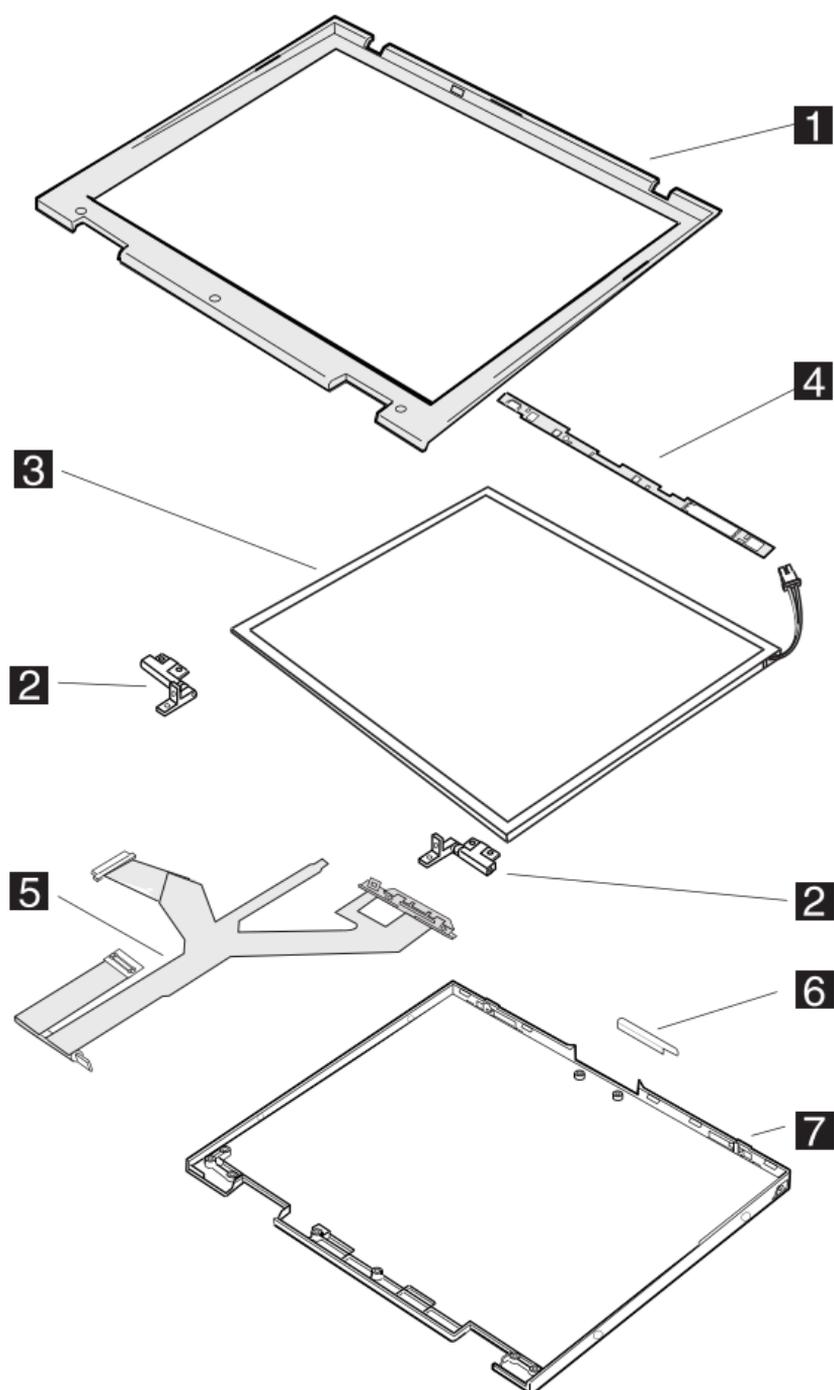
X22 series model matrix

The X22 series includes several models. The following table summarizes the characteristics of each model, to help you determine which FRU in the part list meets your need.

CPU	LCD	Mini PCI
2662-88x/85x/8Hx		
• Pentium III-M 733 LV	12.1" TFT, XGA	V.92 DF Modem & EDC
2662-75J/7HJ		
• Pentium III-M 733 LV	12.1" TFT, XGA	V.92 DF Modem & EDC
2662-9Ax/92x/91x		
• Pentium III-M 800 LV	12.1" TFT, XGA	V.92 DF Modem
2662-9Bx/95x/9Hx		
• Pentium III-M 800 LV	12.1" TFT, XGA	V.92 DF Modem & EDC
2662-9Gx/97x/9Kx		
• Pentium III-M 800 LV	12.1" TFT, XGA	V.92 DF Modem & EDC
2662-9Ex/9Dx/9Jx		
• Pentium III-M 800 LV	12.1" TFT, XGA	802. 11 Combo & EDC
2662-93J		
• Pentium III-M 733 LV	12.1" TFT, XGA	Strata Combo

LCD FRU

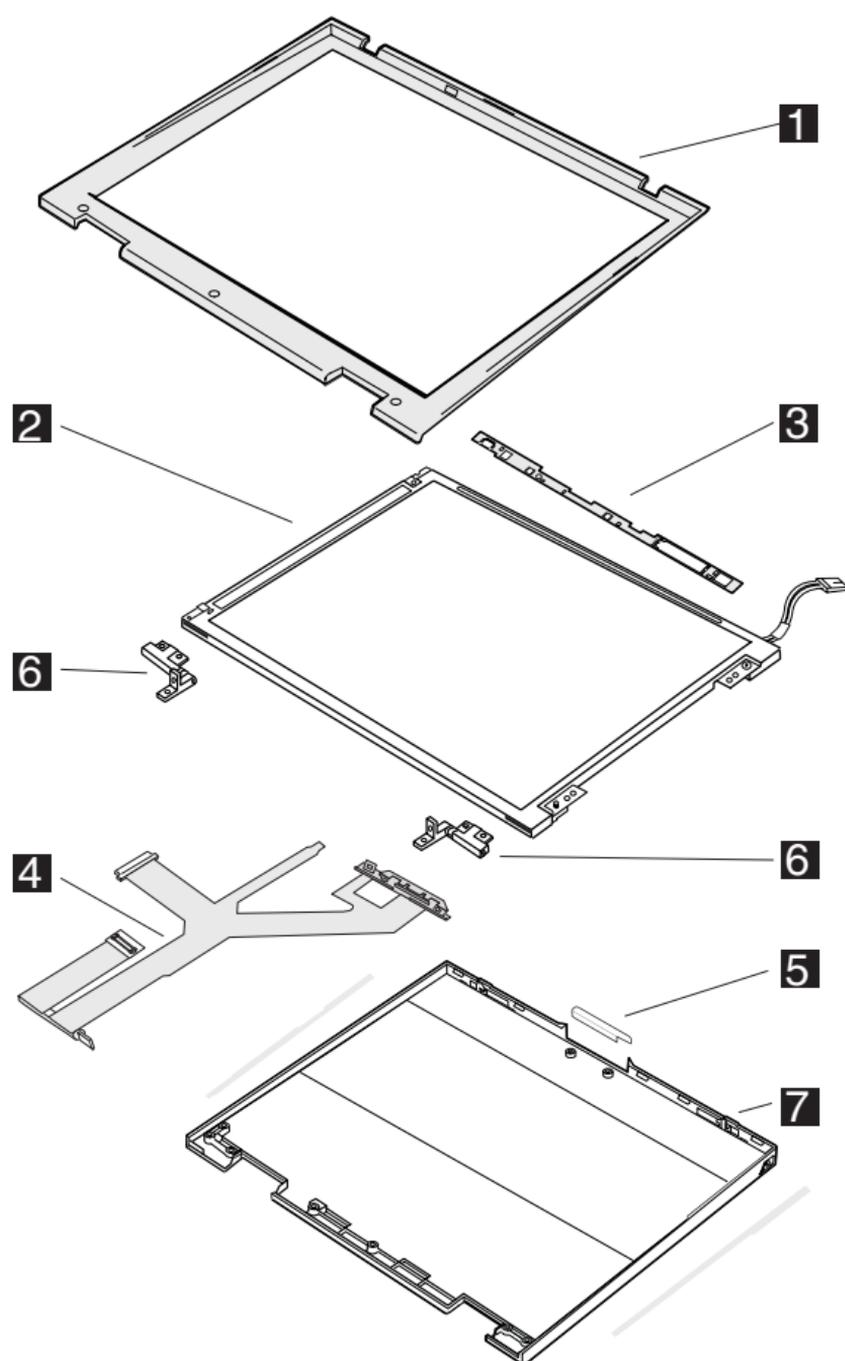
12.1-inch XGA TFT X20, X21



No	Description	FRU No
1	LCD front Bezel BK	04P3174
2	Hinges	04P3169
3	LCD panel (IBM)	05K9676
4	Inverter card (Powernet)	26P8018
	Inverter card (ALPC)	26P8020
	Inverter card (NMB)	26P8021
5	LCD Interface cables 12.1"XGA	27L0584
6	LCD USB Cover	04P3179

7	LCD Rear Cover BK	04P3171
	LCD Rear Cover BK (Korea)	04P3526

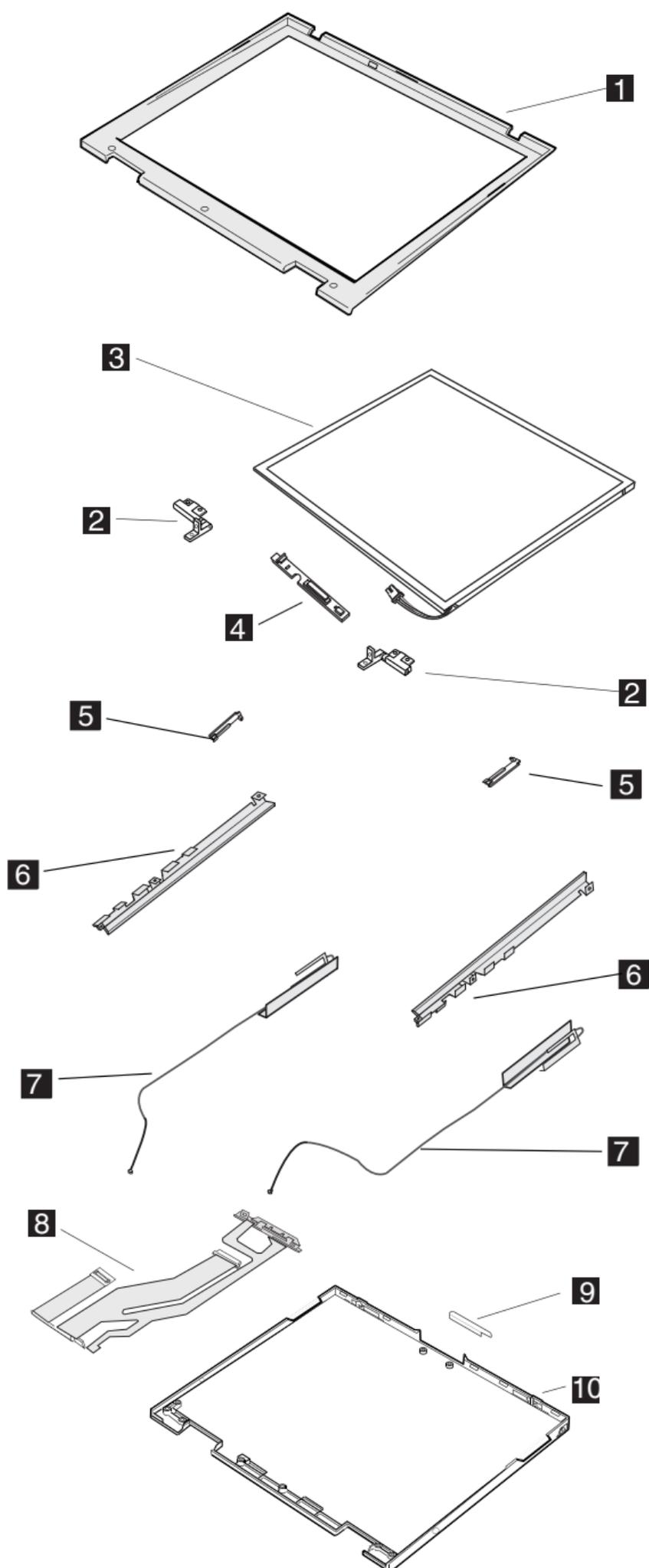
12.1-inch SVGA TFT



No	Description	FRU No
1	LCD front Bezel	04P3173
2	LCD panel (LG-Philips)	05K9675
3	Inverter card (Powernet)	26P8017
	Inverter card (ALPC)	26P8019
4	LCD Interface cables 12.1" SVGA	27L0583
5	LCD USB Cover	04P3179
6	Hinges	04P3168

7	LCD Rear Cover BK	04P3170
	LCD Rear Cover BK (Korea)	04P3527

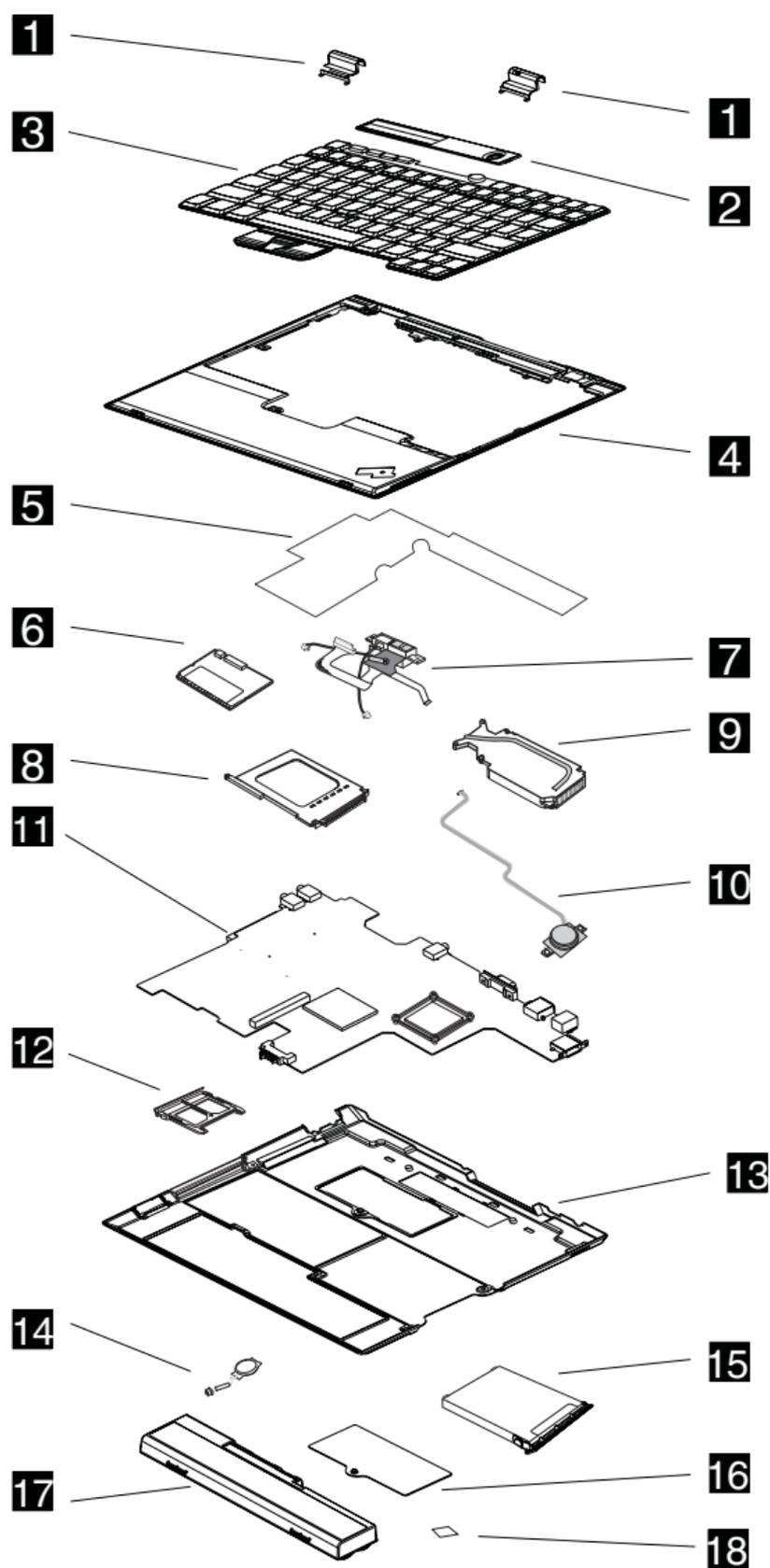
12.1-inch XGA TFT X22



No	Description	FRU No
1	LCD front Bezel BK	26P9823
2	Hinges	26P9825
3	LCD panel (IBM)	05K9961
	LCD panel (Torisan)	11P8203
4	Inverter card (ALPS)	26P8180
	Inverter card (Powernet)	26P8178
	Inverter card (NMB)	26P8179
5	Holder Antena	
6	Bracket L/R	
7	Antena	26P9824
8	LCD Interface cables 12.1"XGA	27L0697
9	LCD USB Cover	04P3179
10	LCD Rear Cover kit (Non Antenna Model W/W)	26P9820
	LCD Rear Cover kit (Antenna Model W/W)	26P9819
	LCD Rear Cover kit (Non Antenna Model Korea)	26P9822
	LCD Rear Cover kit (Antenna Model Korea)	26P9821

System

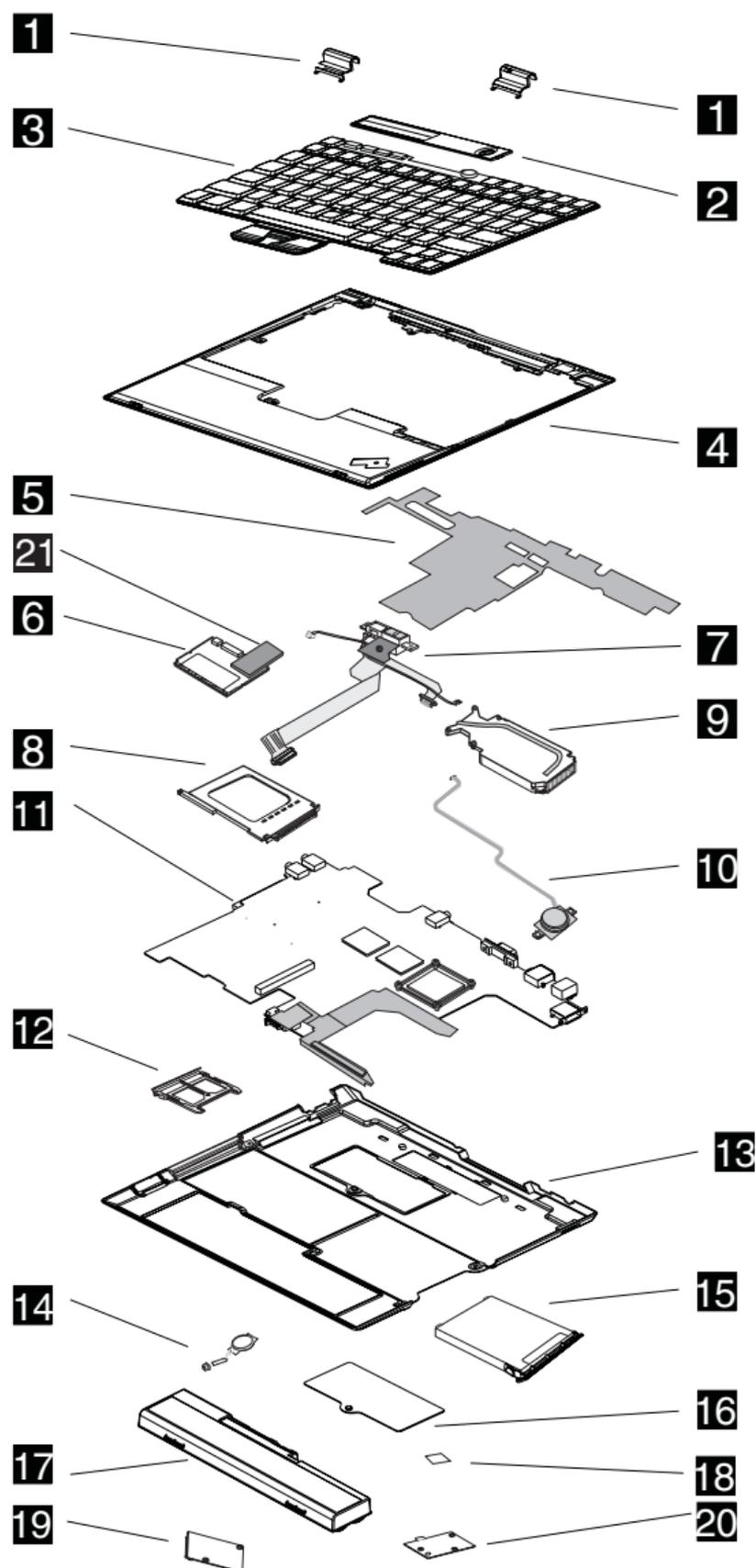
For X20, X21



No.	FRU	P/N
1	Hinge cover	
	SVGA Black	04P3162

	XGA Black	04P3163
2	KBD Control Panel	26P9194
3	Keyboard FRU	
4	Keyboard bezel	
	Keyboard bezel	04P3159
	Keyboard bezel Korea	04P3525
5	Insulation	04P3702
6	Mini PCI Combo card (STRATA)	06P3809
	Mini PCI Combo card (3COM)	22P6444
	Mini PCI modem	08K3383
7	Modem Cable Conn. ASM (RJ11/RJ45)	27L0585
8	Card-Bus Slot	04P3180
9	FAN	04P3161
10	Speaker	02K5879
11	Planer	
	Celeron 500 ULV	26P8013
	GVL LV 600MHz	26P8012
	GVL LV 700MHz	26P8011
12	CF Dummy Socket	04P3184
13	Base Cover FRU	
14	RTC Battery Asm	02K6715
15	HDD 10 GB Hitachi	27L4134
	HDD10 GB IBM Jasper	27L3440
	HDD 20 GB Hitachi	27L4132
	HDD 20 GB IBM Jasper	27L3441
16	Memory Cover	04P3185
17	Battery Li-Ion 6cell Panasonic	02K6710
	Battery Li-Ion 6cell Sanyo	02K6653
	Battery Li-Ion 4cell Sanyo	02K6652
18	Screw Cap Bottom	04P3528

For X22



No.	FRU	P/N
1	Hinge cover	26P9827
	XGA Black	26P9827
2	KBD Control Panel (X22)	26P9829

3	Keyboard FRU	
4	Keyboard bezel	
	Keyboard bezel	26P9815
	Keyboard bezel Korea	26P9816
5	Insulation	
6	Mini PCI Combo card (STRATA)	
	Mini PCI Combo card (3COM)	22P6753
	Mini PCI modem (Ambit)	08K4853
	Mini-PCI Combo Card 802.11b (Actiontec)	26P8092
7	Modem Cable Conn. ASM (RJ11/RJ45)	
8	Card-Bus Slot	
9	FAN	
10	Speaker	
11	Planer	
	Tual 800MHZ W Cript chip W/O 1394	26P8173
	Tual 800MHZ W/O Cript chip W/O 1394	26P8174
	Tual 733MHZ W/O Cript chip W/O 1394	26P8176
	Tual 800MHZ W Cript chip W 1394	26P8201
	Tual 800MHZ W/O Cript chip W 1394	26P8202
	Tual 733MHZ W/O Cript chip W 1394	26P8203
12	CF Dummy Socket	
13	Base Cover FRU	
14	RTC Battery Asm	
15	HDD 10 GB Diablo	
	HDD 15 GB Diablo	
	HDD 20 GB Diablo	
	HDD 30 GB Diablo	
	HDD 10GB Hitachi	
	HDD 15GB Hitachi	
	HDD 20GB Hitachi	
	HDD 30GB Hitachi	
16	Memory Cover	
17	Battery Li-Ion 4cell Sanyo W/W	
	Battery Li-Ion 4cell Sanyo Japan	
	Battery Li-Ion 6cell Sanyo W/W	
	Battery Li-Ion 6cell Panasonic	
	Battery Li-Ion 6cell Sanyo Japan	
	Battery Li-Ion 6cell Panasonic Japan	
18	Screw Cap Botton	

19	EDC Board	26P8181
20	IRDA Port	26P8168
21	Gasket Mini-PCI 802.11b Combo Card	46L4908

Keyboard

For X20, X21

Language	P/N
US English	02K5883
Canadian French	02K5884
LA Spanish	02K5885
Japanese	02K5886
Japanese iSeries	02K5764
Korean	02K5887
Traditional Chinese	02K5888
UK English	02K5889
German	02K5890
French	02K5891
Italian	02K5892
Swiss	02K5893
Dutch	02K5894
Belgian	02K5895
Spanish	02K5896
Portuguese	02K5897
Swedish/Finnish	02K5898
Norwegian	02K5899
Danish	02K5900
Russian	02K5901
Turkish	02K5902
Hebrew	02K5903
Arabic	02K5904
Czech	02K5905
Greek	02K5906
Hungarian	02K5907
Slovakian	02K5908
Slovenian	02K5909
Poland	02K5910
Thai	02K5911

For X22

Language	P/N
US English	02K6049
Canadian French	02K6050
LA Spanish	02K6051
Japanese	02K6052
Korean	02K6054
Traditional Chinese	02K6055
UK English	02K6056
German	02K6057
French	02K6058
Italian	02K6059
Swiss	02K6060
Dutch	02K6061
Belgian	02K6062
Spanish	02K6063
Portuguese	02K6064
Swedish/Finnish	02K6065
Norwegian	02K6066
Danish	02K6067
Russian	02K6068
Turkish	02K6069
Hebrew	02K6108
Arabic	02K6071
Czech	02K6072
Greek	02K6073
Hungarian	02K6074
Slovakian	02K6075
Slovenian	02K6076
Thai	02K6078

Base Cover FRU

For X20

FRU	P/N
2660 W/W	04P3155
2660 Korea	04P3453
2660 China	04P3454
2660 Taiwan	04P3455
2661 W/W	04P3456

2661 Korea	04P3457
2661 China	04P3458
2661 Taiwan	04P3459
2662 W/W	04P3460
2662 Korea	04P3461
2662 China	04P3462
2662 Taiwan	04P3463
2661 W/W i Series	04P3464

For X21

FRU	P/N
2660 W/W	26P9213
2660 Korea	26P9214
2660 China	26P9215
2662 W/W	26P9216
2662 China	26P9218
2662 Korea	26P9217

For X22

FRU	P/N
2660 Antenna model W/W	26P9800
2660 Antenna model Korea	26P9801
2660 Antenna model China	26P9802
2660 Non Antenna model W/W	26P9803
2660 Non Antenna model Korea	26P9804
2660 Non Antenna model China	26P9805
2662 Antenna model W/W	26P9806
2662 Antenna model Korea	26P9807
2662 Antenna model China	26P9808
2662 Non Antenna model W/W	26P9809
2662 Non Antenna model Korea	26P9810
2662 Non Antenna model China	26P9811

Recovery CDs for X21 Series

Windows 98 recovery CDs

Language	P/N
English (modem disabled)	23P8487
English	23P9728

Norway	23P8499
Netherland	23P8498
Finland	23P8497
Italy	23P8496
Spanish	23P8494
LA Spanish	23P8489
Denmark	23P8491
Sweden	23P8495
French	23P8492
Canadian French	23P8488
German	23P8493
Thailand	14P8967
Portuguese	23P8490
Japan	27P1907
Traditional Chinese	27P1827
Simplified Chinese	27P1840
Turkey	23P8528
Greek	23P8529
Hungary	23P8530
Russian	23P8531
Slovenian	23P8532
Slovakian	23P8533
Polish	23P8527
Hebrew	23P8526
CZ	23P8525
Arabic	23P8524

Windows 2000 recovery CDs

Language	P/N
Turkey	23P8600
Greek	23P8601
Russian	23P8603
Slovenian	23P8604
Slovakian	23P8605
Polish	23P8599
Hebrew	23P8598
CZ	23P8597
Arabic	23P8596

Windows 2000/Windows NT recovery CDs

Language	P/N
English (modem disabled)	23P8547
English	23P9717
Norway	23P8559
Netherland	23P8558
Finland	23P8557
Italy	23P8556
Spanish	23P8554
LA Spanish	23P8549
Denmark	23P8551
Sweden	23P8555
French	23P8552
Canadian French	23P8548
German	23P8553
Portuguese	23P8550
Japan	27P1909
Traditional Chinese	27P1831
Simplified Chinese	27P1842
Hungary	23P8602

Windows Me recovery CDs

Language	P/N
Japan	46P4392

Recovery CDs for X22 Series

Windows 98 recovery CDs

Language	P/N
English	32P5403
Thailand	32P5404
Japan	46P6135
Taiwan Traditional Chinese	46P6111
Hong Kong Traditional Chinese	46P6350
Simplified Chinese	46P6113

Windows 2000 recovery CDs

Language	P/N
English (modem disabled)	32P5411

English	32P5410
Norway	32P5421
Netherland	32P5420
Finland	32P5419
Italy	32P5418
Spanish	32P5416
Denmark	32P5413
Sweden	32P5417
French	32P5414
German	32P5415
Brazilian Portuguese	32P5412
Japan	46P6138
Taiwan Traditional Chinese	46P6346
Hong Kong Traditional Chinese	46P6352
Simplified Chinese	46P6348
Turkey	32P5426
Greek	32P5427
Hungary	32P5428
Russian	32P5429
Polish	32P5425
Hebrew	32P5424
CZ	32P5423
Arabic	32P5422

Windows XP Pro recovery CDs

Language	P/N
English (modem disabled)	32P5451
English	32P5450
Norway	32P5461
Netherland	32P5460
Finland	32P5459
Italy	32P5458
Spanish	32P5456
Denmark	32P5453
Sweden	32P5457
French	32P5454
German	32P5455
Brazilian Portuguese	32P5452
Taiwan Traditional Chinese	46P6112
Hong Kong Traditional Chinese	46P6354

Simplified Chinese	46P6114
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Windows XP Home recovery CDs

Language	P/N
Japan	46P6140

Miscellaneous parts

For X20, X21

FRU	P/N
Screw kit (for i Machine):	04P3181
HDD Metal Case	04P3165
HDD Door	04P3166
HDD Screw	04P3167
MISC PCB	08K3225
Track Point Cap	84G6536
HEXA Screw	04P3405
M2 × 3mm WH	04P3402
M2 × 3.5mm BK	04P3404
M2 × 4.5mm BK for KBD	04P3182
M2 × 4.5mm WH	04P3406
M2 × 6mm BK	04P3403
M2 × 8mm BK for Hinge Top	04P3400
M2.6 × 4mm BK	04P3401
M2.6 × 5mm BK	08K7092
M2 × 3.5mm BK Head 0.6T	04P3407
M2 × 2.7mm WH 0.8 for LCD	08K7093
M3 × 3mm Red for HDD Side	04P3399
M3 × 3.5mm BK For Bottom HDD	04P3408
Screw Cap LCD Front Black	04P3529
Screw Cap LCD XGA side Black	08K7062
KBD Misc	26P9179
Misc Parts Kit	04P3156
LCD Misc SVGA	04P3176
LCD Misc XGA	04P3177
Tape	04P3703

For X22

FRU	P/N
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Screw kit (for 10 systems):	26P9830
HDD Metal Case	26P9818
HDD Lid	04P3166
HDD Screw	04P3167
MISC PCB	08K3225
Track Point Cap	84G6536
Screw Cap for 10 systems	26P9831
KBD Misc	26P9828
Misc Parts Kit	26P9812
LCD Misc XGA	26p9826
LCD Misc W/O Antenna	46L4909
KBD Unit Instruction	46P3885
DBU 12.1" W/O Antenna	11P8259
Tape	04P3703

Options FRU list

For X20, X21

Telephone Cable	27L0619
Telephone Cable Austria	27L0624
Telephone Cable Belgium	27L0625
CD-ROM drive (LG)	05K9159
CD-ROM drive (TOSHIBA)	27L3973
CD-ROM drive (Teac)	27L3436
DVD-ROM drive (MKE)	05K9188
DVD-ROM drive (TOSHIBA)	05K9160
SODIMM Card 128MB (133MHz)	19K4653
SODIMM Card 256MB (133MHz)	33L3070
SODIMM Card 64MB (133MHz)	19K4651
UltraBase X2	04P3304
UltraBase X2 Security Screw	08K7004
2nd HDD Adapter	08K6067
USB FDD (TEAC)	05K9283
USB FDD (YE-DATA)	08K9542
USB CD-ROM drive	00N8244
USB CD-ROM Cable	00N8245
Telephone Cable Austria	27L0623
Telephone Cable Belgium	27L0625
LS-120	05K9235
Common Battery Charger	02K6642

CD-RW	00N7955
CD-RW (Sony)	08K9568

For X22

Telephone Cable	27L0603
Telephone Cable Austria	05K2731
Telephone Cable Belgium	05K2732
CD-ROM drive (LG)	08K9545
CD-ROM drive (TOSHIBA)	27L9160
CD-ROM drive (Teac)	27L3436
DVD-ROM drive (MKE)	05K9188
DVD-ROM drive (HITACHI)	27L4167
SODIMM Card 128MB	20L0265
SODIMM Card 256MB	33L3070
SODIMM Card 64MB	20L0264
UltraBase X2	04P3304
UltraBase X2 Security Screw	08K7004
2nd HDD Adapter	08K6067
USB FDD (TEAC)	05K9283
USB FDD (YE-DATA)	08K9542
LS-120	05K9235
Common Battery Charger	02K6642
CD-RW	00N7955
FRU HEAD SET	02K4941

Common parts list (X20, X21, X22)

Tools

Triconnector wrap plug	72X8546
PC test card	35G4703
Audio wrap cable	66G5180
USB parallel test cable	05K2580
USB FDD Tool Kit	27L3452
Screwdriver kit	95F3598
Torque screwdriver	05K4695
5mm socket wrench	05K4694
Screwdriver	27L8126
ThinkPad hardware maintenance diskette version 1.60 Note: Download the file from the Web site.	—

Power code (system)

IBM power cords for a specific country are usually available only in that region:

For 2-pin power cords:

Region	P/N
Canada, Thailand, United States of America	13H5264

For 3-pin power cords(X20, X21):

Region	P/N
Canada, Thailand, United States of America	76H3516
Japan	13H5273
Australia, New Zealand	76H3514
Korea	76H3535
PRC	02K0539
Europe-France, Germany, etc.	76H3518
Argentina	36L8870
Denmark	76H3520
South Africa, India	76H3522
Switzerland	76H3528
Italy	76H3530
Israel	76H3532
UK	76H3524

For 3-pin power cords(X22):

Region	P/N
Canada, Thailand, United States of America	76H3516
Japan	13H5273
Australia, New Zealand	76H3514
Korea	76H3535
PRC	02K0539
Europe-France, Germany, etc.	76H3518
Argentina	368867
Denmark	76H3520
South Africa, India	76H3522
Switzerland	76H3528
Italy	76H3530
Israel	76H3532
UK	76H3524

AC adapter(X20, X21): IBM power cords for a specific country are usually available only in that region:

Region	P/N
72W 2-prong NON-PFC Astec	02K6669
72W 3-prong PFC Astec	02K6666
72W 2-prong NON-PFC Delta	02K6673
72W 3-prong PFC Delta	02K6670

AC adapter(X22): IBM power cords for a specific country are usually available only in that region:

Region	P/N
56W 2-prong Delta	02K6814
56W 3-prong Delta	02K6813
56W 2-prong LITEON	02K6816
56W 3-prong LITEON	02K6815

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Part Number: 24P2915

S24P-2915-00

